Food and Agriculture Organization of the United Nations

GUIDELINES FOR ANTIMICROBIAL USE IN POULTRY AND LIVESTOCK SECTORS IN EGYPT

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Introduction

Antimicrobials are chemical substances with effect on bacterial cells, either by killing or stopping their multiplication. Before the discovery of penicillin as the first antibiotic in 1928 by Alexander Fleming, bacterial diseases were mostly considered extremely serious and life-threatening. After this discovery and upon the first use of penicillin in medicine around 1940 of the previous century, people expected that the age of seriousness of bacterial diseases was over (Chain ***et al.*** 1940).

Unfortunately, it did not go as they thought. Bacteria are "intelligent creatures", which can develop and share antimicrobial resistance. Antimicrobial resistance (AMR) means that bacteria develop a mechanism by which they can withstand the antimicrobial effect, and this means failure of treatment with antimicrobials resulting in serious health complications or even death (Laxminarayan R, ***et al.*** 2016; Laxminarayan R, ***et al.*** 2013; Lim C, ***et al.*** 2016).

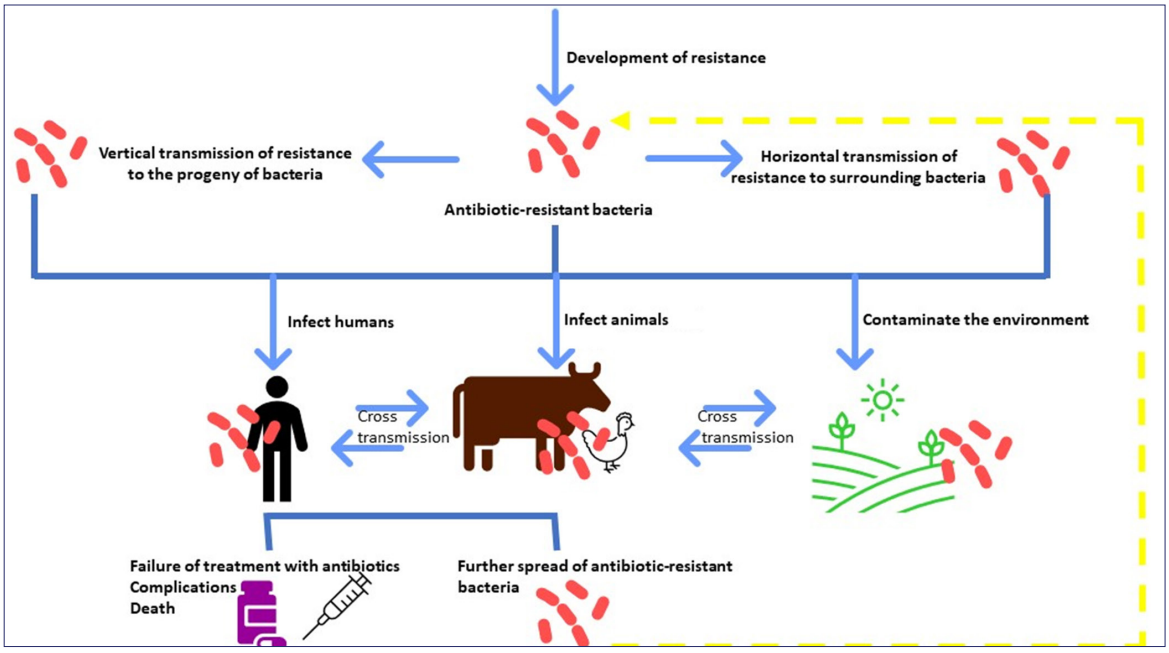
Now and after 93 years of the discovery of penicillin, antibiotic resistance is a worldwide prioritized increasing problem. Although many other antimicrobials were discovered and manufactured after penicillin, according to the World Health Organization (WHO) Antimicrobial Resistance Global Report on Surveillance (2014a), no major new antibiotics have been developed in the last 30 years.

On the other hand, there are continuously increasing rates of antimicrobial resistance. Now, there are a huge number of multidrug resistant and extensively drug resistant bacteria which are resistant to most antimicrobials. Therefore, scientists call for antimicrobial stewardship, which means to improve how antibiotics are prescribed and used, to control antimicrobial resistance rates.

Bacteria become resistant to antimicrobials by several ways; develop resistance upon misuse of antimicrobials, gain resistance from their parent bacterial cells, or through the horizontal transfer of mobile genetic elements containing antibiotic resistance genes (Hedman ***et al.*** 2020). So, the problem of antimicrobial resistance does not mean that a bacterial cell become resistant to a particular type of antimicrobials, but it will transfer the ability of resistance to its progeny as well as to the surrounding bacteria. Another serious fact is that antibiotic resistant bacteria can circulate among and in between animals, humans and the environment (WHO, 2014b).

The misuse of antimicrobials in the veterinary sector is serious because it has a triple effect on the spread of antibiotic resistance in humans. First is through the direct transmission of antibiotic resistant bacteria from animals to humans, second is through potential antimicrobials residues in food of animal-origin, which may enable bacteria within bodies of humans to develop resistance

Figure 1: Misuse of antibiotics



Source: Authors' own elaboration.

to antimicrobials, and third effect occurs from the dissemination of antibiotic resistant bacteria from animals to the environment.

In Egypt, improvement of livestock and poultry productions are very important to increase the animal protein amount available for each person per year. Animal production in Egypt is variable ranges from household breeding of few numbers of animals or birds, or pastoral continuously mobile flocks consisting of tens to hundreds of animals to big and organized farms consisting of thousands of animals.

WHO, in collaboration with OIE and FAO have set a Global Action Plan on the importance of optimal use of antimicrobial medicines in human and animal health to avoid AMR (WHO, 2015) and this plan provides the framework for national action plans to combat antimicrobial resistance. Moreover, FAO contributes to the international efforts to avoid AMR and to provide support to different sectors of communities to adopt measures to minimize the use of antimicrobials and to reduce AMR (FAO, 2016).

