Effect of Different Sites of Intramuscular Injection on Elimination, 
Bioavailability and Tissue Residues Profile of 
Gentamicin in Broiler Chickens

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Abstract: Background: The site of intramuscular (i.m.) injections can affect the serum and tissue concentration profiles and so alter bioavailability of drug. The variation in the pattern of absorption can be attributed to regional differences in blood flow to skeletal muscles. Materials and Methods: The pharmacokinetics and systemic bioavailability of gentamicin in broiler chickens were compared after single intravenous (i.v.) and intramuscular (i.m.) in two sites thigh and pectoral muscles injections of 5 mg kg⁻¹ b.wt. Tissue residue profiles (kidney, liver, lung and muscles) of gentamicin were also compared after both sites of i.m. injections. The concentrations of gentamicin in serum and tissues were measured by microbiological assay using Bacillus subtilis ATCC 6633 as test organism. Results: Following i.v. injection, serum concentration-time curves were best described by a two compartment open model. The decline in serum drug concentration was bi-exponential with half-lives of (t₁/₂) 0.09 h and (t₂/₂) 2.25 h for distribution and elimination phases, respectively. After i.m. injections in thigh and pectoral muscles, serum concentrations were significantly lower in those injected gentamicin through thigh muscles. The peak serum concentrations of gentamicin (Cmax) were 32.44 and 39.34 μg mL⁻¹ and were obtained at 0.44 and 0.42 h (Tmax), respectively and the elimination half-lives (t1/2) were 1.74 and 2.39 h, respectively. The systemic i.m. bioavailabilities were 83 and 105.20%, after thigh and pectoral muscles injections, respectively. In vitro protein binding percent of gentamicin was 3.4%. The tissue levels following i.m. injections in thigh and pectorals muscles were highest in kidney, liver and decreased in the following order: Serum, lung and muscle. No gentamicin residues were detected in tissues and serum after 12 h with both routes of administration, gentamicin was found in both the liver and kidney after 48 h. Conclusion: This study recommend that injectable antibiotics should be injected in pectoral muscles in poultry farms to achieve high efficacy and avoid rapid elimination by renal portal system.

Key words: Intramuscular, bioavailability, muscles, antibiotics, renal portal system

INTRODUCTION

The site of injection of parenteral preparations depends on the animal species or group of related species. Convenience of administration and cost of the drug preparation are foremost considerations in determining the use of a veterinary dosage form by animal owners. The site of i.m. injection can affect the serum concentration profile and bioavailability of a drug, particularly when a long-acting preparation is administered (Baggott, 2006). The variation in the pattern of absorption can be attributed to regional differences in blood flow to skeletal muscles and in absorptive surface area (Tollefson and Flynn, 2002). Avian species have a well-developed renal portal system that allows blood from the back portion of the body to flow to the kidneys via the external iliac veins. This is first-pass renal excretion may decrease the systemic availability of drugs that are primarily eliminated by the kidneys (aminoglycoside antibiotics) when injected intramuscularly in the thigh of birds (Baggott, 2006). Gentamicin a broad-spectrum bactericidal aminoglycoside antibiotic is commonly used in the treatment of respiratory and enteric bacterial infections in animals including chickens (Houdeshel et al., 1982). It is effective against aerobic Gram-negative microorganisms such as Escherichia coli, Klebsiella, Pseudomonas, Salmonella and some Gram-positive microorganisms such as Staphylococcus aureus (Gilbert, 1991; Cid et al., 1996; Haritova et al., 2004). Nephrotoxicity occurred in 17% and
ototoxicity in 8% of those treated with gentamicin (Prins et al., 1993), but in some populations the numbers could be higher (Zaske, 1992). There appears to be a difference in the incidence of toxicity as a result of once- or multiple-daily administration protocols (Nicolau et al., 1995). Regulatory controls of antibiotic use in animals vary from country to country. In some countries, restrictions apply regarding which antibiotic can be used therapeutically. For example, in Australia and other European countries, gentamicin has not been registered for use in food-producing animals in some because of concerns about antibiotic resistance (Joint Expert Advisory Committee on Antibiotic Resistance, 1999). Finally, there is control of use legislation that restricts antibiotics registered for therapeutic or prophylactic use to registered veterinarians, but allows over-the-counter sales to farmers or stock-feed companies of products registered for use as growth promoters especially in developing countries. A microbiological determination procedure for gentamicin have been developed to assay gentamicin in kidney at 0.4 ppm. Since, residues of gentamicin as the parent compound and total residues are equal, the marker (parent drug) residue concentration of 0.4 ppm in kidney corresponds to 0.4 ppm of total residue (FDA, 2010). The pharmacokinetics of gentamicin has been studied in of in broiler chickens (Abu-Basha et al., 2007), turkey (Pedersoli et al., 1989) and hens (Hartiova et al., 2004). The effect of different sites (thigh and pectoral muscles) of i.m. injections on the pharmacokinetics of gentamicin in chicken has not yet been undertaken in one study. This study aimed to compare the pharmacokinetics, systemic bioavailability and tissue residue profiles of gentamicin in broiler chickens after both sites of i.m. injections.

