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Bacterial Quality of Ready to Eat Meals Provided In Food Serving Establishments In Kingdom Of Saudi Arabia

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Abstract

A total of 210 random ready to eat food samples represented by thirty samples each of (beef kabab, chicken kabab, grilled chicken, chicken shawarma, roasted chicken, tehena salad and green salad) beside Sixty swabs collected from the hands of employee and surfaces (30 of each) were collected from different restaurants in Dammam city, the Kingdom of Saudi Arabia (KSA). All samples were subjected to bacteriological examinations beside measuring pH values and recording the temperature of cooked food samples to evaluate their safety and fitness for human consumption. The obtained results showed that almost all of the examined samples constitute bacteriological problems in terms of aerobic plate count, Coliforms count, Faecal Coliforms count and isolation of *E. coli, Salmonella*, and *Staphylococcus aureus*. Different strains of *E.coli* and *Salmonellae* had been isolated in 40, 6.66% of chicken shawarma samples, respectively. There was negative correlation between temperatures of the cooked products with the different bacteriological attributes of cooked food samples. Meanwhile, there was strong positive correlation between pH with the different bacteriological attributes of cooked food samples.

Key words: Quality, ready to eat, meat meals, food serving establishments, bacteriological examination

Introduction

Ready to eat meals are considered one of the most meals offered to the consumers in the Kingdom of Saudi Arabia especially all over the year and during Hajj and Umrah. Ready to eat foods can be described as foods and beverages that can be bought directly from street vendors or hawkers and are consumed at the point of sale or at later time without further processing. It could be raw or cooked, hot or chilled and can be consumed without further treatment (***Tsang, 2002***). Unfortunately, such products offer ideal medium for microbial growth for they are highly nutritious, have a favorable pH, and are normally lightly salted or not salted at all (***Johnston and Tompkin, 1992***). Ready to eat meat or poultry products may be contaminated with high levels of some pathogens that could reach 10^6 cfu/gm. Microbiological quality of food indicates the amount of microbial contaminants it has, a high level of contamination indicates low quality of food storage and its handling more likely to transmit diseases (***Oranusi et al., 2013***). Bacterial count in prepared food and water is a key factor in assessing the quality and safety of food. It also reveals the level of hygiene adopted by food handlers in the course of preparation of such foods. Food and water in particular have been described as vehicle for the transmission of microbial disease among which are those caused by coliforms (***Nkere et al., 2011***). Safe food is a basic human right despite the fact many foods are frequently contaminated with naturally occurring pathogenic microorganisms which cannot be detected organoleptically (seen, smelled or tested) but can cause diseases including death especially if the way they are conserved during exposition for sale provides condition for those microorganisms to grow and reach considerable levels of contamination (***WHO, 2000***). Therefore, the approach of the present study was planned out to investigate of the bacteriological quality attributes of some ready to eat meat meals beside hygienic status of hands of employee and food contact surfaces in different restaurants in Dammam city, the Kingdom Saudi Arabia (KSA).

Material and Methods

Collection of samples

A total of 210 random ready to eat food samples represented by thirty samples each of (beef kabab, chicken kabab, grilled chicken, chicken shawarma, roasted chicken, tehena salad and green salad) beside Sixty swabs collected from the hands of employee and surfaces (thirty of each) were collected from different

restaurants in Dammam city, the Kingdom of Saudi Arabia (KSA). Each food sample was weighted approximately 500 grams. The collected samples were directly subjected to bacteriological examinations beside measuring pH values and recording the temperature of cooked food samples to evaluate their safety and fitness for human consumption.

On the other hand, sterile swabs (Premier, China) were used for the samples collected from food handlers' hands and surface swab before and after cleaning from different restaurants. Sterile swabs were removed from coded test tubes that contained 5 ml of a sterile phosphate-buffered saline (Oxoid, UK) and the targeted areas (palms of food handlers) and surfaces were swabbed. Sampling was performed by swabbing the areas horizontally, vertically and diagonally. The collected samples were kept in insulated boxes filled with crushed ice and transported to the laboratory under complete aseptic conditions and examined as quickly as possible.

Preparation of Food samples (ICMSF,1996)

Ten grams of the product was transferred to a sterile polyethylene bag to which 90 ml of sterile Ringer solution (OXOID) was aseptically added. The contents of the bag were then stomached for 60 seconds using stomacher (Stomacher lab. Blender 400, Seward lab – Serial No. 30469 Type Ba7021 London) to have a dilution of 1/10, one ml from the original suspension was transferred with a sterile pipette to another tube containing 9 ml of sterile Ringer solution and mixed well using test tube shaker to make next dilution.