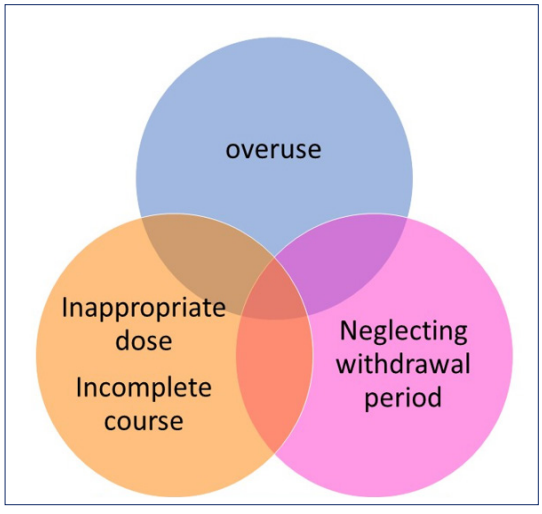
These national guidelines for AMU aims to enlighten the whole community in Egypt, particularly livestock–poultry producers, about the appropriate use of antimicrobials. This is to enhance knowledge of producers for reducing antimicrobial resistance rates, avoid other negative health effects of antimicrobial residues in foods of animal origin, and to enhance safe and profitable animal production.

Misuse of antimicrobials in poultry and livestock sectors in Egypt

In Egypt, the main sources of antibiotics for customers are the local companies which import active principles and manufacture antimicrobials locally, and readymade antimicrobials imported from international producers. Antimicrobials are easily available to livestock and poultry producers without a veterinarian prescription. Misuse and increasing use of antimicrobials are common, particularly in the presence of intensive production practices, and in the presence of many infectious diseases (O'Neill, J. 2016). Antimicrobials may be used in a sub-therapeutic doses or in overdoses and the withdrawal period of different antimicrobials are not considered (Zahangir Hosain *et al.* 2021).

A considerable percentage of livestock and poultry producers are not aware of antimicrobial resistance or how it occurs. In addition, antibiotic products manufactured for human use are also available for the veterinary use as well as for the public without a prescription. Therefore, there is a continuous increase in antimicrobials resistance rates in Egypt. Under field conditions, veterinarians as well as livestock–poultry producers observe that some antimicrobial products turn to be ineffective after years of their usage. In contrast, they observe that the newly available antibiotic active principles are extremely effective. So, veterinarians and animals producers focus on the use of these new antimicrobials, which may become ineffective after years of misuse as their ancestors (O'Neill, J. 2016). To help in breaking of this cycle, for saving animal wealth as well as public health in Egypt, these national guidelines on the appropriate use of antimicrobials in the livestock and poultry sectors were developed.

Figure 2: Misuse of antimicrobials



Source: Authors' own elaboration.

1. Guidelines of antimicrobial use for poultry in Egypt

1.1 How to reduce the need for antimicrobial?

1.1.1 Good husbandry practices

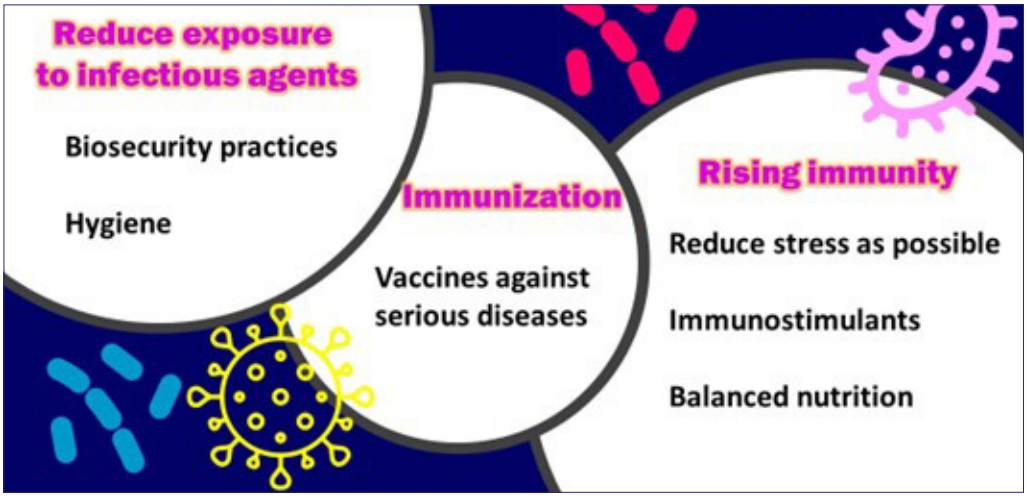
1.1.1.1 Source of chicks from good health, quality, and disease free parents

- A healthy one-day old chick of a good source will be of high food conversion rate and profitable and low disease incidence. This can be achieved by examination of one-day old chick against infection in laboratory.

1.1.1.2 Good management and husbandry practices in incubators and farms

- Hygienic management – proper cleaning and disinfection – reduces microbial load and decreases the infection and disease rates, and as a result reduce antimicrobials use and resistance.
- Considering standard construction of