**MATERIALS AND METHODS**

**Drugs:** Gentamicin 5% injection (For veterinary use only) was obtained from Alexandria Co. for Pharmaceutical and Chemical Industries, Egypt. Each ml contains 50 mg gentamicin sulphate.

**Chickens:** Eighty female broiler chickens (Hubbard breed), 40-45 days old, weighing between 2 and 2.5 kg, were obtained 2 weeks before the start of the study. During acclimatization (at least 2 weeks before starting the experiment to ensure the complete withdrawal of any residual drugs) and subsequent treatment periods, all chickens had free access to water and antibacterial-free food. The animal house temperature was maintained at 22±2°C and humidity at 40-55%. The study was approved by the Animal Care and Use Committee at the Faculty of Veterinary Medicine, Cairo University.

**Experimental design**

**Pharmacokinetic study:** Chickens were individually weighed before drug administration and doses were calculated precisely for each bird. Fifteen chickens were allocated to three equal groups of 5 each. Birds in group one were given a single i.v. dose of gentamicin at 5 mg kg⁻¹ into the left brachial vein. Birds in the other groups were given the same dose by i.m. injections through the thigh and pectoral muscles, respectively. All chickens had free access to water and food during experiment.

Blood samples (1-1.5 mL) were collected from brachial and cutaneous ulnar veins at time 0 (pretreatment) and at 15 and 30 min and 1, 2, 4, 6, 8, 12, 24, 48 and 72 h after drug administration. The samples were left to clot at room temperature then centrifuged at 1500 g for 15 min to obtain clear serum and were kept frozen at −70°C until analyzed.

**Tissue residue study:** Sixty broiler chickens were divided into two equal groups of 30 birds each. The two groups were given gentamicin at a dose of 5 mg kg⁻¹ through i.m. injections in thigh and pectoral muscles, respectively. Three broiler chickens were sacrificed at 1, 2, 4, 6, 8, 10, 12, 24, 48 and 72 h post gentamicin administration. Tissue samples from liver, kidney, lung and muscles (thigh and breast) were taken and stored at −70°C pending assay.

Five chickens did not receive any medications served as a negative control for serum and tissues.

**Analytical procedure:** Chicken serum and tissue samples were assayed for determination of gentamicin concentrations by microbiological assay as described by Reamer et al. (1998) using *Bacillus subtilis* ATCC 6633 as test organism and Mueller-Hinton agar (Difco, Detroit, MI, USA). Five wells, 6 mm in diameter, were made in a standard Petri-dish plate (120 mm) containing 25 mL inoculated agar. Wells were filled with tested serum and tissue extracts samples or gentamicin standard. Zones of inhibition were measured after 18 h of incubation at 37°C and the concentrations of gentamicin were calculated from the standard curve. Standard curves of gentamicin were prepared in antibacterial-free chicken's serum by the appropriate serial dilution. Standard curves of gentamicin were prepared in pooled control serum and tissues. The standard curve in chicken serum was linear from 0.02 to 100 μg mL⁻¹ (R² = 0.992). The limit of quantification was 0.02 and 0.2 μg mL⁻¹ for serum and tissues, respectively.

**Tissues preparation:** One gram of tissues was homogenized with Phosphate Buffer Solution (PBS) three times and then was centrifuged 1500 g for 20 min. The supernatant layer was evaporated and the residue was mixed with 0.5 mL PBS (Fan et al., 2001). The residues of different tissues were used directly to estimate gentamicin concentrations. The mean recovery from tissues was 89.5±3.7% and the intra-assay coefficient of
Variation Coefficient (CV) was 9%. Negative control samples (non-treated) showed no bacterial inhibition, indicating no intrinsic antibacterial activity of the samples.