Preparation of Swabs (ICMSF, 1996)

The test tubes and the swabs were shook vigorously for ten seconds to release bacteria from the swabs. One ml from the swab content suspension was transferred with a sterile pipette to another tube containing 9 ml of sterile Ringer solution and mixed well using test tube shaker to make next dilution.

Bacteriological investigations

Enumeration of Aerobic Plate Count (FAO, 1992)

From each of the previously prepared sample homogenate, 0.1 ml was aseptically spread onto the surface of double sets of dried standard plate count agar plates using sterile bent glass spreader. The plates were incubated at 30°C for 48 hours.

Enumeration Of Coliforms Bacteria "Mpn" (Fao, 1992)

Three tubes method were performed; where 3 tubes of Laury sulphate tryptose broth "LST" (Oxoid, CM 451) contained inverted Durham's tubes were inoculated with 1 ml of the previously prepared homogenate 1:10 and another 3 tubes for dilution 1:100, and 3 tubes for dilution 1:1000 were inoculated, then the "LST" tubes were incubated at 37°C for 24-48 hours.

Enumeration of Faecal Coliforms count "MPN" (FAO, 1992)

A loopful from each gas positive tubes of (LST) was transferred to *Escherichia coli* broth (Oxoid, CM 853), the inoculated tubes were incubated at 44.5±0.5 °C in water bath for 24-48 hours. Positive tubes showed gas production in Durham's tubes were recorded as positive and the MPN of faecal coliforms was calculated.

Enumeration of presumptive Staphylococci (Bailey and Scott, 1982)

A quantity of 0.1 ml from each previously prepared dilution was transferred and evenly spread over a dry surface of duplicate Baird Parker agar (Oxoid, CM 272) plates with sterile bent glass rod. The inoculated plates were incubated at 35-37°C for 30-48 hours.

Isolation and identification of pathogenic bacteria

Suspected colonies of Staphylococcus aureus were isolated, purified and identified according to ***Varnam and Evans (1991)***. Isolation and identification of *E.coli* was carried out according to ***FAO (1992)***. Isolation and identification of Salmonella species was carried out according to ***HPA (2007)***.

Measurement of pH value

The pH values were measured by TESTO 230 pH meter (TESTO®, Germany) by insertion of penetration electrode (type 13) in the core of the examined product and record the measured value.

Measurement of cooked food temperature

The core temperature of the examined samples was recorded with a digital probe thermo-meter (Model CT-809, Century

Instruments (P) Ltd, Chandigarh) just after collection of the cooked food samples.

Statistical analysis

Microbial counts (cfu/gm in food, CFU/cm in surfaces or cfu/hand in hands) were transformed into log values. Results were analyzed by analysis of variance (ANOVA) using IBM SPSS statistics 20 to find differences among samples. Data of all variables were subjected to correlation matrix as a completely randomized design according to *Snedecor and Cochran (1989).*

RESULTS

Table (1): Descriptive analysis of aerobic plate count (log_{10} cfu/g) of ready to eat food samples (n=30)

	Minimum	Maximum	Mean ± SE	LSD
Beef kabab	5.33	6.40	5.78 ± 0.62	1.79
Chicken kabab	5.20	6.64	5.87 ± 0.13	1.86
Grilled chicken	5.42	7.40	6.50 ± 0.64	2.02
Chicken shawarma	5.50	7.50	6.93 ± 0.34	1.65
Roasted chicken	5.10	6.90	5.43 ± 0.38	1.87
Green salad	6.50	8.10	7.86 ± 0.76	1.98
Tehena salad	6.00	6.40	6.07 ± 0.42	2.01

N: Number of examined samples
SE: Standard error
LSD: Logarithmic standard deviation

Table (2): Descriptive analysis of aerobic plate count of hands of employee (log10 cfu/hand) and food contact surfaces (log_{10} cfu/cm2) in different restaurants (n=30)

	Minimum	Maximum	Mean ± SE	LSD
Hands	4.50	6.00	5.96 ± 0.43	1.65
Surfaces	4.70	5.90	5.72 ± 0.37	1.48

Table (3): Descriptive analysis of coliforms count (log_{10} cfu/g) of ready to eat food samples (n=30)

