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Some Molecular and Control Studies on *Escherichia coli* in broiler chickens

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Chapter IV: Summary

Colibacillosis in poultry includes systemic and localized infections. The localized infections are omphalitis, swollen head syndrome, cellulitis, and diarrhea. Systemic infection includes respiratory colisepticemia, enteric colisepticemia and neonatal colisepticemia. In this study; a total of 400 samples from 20 broiler farms in Fayoum and Beni-Suef governorates were collected and avian pathogenic *E. coli* (APEC) were isolated morphologically, biochemically identified and Congo red binding as well as hemolytic activity were performed. Selected 20 isolates were serologically identified, and their antimicrobial susceptibility profiles were determined. Ten representative serogroups were subjected to virulence and antimicrobial resistance genes detection using PCR. *In vivo* pathogenicity test was performed for 5 *E. coli* strains that were selected based on serogroups prevalence, virulence, and antimicrobial genes patterns. In the second part, the protective efficacy of *E. coli* live attenuated vaccine (by spray method at one day old) was compared with the preventive administration of lectin preparation before challenge. Both treatments were evaluated using either homologous *E. coli* O₇₈ or heterologous *E. coli* O₁₂₅ strains, separately. The challenge was at 21 days old with dose of 0.5 ml of $\sim 10^8$ CFU/ ml via subcutaneous inoculation. The bodyweight and feed conversion ratios (FCR) were calculated on weekly basis. Clinical signs and lesions (in dead and necropsied chickens) were scored and histopathological examination was performed at 2- and 7-days post inoculation (dpi). The liver and heart of euthanized chickens were tested for pathogenic *E. coli* colonization.

Results of the first part of the study revealed an incidence of 53.8% of *E. coli* from broiler chickens with the predominance of O₁₂₅ (30%), O₁₁₉ (20%), O₁₂₆, and O_{86a} (15% each) serogroups. The selected 20 *E. coli* strains were multi-drug resistant (MDR) but sensitive to fosfomycin. The β -lactams and tetracycline resistance genes were detected in all tested isolates, however,

aminoglycoside and quinolone resistance genes were not detected. Ten percent of isolates were resistant to colistin and the *mcr-1* gene was detected by PCR. *In vivo* pathogenic strains consistently harbored the virulence gene pattern of *fimH*, *fimA*, *papC*, *iutA*, and *tsh* which was the most common gene constellation detected. The detection of *tsh* gene was consistently associated with lethality in day-old chicks.

Regarding vaccine (by spray method at one day old) versus lectin evaluation, The Nisseiken Avian Colibacillosis Vaccine (CBL) reduced mortalities to 16% in homologous challenge group (at 21 days old) but there was no obvious reduction in mortalities (28%) in heterologous challenge group. Lector-50[®] treated groups showed 20% and 16% mortalities after challenge with the *E. coli* O₇₈ and O₁₂₅, respectively. However, both groups showed comparable performance parameters, clinical signs score, lesion scores and histopathological lesion score to the homologous vaccinated group with variable *E. coli* colonization of heart and liver.

Conclusion:-

1. Prodominance of *E. coli* O₁₂₅ then *E. coli* O₁₁₉ followed by *E. coli* O₁₂₆ and *E. coli* O_{86a} in broiler chickens.
2. The high prevalence of multi-drug resistant *E. coli* with increased detection rate of colistin resistance (*mcr-1* gene) in *E. coli* associated with colibacillosis in broiler chickens indicating a potential public health concern.
3. The gene constellation of *fimH*, *fimA*, *papC*, *iutA*, and *tsh* was found to be the most prevalent virulence markers of APEC and could be used as fast pathotyping of avian *E. coli* isolates especially the virulence gene *tsh*.
4. The efficacy of Nisseiken avian colibacillosis vaccine[®] "CBL" against homologous but not heterologous challenge with APEC and the use of *E. coli* vaccines in the present time is unable to protect against various *E.*

coli strains which appeared by conjugation, transformation and transduction.

5. The prebiotic products containing lectins can be used to minimize economic losses of avian colibacillosis when administered via drinking water regardless of the challenge strain serotype.