The extent of protein binding was determined in vitro as previously described (Craig and Suh, 1991). The method is based on the diffusion of free antibiotics into the agar medium. To estimate the protein binding of the drug, gentamicin was dissolved in phosphate buffer and antibiotic-free chicken serum at different concentrations. The differences in the diameter of the inhibition zone between the solution of the drug in the buffer and serum samples were calculated. The percentage of protein-bound fraction was calculated according to the following equation:

\[
\text{Protein binding} (\%) = \frac{\text{Zone of inhibition in buffer} - \text{Zone of inhibition in serum}}{\text{Zone of inhibition in buffer}} \times 100
\]

### Pharmacokinetic analysis:
A computerised curve-stripping program (R Strip; Micromath Scientific Software, Salt Lake City, UT, USA) was used to analyse the concentration-time curves for each individual bird after the administration of gentamicin by different routes. For the intravenous data, the appropriate pharmacokinetic model was determined by visual examination of individual concentration-time curves and by application of Akaike's Information Criterion (AIC) (Yamaoka et al., 1978). The serum concentration-time relationship was best estimated as a two-compartment open model:

\[
C_P = A e^{\alpha t} + B e^{\beta t}
\]

where, \(C_P\) is the concentration of drug in serum at time \(t\); \(A\) is the intercept of the distribution line with the concentration axis expressed in (µg mL\(^{-1}\)); \(B\) is the intercept of the straight line of elimination phase with the concentration axis expressed as µg mL\(^{-1}\); \(\alpha\) is the distribution rate constant expressed in units of reciprocal time (h\(^{-1}\)); \(\beta\) is the elimination rate constant expressed in units of reciprocal time (h\(^{-1}\)) and \(e\) is the base of natural logarithm. The coefficient (\(A\) and \(B\)) and rate constants (\(\alpha\) and \(\beta\)) were calculated from the experimental data by the technique of least squares regression analysis.

The i.m. data were analysed by adopting a one-compartment open model. This program also calculated non-compartmental parameters using the statistical moment theory (Gilbadi and Perrier, 1982). The \(C_{\text{max}}\) (maximum serum concentration) and \(T_{\text{max}}\) (time of maximum serum concentration) were taken directly from the curve. The terminal elimination half-life (\(t_{1/2}\)) and absorption half-life (\(t_{0.5}\)) were calculated as \(\ln(K_e)\) or \(\ln(K_{\text{abs}})\), respectively. The area under serum concentration-time curve (AUC) and area under the first moment curve (AUMC) were calculated by the method of trapezoids and extrapolation to infinity was performed.

The systemic clearance as:

\[
C_{\text{tot}} = \frac{\text{Dose}}{\text{AUC}}
\]

The absolute bioavailability (F) was calculated as:

\[
F = \frac{\text{AUC iv.}}{\text{AUC i.m.}} \times 100
\]

### Statistical analysis:
The mean serum pharmacokinetic variables for gentamicin after both sites of i.m. injections were statistically compared by nonparametric analysis, using the SPSS® 10.0 software package (SAS, Cary, NC, USA). Results are presented as arithmetic Mean±SD. The nonparametric Wilcoxon test was used to compare the tissue residues following each route of administration. Means were considered significantly different at \(p<0.05\) and \(p<0.01\).

### RESULTS
All chickens were clinically healthy throughout the experimental period. Gentamicin was well tolerated by the chickens; there were no unexpected events that could have influenced the outcome of the study. Gentamicin was not detected at 24 and 48 h post drug administration for i.v. and i.m. routes, respectively in any chicken.

The combined data of i.v. and i.m. injections were best fitted by a 2-compartment open model. The mean serum concentration-time profiles of gentamicin following single i.v. and both sites of i.m. administrations of 5 mg kg\(^{-1}\) are illustrated in Fig. 1. Mean values of pharmacokinetic parameters estimated from the curve fitting are shown in Table 1. Kinetic analysis of the data after a single i.v. dose provided the following mean values: \(t_{1/2}\) and \(t_{0.5}\) were 0.09 and 2.25 h, respectively. The volume of the central compartment \(V_c\) was 0.016 L kg\(^{-1}\), volume of distribution at steady state \(V_d\) was 0.10 L kg\(^{-1}\) and the total body clearance \(Cl_{\text{tot}}\) was 42 mL h kg\(^{-1}\). Following i.m. administrations in thigh and pectorals muscles the corresponding pharmacokinetic variables are...
Table 1: Mean±SD serum pharmacokinetic parameters of gentamicin in broiler chickens following i.v. and i.m. injections at a dose rate of 5 mg kg⁻¹ b.wt., n = 5