	Minimum	Maximum	Mean ± SE	LSD
Beef kabab	0.48	3.04	1.76 ± 0.23	0.65
Chicken kabab	0.48	2.32	2.04 ± 0.45	0.76
Grilled chicken	1.18	3.04	2.33 ± 0.65	0.98
Chicken shawarma	2.32	6.70	4.00 ± 0.76	0.32
Roasted chicken	0.48	2.18	1.76 ± 0.32	0.50
Green salad	4.30	6.70	5.03 ± 0.76	0.25
Tehena salad	2.18	4.04	3.60 ± 0.21	0.22

Table (4): Descriptive analysis of coliforms count of hands of employee (log10 cfu/hand) and food contact surfaces (log_{10} cfu/cm^2) in different restaurants (n=30)

	Minimum	Maximum	Mean ± SE	LSD
Hands	1.30	3.04	2.53 ± 0.21	0.11
Surfaces	0.48	2.32	1.67 ± 0.40	0.32

Table (5): Descriptive analysis of faecal coliforms count (log_{10} cfu/g) of ready to eat food samples (n=30)

	Minimum	Maximum	Mean ± SE	LSD
Beef kabab	<0.48	<0.48	<0.48 ± 0.00	0.00
Chicken kabab	<0.48	<0.48	<0.48 ± 0.00	0.00
Grilled chicken	<0.48	<0.48	<0.48 ± 0.00	0.00
Chicken shawarma	1.30	3.04	2.54 ± 0.21	0.19
Roasted chicken	<0.48	<0.48	<0.48 ± 0.00	0.00
Green salad	2.32	4.04	3.20 ± 0.13	0.15
Tehena salad	1.30	2.18	1.94 ± 0.48	0.12

N: Number of examined samples
SE: Standard error
LSD: Logarithmic standard deviation

Table (6): Descriptive analysis of faecal coliforms count of hands of employee (log_{10} CFU/hand) and food contact surfaces (log_{10} cfu/cm^2) in different restaurants (n=30)

	Minimum	Maximum	Mean ± SE	LSD
Hands	1.18	2.32	1.82 ± 0.21	0.16
Surfaces	<0.48	<0.48	<0.48 ± 0.00	0.00

Table (7): Descriptive analysis of presumptive Staphylococci count (log_{10} cfu/g) of ready to eat food samples (n=30)

	Minimum	Maximum	Mean ± SE	LSD
Beef kabab	<2	<2	<2 ± 0.00	0.00
Chicken kabab	<2	<2	<2 ± 0.00	0.00
Grilled chicken	2.00	3.10	2.22 ± 0.35	0.38
Chicken shawarma	2.00	3.50	2.30 ± 0.65	0.34
Roasted chicken	<2	<2	<2 ± 0.00	0.00
Green salad	2.10	3.70	3 ± 0.18	0.15
Tehena salad	2.00	4.00	2.00 ± 0.37	0.25

Table (8): Descriptive analysis of presumptive Staphylococci count of hands of employee (log_{10} cfu/hand) and food contact surfaces (log_{10} cfu/cm2) in different restaurants (n=30)

	Minimum	Maximum	Mean ± SE	LSD
Hands	2.00	3.10	2.14 ± 0.21	0.19
Surfaces	<2	<2	<2 ± 0.00	0.00

Table (9): Incidence of isolated pathogens from chicken shawarma (n=30)

	Number	%
Staphylococcus aureus (Coagulase +ve)	9	30.00
Salmonella banana	1	3.33
Salmonella blegdam	1	3.33
E. coli (O_{44})	3	10.00
E. coli (O_{158})	1	3.33
E. coli (O_8)	1	3.33
E. coli (O_1)	1	3.33
E. coli (O_{157})	1	3.33
E. coli (O_{126})	1	3.33
E. coli (O_{78})	1	3.33
E. coli (O_{146})	1	3.33
E. coli (O_{142})	1	3.33
E. coli (O_{86a})	1	3.33

Table (10): Descriptive analysis of pH of ready to eat food samples (n=30)

	Minimum	Maximum	Mean ± SE	LSD
Beef kabab	5.88	6.18	6.11 ± 0.50	0.40
Chicken kabab	5.75	6.28	6.03 ± 0.50	0.55
Grilled chicken	5.82	6.69	6.33 ± 0.20	1.20
Chicken shawarma	5.77	6.43	6.10 ± 0.50	0.45
Roasted chicken	5.69	6.43	5.99 ± 0.85	1.15