Figure 3: Combating infectious diseases

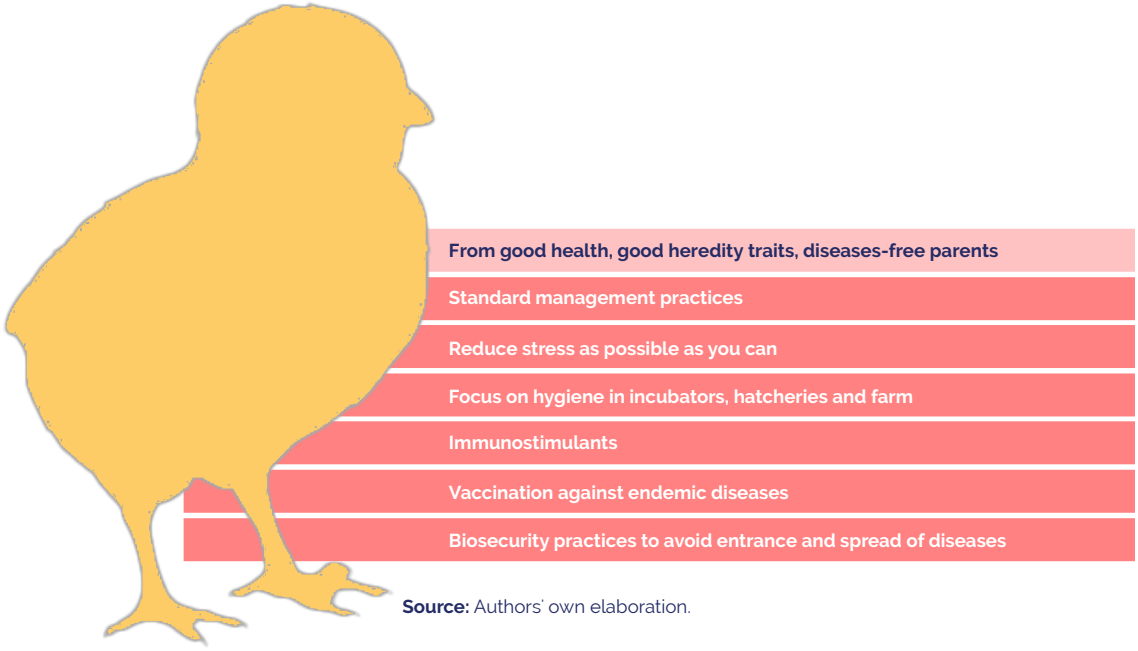


Source: Authors' own elaboration.

the farm (accurate dimensions, direction of the farm, ventilation rate, etc....) and farm density of birds is crucial to avoid continuous stress, lowering this way chicken immunity and predisposing them to infection.

- Increase of ammonia in poultry farms during winter season should be avoided as much as possible because it is a predisposing factor for occurrence of diseases and increase of antimicrobials use. Balanced ration, accurate stocking density, good ventilation, and appropriate removal of dropping-contaminated litter are important to reduce ammonia level in poultry farms.
- Short production cycles are recommended to minimize antimicrobial use.
- Hygiene and proper conditions of incubators and hatcheries are important to get a healthy chick of lower need to antimicrobials and more profitable. This includes professional sorting of chicks after hatch (only perfect high-quality chicks are allowed to enter the production cycle), and transportation of chicks from hatchery to the farm should be of minimal stress and under the recommended conditions of temperature, relative humidity, and ventilation rate to avoid immunosuppression and higher chances to get infections with subsequent increase of antimicrobial use. Mixing of eggs of different sources or of different species (e.g. eggs of chicken and ducks) in hatcheries is not recommended.
- Veterinary supervision is essential in all poultry production practices.
- All in – All out system minimizes the infection rate and losses.

Figure 4: Chick of good health less likely to be diseased profitable

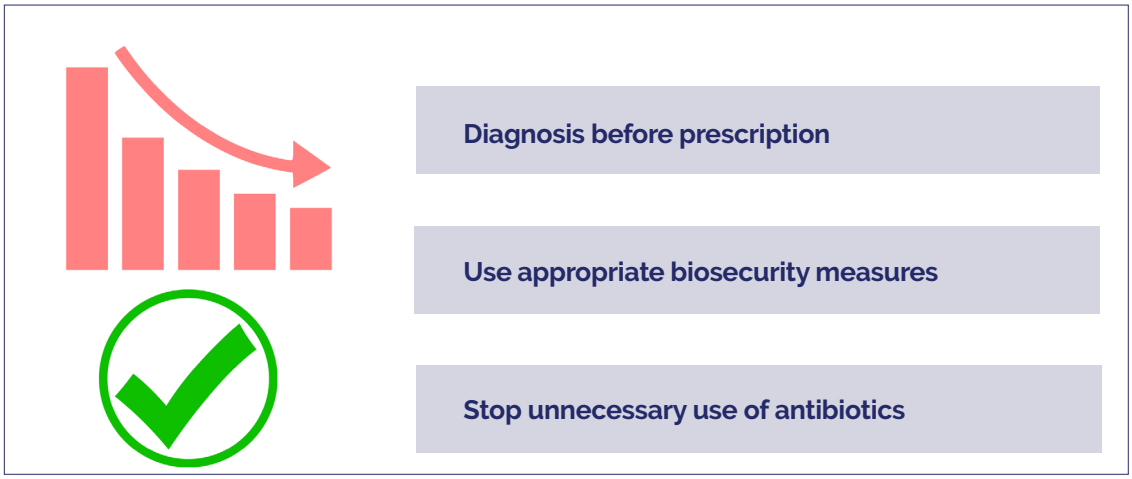


Source: Authors' own elaboration.

1.1.1.3. Balanced nutrition and avoid unnecessary antimicrobial feed additives

- Avoidance of stress, and balanced nutrition are essential to have poultry of strong immunity, better resistance against infection, and of low need of antimicrobials.
- Using antibiotics for incubation of chicks during the first three days of life has to be avoided unless sensitivity analysis was carried out to one day-old chick. Also, it is recommended to stop using antibiotics just before the exit/slaughter of birds for human consumption.
- Unnecessary addition of antibiotics – for prevention of diseases and/or mortalities – on poultry feed should be avoided. Although it appears useful and reduces losses, it can lead to disastrous drawbacks on public health. This results from the effect of antimicrobial residues on vital organs as well as increase the antimicrobial resistance rates.
- Organic products in poultry production can replace pharmaceutical medicines and give better result and safer products. These models have to be highlighted and widely distributed to encourage and guide the producers on how to stop or greatly reduce antimicrobials use.
- The Usage the non-antimicrobial growth promotors such as probiotics, prebiotics, organic acids as citric and acetic acids, and bioactive compounds as tannin and saponin to improve the growth rate and reduce antimicrobial resistance is needed.
- The use of herbal medicine (For example: garlic extract, thyme, turmeric, chamomile, hibiscus, anise and many other plants) can be of value to enhance growth, rise immunity, and reduce antibiotics use in poultry production.
- It is of a great value to record antimicrobial use for birds including date, type of antimicrobial, reason of use, which birds received the medication, dose, route of administration, action taken toward antibiotic-containing products, and the response to antimicrobial treatment of each disease condition. This is useful for the future use of antibiotics by veterinarians in the farm and help to reduce antimicrobial resistance rates.
- It is necessary to notify the veterinary authorities about infectious diseases