<table>
<thead>
<tr>
<th>Parameters</th>
<th>i.v.</th>
<th>i.m. Thigh</th>
<th>i.m. Pectoral</th>
</tr>
</thead>
<tbody>
<tr>
<td>α (k₁) (h⁻¹)</td>
<td>7.37±1.86</td>
<td>18.31±2.17</td>
<td>21.05±2.68</td>
</tr>
<tr>
<td>t₁/₂α (t½α) (h)</td>
<td>0.9±0.01</td>
<td>0.03±0.02</td>
<td>0.03±0.01</td>
</tr>
<tr>
<td>β (k₂) (h⁻¹)</td>
<td>0.3±0.09</td>
<td>0.4±0.05</td>
<td>0.29±0.05</td>
</tr>
<tr>
<td>t½β (t½β) (h)</td>
<td>2.2±0.50</td>
<td>1.74±0.18</td>
<td>2.39±0.20**</td>
</tr>
<tr>
<td>K₀ (h⁻¹)</td>
<td>0.8±0.14</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>K₁ (h⁻¹)</td>
<td>4.2±1.12</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>V₁ (L kg⁻¹)</td>
<td>0.01±0.07</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>V₀ (L kg⁻¹)</td>
<td>0.10±0.01</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cl₆₀ (mL h⁻¹ kg⁻¹)</td>
<td>42.00±5.7</td>
<td>51.00±3.20</td>
<td>40.00±3.11*</td>
</tr>
<tr>
<td>AUC₀₆₀ (µg h⁻¹ mL⁻¹)</td>
<td>119.00±12.51</td>
<td>98.8±48.11</td>
<td>125.25±45.32*</td>
</tr>
<tr>
<td>AUMC (µg h⁻² mL⁻¹)</td>
<td>230.5±21.88</td>
<td>227.6±18.10</td>
<td>58.9±29.20***</td>
</tr>
<tr>
<td>MRT (h)</td>
<td>2.16±0.61</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MAT (h)</td>
<td>0.41±0.07</td>
<td>1.33±0.12***</td>
<td>3.49±0.43</td>
</tr>
<tr>
<td>Cmax (µg mL⁻¹)</td>
<td>32.44±1.74</td>
<td>39.34±2.10*</td>
<td>39.34±2.10*</td>
</tr>
<tr>
<td>Tmax (h)</td>
<td>0.44±0.10</td>
<td>0.42±0.12</td>
<td></td>
</tr>
<tr>
<td>F (%)</td>
<td>83.3±10</td>
<td>105.2±3.2**</td>
<td></td>
</tr>
</tbody>
</table>

α: Distribution rate constant, β: Elimination rate constant, t₁/₂α: Distribution half-life, t½β: Elimination half-life, K₀: and K₁: First-order rate constants for drug distribution between the central and peripheral compartments, V₁: Volume of distribution, Cl₆₀: Total body clearance, AUC: Area under the curve by the trapezoidal integral, AUMC: Area under moment curve by the trapezoidal integral, MRT: Mean residence time, k₀: Absorption rate constant, k₂: Absorption half-life, k₁: Elimination rate constant, t½β: Elimination half-life, MAT: Mean absorption time, Cmax: Maximum serum concentration, Tmax: Time to peak concentration, F (%): Bioavailability, values after i.m. injections in pectoral muscles were significantly different from corresponding values following i.m. injection in thigh muscles at *p<0.05 and ***p<0.001.