N: Number of examined samples
SE: Standard error
LSD: Logarithmic standard deviation

Table (11): Descriptive analysis of temperature (^{0}C) of ready to eat food samples (n=30)

	Minimum	Maximum	Mean ± SE	LSD
Beef kabab	45.00	70.00	53.33 ± 0.60	1.40
Chicken kabab	40.00	65.00	52.92 ± 0.70	1.50
Grilled chicken	38.00	50.00	42.42 ± 0.30	1.20
Chicken shawarma	35.00	65.00	40.77 ± 0.40	1.45
Roasted chicken	50.00	70.00	60.57 ± 0.65	1.10

Table (12): Correlation matrix between pH, Temperature and Microbiological attributes of ready to eat food samples

	pH	Temperature
APC	0.431**	-0.334**
Coliforms	0.432**	-0.332**
Faecal coliforms	0.452**	-0.332*
E. coli	0.420**	-0.300**
Presumptive staphylococci	0.446**	-0.326**
Salmonellae	0.420**	-0.300**
pH	1	-0.325**
Temperature	-0.325**	1

*. Correlation is significant at the 0-0.05 level
**. Correlation is significant at the 0-0.01 level

Discussion

Data in table (1) summarized results of aerobic plate count (APC) of examined food samples, which collected from different restaurants in Dammam city, The Kingdom of Saudi Arabia. The APC (log_{10} CFU/g) in beef kabab samples ranged from 5.33 to 6.40 with a mean value of 5.78. Several authors reported different values for APC in cooked beef samples such as ***Kirralla (2007) and Alsaimary (2015)***. The APC (log_{10} cfu/g) in chicken kabab samples ranged from 5.20 to 6.64 with a mean value of 5.87. In this concern, ***Mahmoudi et al. (2014)*** reported that the mean values of APC (log_{10} CFU/g) of cooked chicken samples ranged from 5 to 6.19 with a mean value of 5.87. Regarding the APC (log_{10} CFU/g) of grilled chicken samples, the results ranged from 5.42 to 7.40 with a mean value of 6.50 while, the APC (log_{10} cfu/g) in chicken shawarma samples ranged from 5.50 to 7.50 with a mean value of 6.93. Meanwhile, the APC (log_{10} cfu/g) of roasted chicken samples ranged from 5.10 to 6.90 with a mean value of 5.43. It is of importance to recognize that all the previous results were unsatisfactory not only according to ***Microbiological guidelines for food (2014)*** but also according to the Gulf Standard Specifications ***(GSS 1016/1998)*** where the APC of cooked meat products shouldn't exceed (log_{10} 5 CFU/g)). These high APC, may indicate that the cooking process was inadequate, that post cooking contamination had occurred, that the length of time and temperature control in storage or display facilities was inadequate to prevent bacterial growth, or that a combination of these factors was involved. On the other side, mean values of APC (log_{10} CFU/g) of green salad and tehena salad were 7.86 and 6.07, respectively. The obtained results are high and unsatisfactory with respect to ***GSS 1016/1998*** regulations where the APC of green salad should not exceed (log_{10} 6 CFU/g). These high counts could be attributed to the unhygienic practices right from the farm to the market. Meanwhile, mean values of APC on food handlers' hands and food contact surfaces (Table 2) were log_{10} 5.96 CFU/hand and log_{10} 5.72 CFU/cm^2, respectively. In this aspect, ***Microbiological guidelines for food (2014)*** established a maximum limit of 3.48 for APC (log_{10} CFU/hand) on food hands and (1.70-3) for APC (log_{10} CFU/cm^2) on food contact surfaces. ***Lambrechts et al. (2014)*** found that the mean value of aerobic plate counts in the examined hands of employee and food contact surfaces were log_{10} 3.86 CFU/hand and log_{10} 3.90 CFU/cm^2, respectively. Food handlers should improve on good hand hygiene practices as the incidence of APC on food handlers' hands was extremely high. Good Manufacturing Practice (GMP) and Sanitation Standard Operating Procedures (SSOP) are the two mandatory aspects that every food handlers should comply with to ensure the safety of the food produced.