Figure 5: Decrease antibiotics use

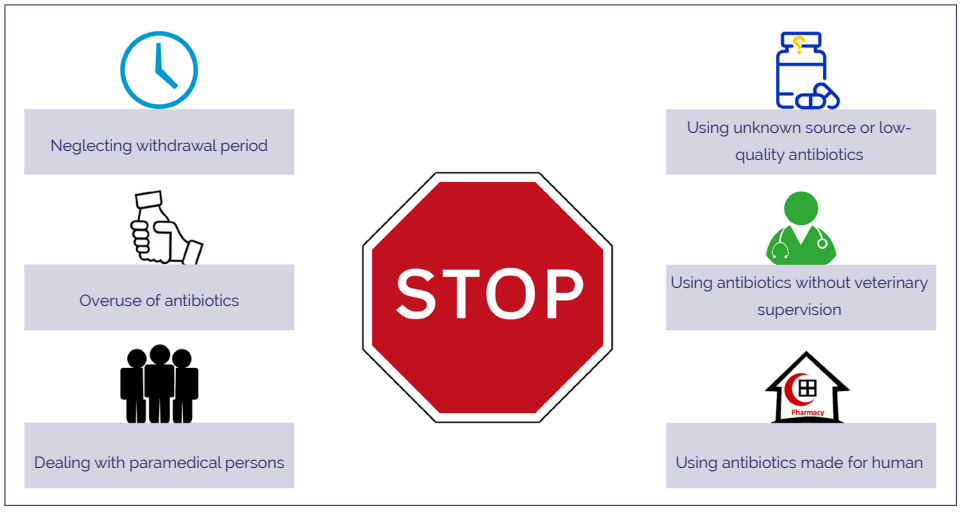


Source: Authors' own elaboration.

outbreaks when they occur in your farm. This assists in limiting diseases spread and consequently reducing antimicrobials use and resistance rates.

- Good quality and balanced feed ration of low bacterial load and free of mycotoxin is important to reduce foodborne infections such as salmonellosis. Avoid ration of animal origin to prevent the introduction of infection especially Salmonella spp. found sometimes in these feed components.

Figure 6: Warnings to rationalize the use of antimicrobials



Source: Authors' own elaboration.

Nb. Paramedical person is the person who provide assistance services to patients under the supervision of a veterinarian. In Egypt, these persons sometimes deal with animals direct without licence and provide farmers with medical advice illegally.

1.1.2 Good biosecurity practices

1.1.2.1 Farm maintenance to prevent external access of birds, rodents and other animals

- Preventing the entrance of wild birds, rodents, cats and any other animal species to the farm is required. Such birds may transmit and disseminate infectious diseases.
- Closed systems are recommended for poultry production as they are more productive, have more hygienic measures, meaning lower mortalities.

1.1.2.2 Visitor control (vehicle and people)

- Entrance and exit of vehicles, tools and persons in the farm should be only if necessary and under complete control to avoid getting infectious diseases from outside the farm.
- The entrance of vehicles, tools and persons to your farm has to be prevented if they entered to other farms suffering from contagious diseases outbreaks.

- There is a need to avoid sharing tools with farms suffering from infectious diseases outbreaks. In general, it is preferable not to share tools at all.

1.1.2.3 Workers hygienic measures and health

- Continuous health check of the farm workers against infectious diseases especially Salmonella spp. and E. coli infection is recommended.
- There is a need for continuous health check of the farm workers accommodation especially the toilets and bathrooms.
- Continuous training of the farm workers on the biosecurity measures is required.
- It is better to have a special uniform for the farm to any person that enters the flock before dealing with birds. The use of over shoes, plastic coat, gloves, and masks is also required.

1.1.2.4 Cleaning and disinfection

- It is important to have the water quality checked for chemicals and bacteria regularly.
- There is an actual need to use disinfectant bucket so that persons dip their shoes in it before entering the farm.
- Cleaning is a very important step before disinfection, because the presence of organic materials can make disinfectants ineffective.
- There is a need for changing – rotating – the used disinfectants in the farm every specific period; 3 months for example. real

1.1.2.5 Safe disposal of dead birds and wastes

- Hygienic disposal of carcasses, litter and waste products of the farms to prevent spread of infection; composting offers a good choice for that.

1.1.3 Vaccination

- Vaccination of one day-old chicks – hatchery vaccination – is important and must be considered to reduce the possibility of disease occurrence and antimicrobials use.
- Vaccination against bacterial, viral, as well as other infectious diseases is a cornerstone to reduce the use of antimicrobials. This is because vaccinated birds are protected against diseases and consequently decreases the usage of antimicrobials which minimizes the risk of antimicrobials resistance.
- Always keep the immunity strong through immune-stimulants such as vitamins (vitamin A, D and other vitamins) and minerals (zinc, iron, selenium and other minerals) or immune-biotics to enable birds to resist infections and reduce the need for antimicrobials use.