Table 2: Mean±SD serum and tissues concentrations of gentamicin (µg g⁻¹ or µg mL⁻¹) following i.m. injection in thigh muscle at a dose of 5 mg kg⁻¹ b.wt. in broiler chickens

<table>
<thead>
<tr>
<th>Gentamicin concentrations (µg g⁻¹)</th>
<th>Time after injection (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Serum</td>
<td>-</td>
</tr>
<tr>
<td>Kidney</td>
<td>-</td>
</tr>
<tr>
<td>Liver</td>
<td>-</td>
</tr>
<tr>
<td>Lung</td>
<td>-</td>
</tr>
<tr>
<td>Thigh</td>
<td>1.55±0.20</td>
</tr>
<tr>
<td>Breast</td>
<td>0.85±0.08</td>
</tr>
</tbody>
</table>

mid: Not detected, n = 3, M: Muscle

Table 3: Mean±SD serum and tissues concentrations of gentamicin (µg g⁻¹ or µg mL⁻¹) following i.m. injection in pectoral muscles at a dose of 5 mg kg⁻¹ b.wt. in broiler chickens

<table>
<thead>
<tr>
<th>Gentamicin concentrations (µg g⁻¹)</th>
<th>Time after injection (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Serum</td>
<td>-</td>
</tr>
<tr>
<td>Kidney</td>
<td>-</td>
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<tr>
<td>Liver</td>
<td>-</td>
</tr>
<tr>
<td>Lung</td>
<td>-</td>
</tr>
<tr>
<td>Thigh</td>
<td>1.52±0.31</td>
</tr>
<tr>
<td>Breast</td>
<td>0.85±0.08</td>
</tr>
</tbody>
</table>

mid: Not detected, n = 5, M: Muscle

shown in Table 1. Significant differences in the resultant kinetics data and tissue residue profiles were obtained between i.m. administrations in thigh and pectoral muscles administration. The Cl₆₀ after i.m. injection of gentamicin in thigh muscles was significantly faster than that after pectoral muscles injections. Gentamicin was rapidly absorbed with a t½β of 0.04 and 0.032 h, the maximal serum concentration (Cmax) 32.44 and 39.34 µg mL⁻¹ were detected at 0.44 and 0.42 h, the time to peak concentration (Tmax), the t½β of gentamicin were 1.74 and 2.39 h, gentamicin bioavailability were 83 and 105.20%, respectively. In vitro serum protein binding percent of gentamicin in serum was 3.4%. After i.m. injections, tissue concentrations were significantly higher in chickens' injected gentamicin through pectoral muscles than those injected in thigh muscles. The tissue concentrations were highest in kidney and liver, respectively and decreased in the following order: Lung and muscles. No gentamicin residues were detected in tissues after 24 h except in kidney of chickens received gentamicin through pectoral injection; it was detected until 48 h post-dosing (Table 2, 3).
DISCUSSION

Gentamicin pharmacokinetics has been a subject of considerable interest due to its clinical importance on the one hand and its toxicity on the other hand. Gentamicin is a highly hydrophilic drug that distributed into the extracellular space with poor tissue penetration and accumulates in the tissues of high lipid content (Ziv et al., 1982; Frazier et al., 1988). It is excreted unchanged from the body, primarily by renal glomerular filtration (Al-Amoud et al., 2002). We used the bioassay technique for estimation of gentamicin concentrations in serum and tissues, this method did not distinguish active metabolites from the parent compounds. Since, gentamicin is a very polar entity that does not undergo metabolism in the body and is excreted mainly by glomerular filtration (Zaske, 1992) there is no interfere with determination of gentamicin dosage regimen by this technique.

After i.v. administration of antibiotic gentamicin (5 mg kg⁻¹ b.w.t.), the t₁/₂α (2.25 h) was similar to values reported in broiler chickens (Abu-Basha et al., 2007), turkeys (Haritova et al., 2004) and the golden eagles (Bird et al., 1983) and was slightly lower than those found in ducks (Pedersoli et al., 1990). These differences might be due to different assay methods, different age of animals, or differences between the species. The Cl₁ (42 mL h kg⁻¹) was similar to that values reported in roosters (Pedersoli et al., 1990) and turkeys (Pedersoli et al., 1989) 46.5 and 49.8 mL h kg⁻¹, respectively. The high body clearance indicates high tubular secretion of gentamicin. The V₁ (0.10 kg) indicates the rapid distribution of gentamicin in the body. This according with values reported in roosters (Pedersoli et al., 1990), rabbits (Curl and Curl, 1988) and turkeys (Pedersoli et al., 1989, Haritova et al., 2004) and was lower than the value reported in broiler by (Abu-Basha et al., 2007). The V₁ is an accurate indicator of drug diffusion in the body tissues and indicates that gentamicin is distributed primarily into extracellular tissues. After single i.m. injection of gentamicin at a dose of 5 mg kg⁻¹ b.w.t., in thigh and pectoral muscles, serum concentrations were significantly higher in those injected gentamicin through pectoral muscles. The serum concentration of gentamicin exceeded the MFC for most sensitive pathogens for a longer time than i.v. injection. The persistence of antibiotic concentrations in serum and tissues above the MFC is the pharmacodynamic variable related to the clinical efficacy of gentamicin (Toutain et al., 2002).

