CONTENTS

LIST OF TABLES

List of Figures

List of Abbreviations

B.Cereus	**Bacillus cereus**
CDC	**Centers for Disease Control and Prevention**
Cytk	**Cytotoxin K**
FDA	**Food and Drug Administration**
GMP	**Good manufacturing practice**
HACCP	**Hazard Analysis and Critical Control Point**
Hbl	**Heamolysine BL**
Nhe	**Non heamolytic enterotoxin**
PCR	**Poly merase chain reaction**
WHO	**World Health Organization**

14. Using Marjoram oil the best added essential oil as it was the most effective on *B. cereus* strains followed by clove and cinnamon oils.

7. Summary

Bacillus cereus considered as one of the most important pathogens and the presence of them in meat products constitutes serious problems for consumers. So, the present study was conducted to throw light over the prevalence of *B. cereus* in common meat products (rice kofta; kobeba; sausage and beef burger) sold in different supermarkets at Kaliobia Governorate, beside the phenotypic characterization of the isolated strains ; detection some virulence genes(***hbl*C, *cyt*K**) and trials to control them by using some essential oils.

The results revealed that, 47isolates of *B. cereus* were isolated from 100 examined meat products samples (rice kofta; kobeba; sausage and beef burger) represented as 15 (60%) from rice kofta samples; 13 (52%) from kobeba samples; 10 (40%) from sausage samples and 9 (36%) from beef burger samples.

In addition, the minimum and maximum *B. cereus* count in the examined meat products samples (rice kofta; kobeba; sausage and beef burger) were ranged from 6.0×10^2 to 4.9×10^4; 3.0×10^2 to 2.1×10^4; 1.0×10^2 to 1.3×10^4 and 1.0×10^2 to 8.5×10^3 respectively, with a mean value of $1.57\times10^4\pm 0.39\times10^4$; $9.14\times10^3\pm 2.06\times10^3$; $7.82\times10^3\pm 1.65\times10^3$ and $2.35\times10^3\pm 0.72\times10^3$, respectively. So, the highest bacterial

percentage was in rice kofta followed by kobeba then sausage and finally beef burger.

The PCR results showed that, ***cytK*** virulence gene was detected in 15 out of 47 studied strains (3 rice kofta; 3 kobeba; 5 sausages and 4 beef burger) giving product of 565 bp. Meanwhile, ***hblC*** virulence gene was detected in 7 out of 47 studied strains (1 rice kofta; 2 kobeba; 2 sausages and 2 beef burger) giving product of 695 bp. Moreover, both ***cytK*** and ***hblC*** virulence genes were detected in 24 out of 47 studied strains(11 rice kofta; 8 kobeba; 3 sausage and 2 beef burger) giving product of 565 bp. and 695 bp.

Regarding to studying the effect of different essential oils (1%) on viability of *B. cereus* strains,the results cleared that, the *B. cereus* counts in examined minced meat samples after addition of 1% essentials oils (cinnamon, clove and marjoram) were as follow:

At zero time, the mean value of *B. cereus* counts for control and treated samples was $3.0x10^6$ $\pm0.5x10^6$.

In control samples, *B. cereus* counts were decreased by 3.3%; 10.0% and 13.3% with mean values of $2.9x10^6$ $\pm0.3x10^6$; $2.7x10^6$ $\pm0.3x10^6$ and $2.6x10^6$ $\pm0.2x10^6$ after 2^{nd}; 4^{th} and 6^{th} days, respectively; meanwhile, the mean value of *B. cereus* counts at zero time was $3.0x10^6$ $\pm0.5x10^6$.

Concerning to addition of cinnamon oil 1%, *B. cereus* counts were decreased by 94.0%; 97.4% and 98.9 % with mean values of $1.8x10^5$ $\pm0.2x10^5$; $7.9x10^4$ $\pm1.4x10^4$ and $3.3x10^4$ $\pm0.6x10^4$after 2^{nd}; 4^{th} and 6^{th} days, respectively; meanwhile, the mean value of *B. cereus* counts at

zero time showed no changes since reduction effect of cinnamon oil was not initiated yet.

Meanwhile, the addition of clove oil 1% revealed the decrease of *B. cereus* counts by 97.2% and 99.8% with mean values of $8.5\times10^4\pm 2.1\times10^4$ and $5.2\times10^3\pm 1.0\times10^3$ after 2nd and 4th. But, at the 6th day of storage, it had complete inhibited effect on *B. cereus* strains that cannot be detected in treated samples.

Moreover, the addition of marjoram oil 1% revealed the decrease of *B. cereus* counts by 99.7 % with mean value of $6.7\times10^3\pm 1.5\times10^3$ after 2nd day of storage and after that, it had complete inhibited effect on *B. cereus* strains which cannot be detected in treated samples.

Finally, the results proved that, meat products (rice kofta; kobeba; sausage and beef burger) are considered public health hazard and the presence of *B. cereus* may be due to lack of sanitary measures during processing, handling and storage or using contaminated flesh, rice, spices and vegetables in manufacture of such product. Moreover, Marjoram oil was considered the best added essential oil as it was the most effective on *B. cereus* strains which cannot be detected in treated samples at 4th day of storage followed by clove and cinnamon oils.

Therefore, it was concluded that, *B. cereus* is meat borne pathogen of public health important and the hygienic measures are suggested for obtaining meat products with controlled bacterial pathogens to be fit for human consumption.