Regarding the mean values of coliforms count (log_{10} CFU/g) (Table 3), the obtained results were 1.76, 2.04, 2.33, 4.00, 1.76, 5.03 and 3.60 for beef kabab, chicken kabab, grilled chicken, chicken shawarma, roasted chicken, green salad and tehena salad, respectively. The results of grilled chicken, chicken shawarma, green salad and tehena salad are not accepted neither according to ***Microbiological guidelines for food (2014)*** nor according to ***GSS 1016/1998,*** where the coliforms count (log_{10} CFU/g) should not exceed 2.30. ***Jay (2005)*** declared that the presence of coliforms in food depicts a deplorable state of poor hygiene and sanitary practices employed in the processing of food product. Coliforms are usually indicators whose presence will normally indicate the probable presence of pathogenic organisms. There is high count of coliforms in these vegetables, which could be attributed to the use of domestic sewage to water the vegetables in the respective farms and garden.

At the same time, the mean values of coliforms count on food handlers' hands and food contact surfaces (Table 4) were log_{10} 2.53 CFU/hand and log_{10} 1.67 CFU/cm^2, respectively. The presence of coliforms on the workers' hands indicated that the employees needed to improve personal hygiene practices. In addition,

educational programs should be established to continually reinforce food-safety principles as Good Hygienic Practice (GHP). Data in Table 5 revealed the mean values of faecal coliforms (log_{10} CFU/g) in chicken shawarma, green salad and tehena salad were 3.04, 4.04 and 2.18, respectively. While the other food samples had low values (log_{10} <0.48 CFU/g). The investigated samples of chicken shawarma, green salad and tehena salad are not accepted according to ***Microbiological guidelines for food (2014)*** and according to ***GSS 1016/1998*** where the faecal coliforms count (log_{10} CFU/g) should not exceed 2.00.It is of significant to spotlight that different strains of *E.coli* had been isolated in 40% of chicken shawarma samples (Table 9) which in turns emphasis the positive correlation between the presence of *E. coli* and the contamination due to washing of chicken meat with fecal contaminated water. It is also suggested that the interior of meat is contaminated during handling however; chilling room and storage also contribute in the contamination. Concerning food handlers' hands and food contact surfaces (Table 6), faecal coliforms counts were (log_{10} 1.82 CFU/hand) and (log_{10} <0.48 CFU/cm^2), respectively. ***Yuksek et al. (2009)*** recorded that the mean value of faecal coliforms which collected from personnel hand swabs from a chicken shawarma catering company in Bursa, Turkey; was log_{10}1.15 CFU/hand.

The results in Table (7) showed that samples of green salad were most heavily contaminated with presumptive staphylococci as their mean value were log_{10} 3 CFU/g and. The mean values of presumptive staphylococci (log_{10} CFU/g) of beef kabab, chicken kabab, grilled chicken, chicken shawarma, roasted chicken and tehena salad were <2, <2, 2.22, 2.30,<2 and 2, respectively. All the obtained results are accepted according to according to ***Microbiological guidelines for food (2014)*** and according to ***GSS 1016/1998*** where the staphylococci count should not exceed log_{10} 3 CFU/g. On the other hand, mean values of presumptive staphylococci on food handlers' hands and food contact surfaces (Table 8) were log_{10} 2.14 CFU/hand and log_{10} < 2 CFU/cm^2, respectively. It is important to declare that 30% of chicken shawarma samples were contaminated with coagulase positive *staphylococcal aureus*. Nearly similar results were observed by ***Abdalhamid et al. (2013) and Hassanien et al., (2015).*** In our study, the highest rate of contamination in the ready to eat serve meal was due to unawareness, little food safety and hygiene knowledge of serving and preparing staff. Majority of the cooking and catering staff working at these shops was found nominally educated with limited food safety awareness and training exposure during their work period. Respective authorities are less attentive toward implementation of food safety laws and regulation to provide proper guidance on good hygienic practices. In the ready to serve cooked meats, contamination may occur due to the inadequate cooking, washing with contaminated unsafe water, unhygienic handling and cross contamination from unprocessed food materials. The poor sanitary condition can also be a contributing agent (***Little et al., 2002***) reported that pathogenic bacteria including *S. aureus* and *E. coli* in restaurants would transfer. It was evident that Salmonellae were not detected in all examined samples except in 6.66 % of chicken shawarma samples (Table 9). Similar results reported by ***Soriano et al., (2003)*** who failed to isolate *Salmonella* spp. from the examined cooked beef meat samples. ***Hassanien et al. (2015)*** found that 4% to 6.67% of the examined ready to eat chicken shawarma samples were positive for *Salmonella* spp.