Gentamicin is rapidly eliminated after i.m. injection in thigh muscles than after pectoral injection and the elimination half-lives (t₁/₂α) were 1.74 and 2.39 h, respectively. Furthermore, the C₁₀₀ after i.m. injection of gentamicin in thigh muscles was significantly faster than that after pectoral muscles injections. Avian species has a well-developed renal portal system, first-pass renal excretion may decrease the systemic availability of drugs that are primarily eliminated by the kidneys (aminoglycoside antibiotics) when injected intramuscularly in the thigh of birds (Beggat, 2006).

Our results showed that gentamicin is rapidly absorbed after i.m. injections with both sites, with peak serum concentrations of gentamicin (C₁₀₀) were 32.44 and 39.34 μg mL⁻¹ and were obtained at 0.44 and 0.42 h (T₁₀₀), respectively. The variation in the pattern of absorption can be attributed to regional differences in blood flow to skeletal muscles and in absorptive surface area (Toddson and Flynn, 2002). These results are higher than those reported in roosters (Pedersoli et al., 1989) and broiler chickens (Abu-Basha et al., 2007) after subcutaneous route. The bioavailability (F) of gentamicin after i.m. administration in thigh and pectorals muscles administration were 83 and 105.20%, respectively. Similar findings are reported in roosters (Pedersoli et al., 1989) (95%) and turkeys (Pedersoli et al., 1989) (102%). The high bioavailability after pectoral injection may be due to the effect on the drug absorption rate of factor such as blood supply, site of injection and dose. This can be particularly the case when absorption is considerably slower than disposition, resulting in ‘flip-flop’ pharmacokinetics (Toutain and Bousquet-Melou, 2004).

In vitro serum protein binding percent of gentamicin in chicken’s serum was 34%. This finding is in accord with that reported in broiler chickens by Abu-Basha (6.46%). In this respect, Zaske (1992) stated that the plasma protein binding of gentamicin (aminoglycosides in general) is less than 10%. Estimates of the plasma protein binding of gentamicin have ranged from zero binding (Rosenkranz et al., 1978) to 20% binding (Meyers et al., 1978).

Tissue concentrations following i.m. injections were initially increased till it reaches the maximal between 6 and 8 h then decreased over time. Concentrations were highest in kidney and liver, respectively and decreased in the following order: Lung and muscles. No gentamicin residues were detected in tissues after 24 h except in kidney of chickens received gentamicin through pectoral injection; it was detected until 48 h post-dosing. Concentrations of gentamicin in tissues were similar or higher than the corresponding serum concentrations. This indicates that the penetration of gentamicin into these tissues was good. The high volume of distribution and low protein binding of this drug in chickens is reflected by its persistence in tissues for longer periods. Brown et al. (1985) explained the accumulation of gentamicin in may be due to a slow release from tissues containing high concentrations. Such high concentration may be achieved by active uptake by the proximal tubules and other body tissues (Schentag and Jusko, 1977). The rate of cortical uptake may predict gentamicin nephrotoxicosis in
species. Acceptable daily intakes for human subjects based on 'no-effect levels' and safety have been calculated for many antibiotics, despite the lack of accurate data. From these values, a tolerance level or maximum residue level (MRL) is calculated. Established MRL is modified and often reduced as the techniques for detection of residues improve and become more sensitive. Conversely, some levels have been increased recently as data become available that facilitate better risk assessment. A tolerance of 0.1 part per million is established for negligible residues of gentamicin sulfate in the uncooked edible tissues of chickens and turkeys (FDA, 2010).

CONCLUSION

Chickens have a well-developed renal portal system, the first-pass renal excretion decrease the systemic availability of antibiotics that are primarily eliminated by the kidneys as gentamicin when injected intramuscularly in the thigh muscles of birds. Consequently, we recommend that injectable antibiotics should be injected in pectoral muscles in poultry farms to achieve high efficacy.

REFERENCES