1.2 How and when to use antimicrobial?

1.2.1 When birds are sick

- Diagnosis of the disease before treatment is recommended to avoid unnecessary use of antimicrobials. Therefore, symptomatic treatment of diseased birds without a diagnosis is not recommended.
- Rapid and field diagnostics are helpful for the diagnosis of diseases of poultry in a short time without the need for an equipped laboratory, which reduces the symptomatic misuse of antimicrobials.
- Antibiotics are used only against bacterial diseases, the unnecessary use of antibiotics in viral, mycotic, or parasitic diseases should be discontinued.
- Avoidance the injection of poultry with antibiotics before marketing as a chemo-prophylactic measure to prevent mortalities in markets or during viral outbreaks.
- Antibiotics that are commercialized to be administered orally should not be given in injectable format, as they might lose their efficacy, and have toxic effects.
- Antibiotic-susceptibility testing is strongly recommended for the choice of the proper antibiotic treatment of bacterial diseases in poultry.
- When the use of antimicrobials is strictly needed for chemoprophylaxis, treatments should be performed as recommended by the pharmaceutical respective protocols. However, reduction of stress, rising immunity, and good control measures during outbreaks may eliminate/reduce the need for chemoprophylaxis by antimicrobials.
- Using antibiotics as growth promotors is a potential route to increase in antimicrobial-resistance rates of bacteria and has to be avoided.

1.2.2 Upon veterinary supervision

- It is very important to avoid use of antimicrobials for animal treatment unless prescribed by a veterinarian.
- If prescribed by a veterinarian, use the indicated antibiotic, and do not replace it by other product/molecule.
- Diagnosis through phone calls, which is noticed to some extent in Egypt, should be stopped because it is not sufficient even to make a preliminary diagnosis. This phenomenon may result in misdiagnosis of the diseased cases and misuse of antimicrobials.
- Always seeking for a trusted source of information on antimicrobials is important to avoid getting improper information related to the use of antimicrobials in poultry sector from informal social media networks and para-medicals.

1.2.3 Good use of antimicrobials

- Before using an antibiotic product it is better to read the instructions of its use.
- The use of two different antibiotics in

drinking water for poultry without previous information on the interaction between these compounds and the suitable dose of each active principle could render the antibiotics inactive, and antagonize each other inside the body, and may result in unpredicted withdrawal periods of antibiotics.

- Although of lower adulteration rate and their high efficacy, the use of human antibiotic products for poultry, (eg. Use of human antibiotic capsules in drinking water), should be stopped. This is because of species and prescription differences which may enhance the development of antimicrobial resistance.

- Expired antibiotics could have serious side effects on the treated birds and it is important to stop using them to avoid the increase in antimicrobial resistance rates.

- It is necessary to producers and veterinarians to obtain the antimicrobials from trusted sources, and not from mobile vendors', to ensure safe storage and efficacy. Reduced efficacy antibiotics products will be of poor therapeutic performance and can increase antimicrobials resistance rates.

- Avoidance of mixing antimicrobials with other medications is prerequisite to avoid rendering them inactivate.

- The producers are required to assure that the farm workers respect the treatment regimens.

1.2.4 Dose, course of treatment, and withdrawal period of antimicrobials

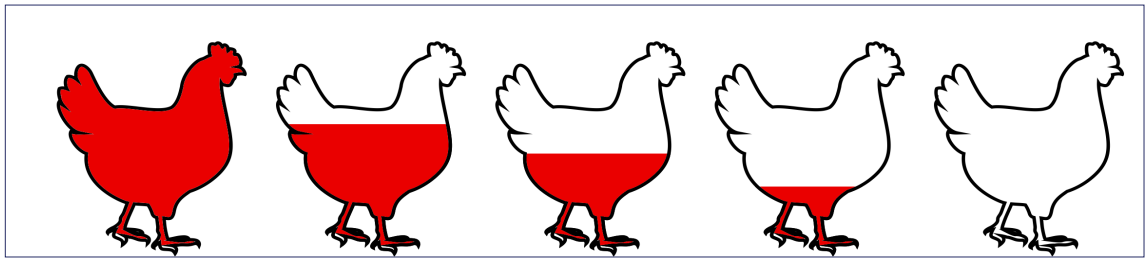
- It is very important to consider the dose of the antibiotic prescribed and avoiding overdose or sub-minimal dose.

- The prescribed course and frequency of treatment with antibiotics is the cornerstone in effective treatment and has to be considered to keep antibiotic concentration effective.

- Stopping the treatment with antibiotics just after clinical improvement is not a required practice. Disappearance of clinical signs does not mean elimination of infection and may enable bacteria to develop resistance against the used antibiotic.

- Withdrawal period –The time that must elapse between the last administration of a veterinary medicine and the slaughter or production of food from that animal – must be considered. Otherwise, antibiotic residues will exist in meat and eggs for human consumption which enable bacteria to develop resistance to these low sub-therapeutic concentrations of

Figure 7: Withdrawal period of antibiotics



Source: Authors' own elaboration.

2. Guidelines of antimicrobial use for livestock in Egypt

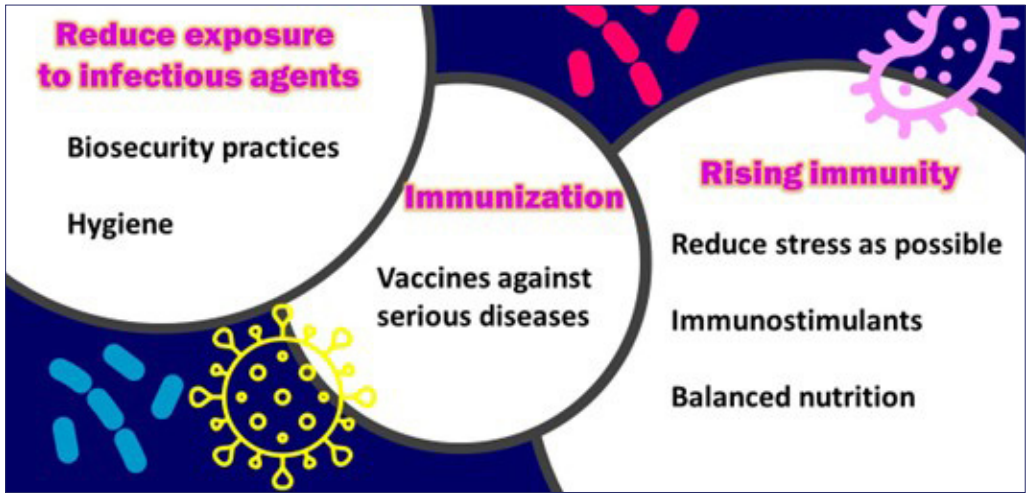
2.1 How to reduce the need for antimicrobial?