Table (10) illustrated the mean values of pH of the cooked ready to eat food samples. The recorded values were 6.11, 6.03, 6.33, 6.10 and 5.99 for beef kabab, chicken kabab, grilled chicken, chicken shawarma and roasted chicken, respectively. The high pH values of the samples could be attributed to the marination and cooking method. In this concern, pH value is an indicator of keeping quality of meat and assesses the shelf life of the products, most bacteria grow best in a medium that is neutral or slightly acidic, and the growth of most bacteria significantly inhibited in very acidic foods. Hence, these results explain the increased bacterial load in all samples.

Results of the recorded temperature of cooked ready to eat food samples (Table 11) showed that the mean values were 53.33, 52.92, 42.42, 40.77and 60.57 °C for beef kabab, chicken kabab, grilled chicken, chicken shawarma and roasted chicken, respectively. However, these results were lower with respect to ***FSIS (2008)*** who stated that any cooking method must produce an internal temperature at least 71°C inside meat to be safe for human consumption. They added that if the temperature is above 32 °C, food should not be left out more than one hour. ***Brown (2000)*** recommended that all high risk food items should be cooked to a temperature of at least 74°C and should be served as soon as possible after preparation. If food items are kept for extended period, they must be kept either above 60°C or below 5°C. Data of correlation matrix (Table 12) clearly indicated presence of slight ($P< 0.05$) to strong correlation ($P< 0.01$) between the different investigated criteria. It is of importance to recognize that there was negative correlation between temperature with the different microbiological attributes of cooked food samples. On the other hand, there was strong positive correlation between pH with the different microbiological attributes of cooked food samples.

Conclusion

From the achieved results it can be concluded that that almost all of the examined samples suffer from bacteriological problems in terms of aerobic plate count, Coliforms count, Faecal Coliforms count, *E. coli*, *Salmonella*, and *Staphylococcus aureus*. Most of the investigated ready to eat food were unsatisfactory not only with the (Gulf Standard Specifications) but also with (Microbiological Guidelines for Food) for each product. The presence of *E. coli* in chicken shawarma samples indicated fecal contamination, while presence of *Salmonella* species in chicken shawarma samples indicated sewage pollution, thereby suggesting possible risk of infection involved in the consumption of such food. Food preparation practices were found to be important aspects that affect the food safety as food handlers' hands and food contact surfaces had a high bacterial load in all of the examined restaurants.

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الملخص العربي

جودة الوجبات الجاهزة بمنشآت تداول المواد الغذائية بالمملكة العربية السعودية

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تم فحص270 عينة عشوائية ممثلة كالآتي:30عينة من كلاً من (كباب اللحم، كباب الدجاج، الدجاج المجهز علي الفحم، شاورما الدجاج، الدجاج المحمر، سلطة الطحينة، السلطة الخضراء، مسحات من أيدي عمال تجهيز الأغذية ومسحات من الأسطح الملامسة للأغذية). وقد تم تجميع العينات من المطاعم المتخصصة في تقديم وجبات اللحوم الجاهزة في منطقة الدمام بالمملكة العربية السعودية وذلك لتحديد الحمل الميكروبي بها حيث شمل الفحص العد الكلي للميكروبات الهوائية، المجموعة القولونية، المجموعة القولونية البرازية، المكورات العنقودية بالإضافة إلى عزل كل من ميكروب القولون والسالمونيلا والمكورالعنقودي الذهبي إضافة إلى أنه قد تم رصد وتدوين درجات الحرارة والأس الهيدورجيني لوجبات اللحوم والدواجن المطهية والجاهزة للأكل. وقد دلت نتائج الفحص البكتريولوجي للعينات إلي إرتفاع الحمل البكتيري بها و إرتفاع متوسط عد المجموعة القولونية في جميع العينات مما يرجح سوء حالة الممارسات الصحية وإجراءات النظافة داخل هذة المطاعم. وقد تم عزل عدداً من العترات المختلفة لميكروب القولون في 40% من عينات شاورمة الدجاج ولم يتم عزل ميكروب السالمونيلا إلا في6,66 % من عينات شاورمة الدجاج. وقد أظهر التحليل الإحصائي وجود معامل إرتباط قوي بين خصائص الجودة التي تم قياسها العينات لاسيما الخصائص الميكروبيولوجية. حيث كانت العلاقة طردية بين درجة الأس الهيدروجيني والحمل البكتيري بالعينات بينما كانت العلاقة عكسية بين درجات الحرارة والحمل البكتيري بالعينات التي تم فحصها.