2.1.1 Good husbandry practices

2.1.1.1 Source of new animals and calf care

- The newly introduced healthy animals and from a trusted source and of known vaccination status are protected against infection.
- Parturition in hygienic conditions and post-calving care are important to reduce the incidence of bacterial inflammation of birth canal and uterus.
- Giving new-born calves enough amount of colostrum as soon as possible after birth and proper care of calves are important to decrease the incidence of enteritis, pneumonia and reduce antimicrobial use.

Figure 8: Combating infectious diseases



Source: Authors' own elaboration.

2.1.1.2 Good management and husbandry practices in the farms

- Hygienic breeding will reduce microbial load, the exposure of animals to microbes, decrease infection and disease rates, and as a result reduce antimicrobials use and resistance.
- Breeding animals of different species and age groups in the same place together is unfavourable and animals should be separated according to their production type, age and physiological condition to reduce the risk of transmission of diseases in between different animals' groups and species.
- It is of a great value to record each antibiotic use for animals including date, antibiotic used, reason of use, which animal received the medication, dose, route of administration, action taken toward products of animals that were treated by antibiotics, and response to antibiotic treatment of each disease condition. This is useful as a reference for the future use of antibiotics by veterinarians in the farm and to help to reduce the antimicrobial resistance rates.
- Veterinary supervision is essential in all animals' production practices.
- Caution in transportation of animals to their farms or rearing areas with minimal stress is crucial to avoid marked immunosuppression and avoiding higher chances to get infections with subsequent increase of antimicrobial use.
- Increasing numbers of animals per a fixed space area exerts stress on them facilitates the occurrence and transmission of infectious diseases and results in increased antimicrobials use.
- Keeping aged and chronic infected production animals of low productivity, poor immunity, and high susceptibility for infectious diseases in the farm will result in increased use of antimicrobials.
- Milk containing antibiotics residues is not a suitable food to calves. This may enable bacteria within the bodies of such calves to develop resistance to antimicrobials.
- Dry cow treatment – infusion of long-acting antibiotic-preparations directly through teat orifice at the end of the lactation season after the last milking – as well as the use of teat sealants are helpful to reduce udder infection during the critical dry period. These products reduce the prevalence of mastitis during dry period as well as at the beginning of the lactation season. On the other hand, some opinions stated that hygienic dryness of lactating animals and the use of teat sealants may eliminate the need of antibiotics upon drying of lactating cows.
- It is necessary to examine udders frequently during the dry period to treat cases of mastitis during that period and to avoid antibiotics use and residues in milk during lactation.
- Pre-milking and post-milking teat dipping, cleanliness of the udder, cleaning and disinfection of milking machine or hands, and avoidance of over-milking or residual milk are important practices to perform during milking to reduce the occurrence of mastitis and subsequent increase in antimicrobial use and related loss of milk.
- Notification of the authorities on infectious diseases outbreaks as soon as they are diagnosed in your farm is important. This helps in protecting livestock in surrounding disease-free areas and

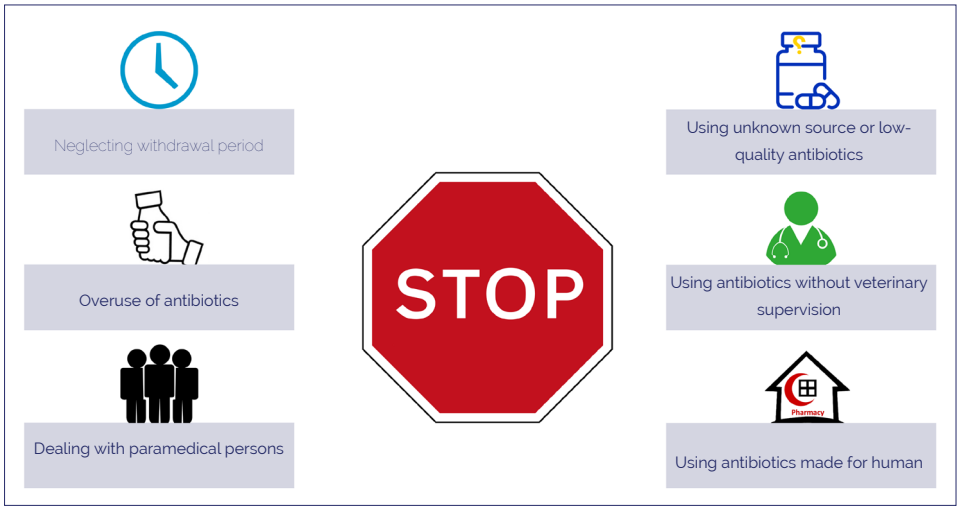
consequently reducing antimicrobials use and resistance rates.

- Following recommendations of veterinary guidance will help you to keep your livestock holdings free from diseases and reduce antimicrobial use.
- It is important to have your animals under veterinary supervision during disease outbreaks as well as in normal conditions.
- Training of farm workers on hygienic and biosecurity measures is required
- It is important to have the water quality checked for chemicals and bacteria regularly.
- The use of herbal medicine can be of value to enhance growth, rise immunity, and reduce antimicrobials use in animal production.
- Immuno-therapy such as specific antibodies against pathogens, antimicrobial peptides, and bacteriophages will be beneficial to reduce the use of antimicrobials in the livestock sector. Similarly, nanoparticles of antibacterial effect will be of additional value.
- Reporting to the veterinary authorities the notifiable diseases and avoid selling of diseased animals is necessary to avoid spread of the diseases which may increase the use of antimicrobials.
- It is important to not sell animals or milk for direct consumption or manufacturing of food products if they contain antibiotic residues. The consumption of antibiotics–containing products will increase antimicrobials resistance rates and, mean many other health risks.
- It is recommended to isolate antibiotic treated cases from other healthy animals to avoid the exposure of healthy animals to low concentration of antibiotics in secretions and excretions of the treated animals in addition to the risk of getting the infection.
- Good drainage system is important to avoid the accumulation of manure which will increase the probability of disease and subsequent increase in antimicrobials use.
- Raising animals by household animal producers in semi-closed rooms of insufficient ventilation which could increases the risk of infections is not advisable.

2.1.1.3 Balanced nutrition and avoid unnecessary antimicrobial feed additives

- Avoidance of stress, balanced nutrition, and correct production practices are essential to have animals of strong immunity, better resistance against infections, and of low need of antimicrobials.
- Sound healthy and balanced ration of low bacterial load is important to reduce foodborne infections such as bacterial enteritis, listeriosis or paratuberculosis.
- Sometimes, farmers use remnants of potato chips, biscuits and cake producing factories to feed their animals. This is inappropriate and usually results in increased occurrence of diseases among these animals and increased antimicrobials use.

Figure 9: Warnings to rationalize the use of antimicrobial



Source: Authors' own elaboration.

2.1.2 Good biosecurity

2.1.2.1 Farm maintenance to prevent external access of birds, rodents and other animals

- As much as you can, keep ration and feed stores free from rodents and away from access of dogs, cats, wild animals and wild birds because these animals may transmit many infectious diseases.

2.1.2.2 Quarantine for new and sick animals

- Stray dogs and cats as well as wild animals may transmit and disseminate infectious diseases in farms and their entrance has to be avoided.
- Quarantine of the newly purchased animals for at least two weeks is an important practice. During this period animals should be subjected to clinical examination, tested for serious diseases such as tuberculosis and brucellosis, faecal examination to detect helminth infestation, and to ensure its freedom from ticks as well as other external parasites.
- Diseased cases should be separated from healthy animals and kept in quarantine until the confirmation of the freedom of the risk of transmission of infection to the healthy animals.

2.1.2.3 Visitor control (vehicle and people)

- Entrance and exit of vehicles, tools and persons into the farm should be only if necessary and under complete control to avoid getting infectious diseases into the farm.
- It is essential to do not allow persons to enter the farm if they contacted cases of contagious diseases outside the farm.
- The entrance of vehicles to your farm needs to be avoided if they entered to other farms suffering from contagious diseases outbreaks.
- Loader/vehicles used for removing manure or transport of dead animals shouldn't be used for ration transport or mixing except after cleaning and disinfection.

2.1.2.4 Workers hygienic measures and health

- Continuous health check of the farm workers against infectious diseases is recommended.
- There is a need for continuous health check of the farm workers accommodations especially the toilets and bathrooms.
- Continuous training of the farm workers on the biosecurity measures is required.

2.1.2.5 Cleaning and disinfection

- There is a need to avoid sharing tools with farms suffering from infectious diseases outbreaks. In general, it is preferable not to share tools at all.
- A slop disinfectant pool of a suitable depth is necessary for vehicles and persons shoes just after the entrance of the farm. You may also use disinfectant bucket, so that persons dip their shoes in it before entering to the farm.
- Persons dealing with animals in quarantine or those isolated for treatment should not come in contact with other animals in the farm except after disinfection of shoes and change clothes. Moreover, a special uniform to be used only in the farm has to be provided for all persons dealing with animals including over shoes, plastic coat, gloves, and masks.
- It is important to avoid the presence of water pools in or around the farm to prevent the multiplication of mosquitoes which may transmit many infectious diseases.
- Control insects and external parasites as ticks or lice to prevent the transmission of many infectious diseases is essential.

2.1.2.6 Safe disposal of dead animals and wastes

- Hygienic disposal of carcasses, placentas, litter and waste products of the farms is required to prevent the spread of infections; composting offers a good choice for that.

2.1.3 Vaccination

- Vaccination against bacterial, viral as well as other infectious diseases is a cornerstone to protect animals against diseases and subsequently to reduce the use of antimicrobials which minimizes the risk of antimicrobials resistance.
- Always keep the immunity of animals strong through immune-stimulants such as vitamins (vitamin A, D and other vitamins) and minerals (zinc, iron, selenium and other minerals) or immune-biotics to enable animals to resist infection.
- There is no need for administrating antibiotics to animals showed post vaccination reaction such as fever, transient anorexia ……etc .
- To get the maximum efficacy of the vaccines, a comfortable conditions to the animals during vaccination to avoid stress and abortion is crucial.

2.2 How and when to use antimicrobial?

2.2.1 When animals are sick

- Symptomatic treatment of diseased animals without accurate diagnosis may lead to the overuse and/or misuse of antibiotics which in turn can increase antimicrobial resistance rates.
- Antibiotics are used only against bacterial diseases. The unnecessary use of antibiotics in viral, mycotic, or parasitic diseases should be discontinued.
- Rapid and field diagnostics are of great help to diagnose some animal diseases in a short period of time without the need for an equipped laboratory.
- Avoiding antibiotics usage for the treatment of mycotic mastitis cases is important.
- It is better to postpone the treatment of subclinical mastitis cases until the end of the lactation using the dry period for that purpose.
- Antibiotic-susceptibility testing is strongly recommended, to increase the chance of the choice of the proper antimicrobial for the treatment of bacterial diseases in livestock.
- Using antibiotics as growth promotors is a potential route to increase in antimicrobial-resistance rates of bacteria and has to be avoided.
- Reduction of stress, rising immunity, and good control measures during outbreaks may eliminate and/or reduce the need for chemoprophylaxis by antimicrobial.

2.2.2 Upon veterinary prescription

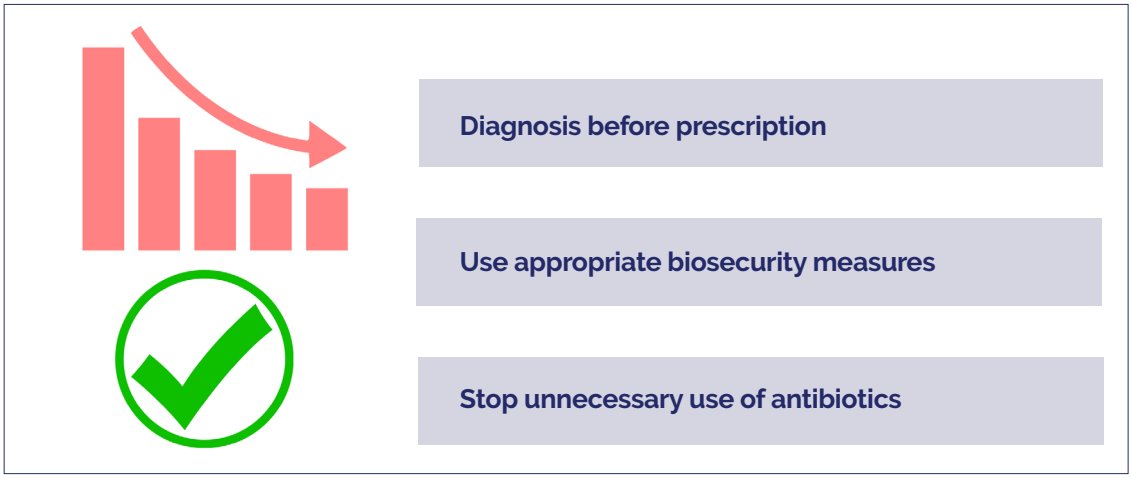
- A qualified veterinarian is the only person responsible for antibiotic prescription; animals' producers must stop using antibiotics themselves without veterinary supervision.
- Following the veterinarian instructions in how to apply medication and for how long, and use the prescribed antibiotic, and no other antimicrobials in replacement is important.
- It is not advisable to receive diagnosis and treatment through phone calls, which is noticed to some extent in Egypt, because it is not sufficient even to make a preliminary diagnosis. This phenomenon may result in misdiagnosis or symptomatic treatment of the diseased cases and misuse of antibiotics.
- Always seeking for a trusted source of information on antimicrobials is important to avoid getting improper information related to the use of antimicrobials in livestock farms from informal social media networks and para-medicals.

2.2.3 Good use of antimicrobial

- Before using an antibiotic product, it is better to read the instructions of its use.
- Mixing two different antibiotics orally or in one syringe for livestock without knowledge on the interaction between them and the suitable dose of each active principle may render the antibiotics inactive, antagonize each other inside the body and results in unpredicted withdrawal periods of the antibiotics.

- Milk constituents as calcium may reduce the efficacy of some antibiotics and this has to be taken into consideration when prescribing/giving oral antibiotics for suckling calves.
- Although of lower adulteration rate and high efficacy, the usage of human antibiotic products for animals should be stopped.
- Expired antibiotics which may have serious side effects on the treated animals and could increase antimicrobial resistance rates.
- Many veterinarians keep medications in their cars or under unsuitable conditions in their clinics. If medications kept in a non-suitable temperature and light conditions, they will be of altered efficacy. Consequently, change in the efficacy of antimicrobials render them of poor therapeutic performance and increase antimicrobials resistance rates.
- Mixing antibiotics with other medications may inactivate each other.

Figure 10: Decrease antibiotics use

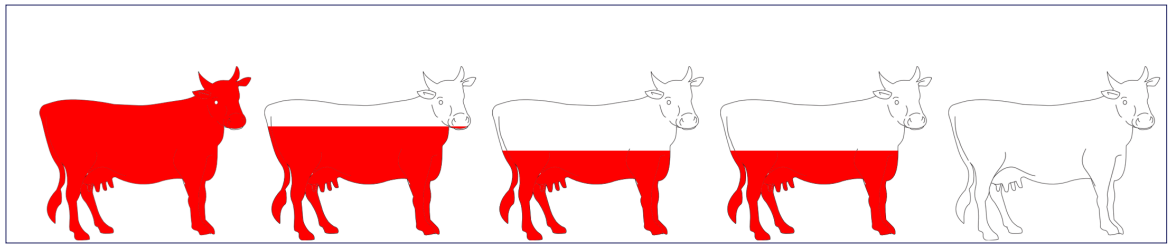


Source: Authors' own elaboration.

2.2.4 Dose, course of treatment, and withdrawal period of antimicrobials

- The accurate antibiotic dose prescribed by veterinarians should be respected.
- Following the course of treatment with antibiotics as well as frequency of their use will keep antibiotic concentration effective.
- Stopping the treatment with antibiotics just after clinical improvement is not a required practice. Disappearance of clinical signs does not mean elimination of infection and may enable bacteria to develop resistance against the used antibiotic.
- Considering the withdrawal period – The time that must elapse between the last administration of a veterinary medicine and the slaughter or production of food from that animal – is important. Otherwise, antibiotic residues will exist in meat, milk or other animal products for human and/or animal consumption which may enable bacteria to develop resistance to these low sub-therapeutic concentrations of antimicrobials. In addition, long-term consumption of antibiotic residues in food has negative effects on many vital organs (for example liver and kidney) as well as many negative health implications.
- Accurate estimation of body weight of the treated animal is important to calculate the correct dose of antibiotics.
- The producers are required to assure that the farm workers respect the treatment regimens during the application of antibiotics and train them on the accurate regimen of dosing.

Figure 11: Withdrawal period of antibiotics



Source: Authors' own elaboration.

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