FACULTY OF AGRICULTURE AND ANIMAL SCIENCES

DEPARTMENT OF ANIMAL PRODUCTION AND MANAGEMENT

PREVALENCE OF SALMONELLA AND ESCHERICHIA COLI BACTERIA IN BROILER MEAT SOLD IN KALERWE MARKET IN KAMPALA DISTRICT IN UGANDA

BY

KIWANUKA JOSEPH

BU/UP/2020/1404

josephjimmykiwanuka@gmail.com

0787426002/0706233365

A RESEARCH DISSERTATION SUBMITTED TO THE FACULTY OFAGRICULTURE AND ANIMAL SCIENCES IN PARTIAL FULFILLMENT OF REQUIREMENTS

FOR THE AWARD OF BACHELOR'S DEGREE IN ANIMAL PRODUCTION

AND MANAGEMENT OF BUSITEMA UNIVERSITY

MAY 2014

DECLARATION

This dissertation contains my own work and has never been submitted to any institution for any assistance or award of academic credit or qualification.

NAME: **KIWANUKA JOSEPH**

REGISTRATION NUMBER: **BU/UP/2020/1404**

Signature: ..... Date 30th/10/2024

i

APPROVAL

The entire work relating to the research dissertation development and writing has been approved by;

Mr. KULAKA ALI TARIQ
Research supervisor
Department of Animal Production and Management
Faculty of Agriculture and Animal Sciences
Busitema University, Arapai campus
P.O Box, 236 Tororo, Uganda.

Signature:.....Date.....30/04/2024.....

ii

DEDICATION

I dedicate this research report to Mr. Zorome Kenneth Tumaine for the unwavering support both financially and physically. I cannot leave out my fellow students for all the advice upon the whole course since 2020.

ACKNOWLEDGEMENT

I really thank my supervisor for the guide through during the whole process of developing this research proposal. I can't forget the coordinator Dr. Matovu Henry of this research project for sure you so grateful to work with.

TABLE OF CONTENTS

ABBREVIATIONS

V.T.E.C	Veteroxin-pro-ducing-E-coli
T.V.C	Total Volume Count
T.C.C	Total coliform Count
T.F.C	Total Fecal Count
PC	Presumptive coliform
ENT	Enterobacteriaceae
SD	Standard deviation
OIE	Office International des Epizooties
TPC	Total plate count

ABSTRACT

The prevalence of *Salmonella* and *E. coli* bacteria in broiler meat, has become a pressing issue in recent years due to the potential health risks causing public health problems, like gastrointestinal infections which manifest with the symptoms like diarrhea, abdominal cramps, The purpose of this research was to determine how common salmonella, E.coli, and the total coliform count are in the broiler meat that is being sold at kalerwe market.

Using random sampling tool, 50 chicken broiler carcasses were collected from three different chicken abattoirs at Kalerwe market A, B and C, sterile sampling tools were used for example forceps, scissors, labeling materials like markers, cooling equipments like ice packs and insulated container were also used, the gloves, lab coat were also used as the protective equipments and after the experiment the colony counter was used to count the number of coliform colonies and E.coli colonies on the plates in the laboratory.

This study identified that Kalerwe market is highly contaminated with E.coli in the fresh broiler meat than *salmonella;* overall mean *E. coli* count was 1616.67 ± 7.4^{a} cfu/g while the mean *E. coli* count from the three different chicken abattoirs A, B, C was 786.67 ± 8.58, 310.00 ± 9.40 and 1560.0 ± 4.22 cfu/g respectively. Out of the 50 samples, no salmonella was found, and the highest count of E. coli was 1560.0 cfu/g, with a detection rate of 37.8%. This study suggests that there is a higher prevalence of E. coli than salmonella in the broiler meat at Kalerwe market.

Therefore the authority in charge of the abattoir should install necessary standard equipment's and major functional facilities in the chicken abattoir. Proper hygiene should be maintained within the slaughter houses and surroundings.

CHAPTER ONE: INTRODUCTION

1.0. Background of the study

Broiler meat is one of the most consumed worldwide due to its easy digestibility but the meat has also been found to be contaminated with food pathogens in most cases(Hidayat *et al.,* 2021).

In many countries, one of the primary causes of foodborne illness, including Brazil, is Salmonella spp. The most frequent food items implicated in human salmonellosis outbreaks are those derived from poultry, such as meat and eggs. (Borges and others, 2018)

The World Health Organization (WHO) has identified salmonella and E. coli as the two most common causes of foodborne illnesses worldwide, making their prevalence in broiler meat a serious food safety concern. (Hanafy, Samir, and others, 2015) Because microorganisms can be pathogenic and because bacterial strains like Salmonella and E. Coli are becoming more resistant to antibiotics, the microbiological contamination of food poses a risk to public health. (Courrol & Vallim, 2021).

Salmonella and E. coli are highly prevalent in broiler meat in Africa; studies have found that the ranges for E. coli and salmonella are 10.6% to 71% and 17% to 38%, respectively. Studies have shown that E. coli and salmonella are highly resistant to common antibiotics, raising concerns about their prevalence. (Juma and others, 2017)

There is little information on the frequency of E. coli and salmonella in Ugandan broiler meat. But according to a study in the Journal of Food Protection, 58% of chicken samples gathered from Kampala markets, Uganda, were contaminated with E.coli. Kalerwe being among the biggest market for chicken meat in Uganda especially broiler meat with more than 3 abattoirs for broiler meat, there's an increasing incidence of food born pathogen diseases in areas around Kalerwe market according to peak clinic center report, found in kalerwe opposite Aloysius tower along Gayaza road. (Kakooza *et al.,* 2021)

The purpose of this study was to determine how common Salmonella and E. Coli were in the broiler meat sold at kalerwe market in Kampala district, Uganda.

REFERENCES

Adeyanju, G. T., & Ishola, O. (2014). Salmonella and escherichia coli contamination of poultry meat from a processing plant and retail markets in Ibadan, Oyo state, Nigeria. *SpringerPlus*, *3*(1), 1–9. https://doi.org/10.1186/2193-1801-3-139

Andoh, L. A., Ahmed, S., Olsen, J. E., Obiri-danso, K., Newman, M. J., Opintan, J. A., Barco, L., & Dalsgaard, A. (2017). *Prevalence and characterization of Salmonella among humans in Ghana*. 1–11. https://doi.org/10.1186/s41182-017-0043-z

Anonimous. (2013). *KENYA, WHERE GMOS ARE BANNED | NW Resistance Against Genetic Engineering*. Epoch Times.

Aworh, M. K., Kwaga, J. K. P., Hendriksen, R. S., Okolocha, E. C., & Thakur, S. (2021). Genetic relatedness of multidrug resistant Escherichia coli isolated from humans, chickens and poultry environments. *Antimicrobial Resistance and Infection Control*, *10*(1). https://doi.org/10.1186/s13756-021-00930-x

Badhe, S. R., Fairoze, N., & Sudarshan, S. (2013). Prevalence of food borne pathogens in market samples of chicken meat in Bangalore, India. *Indian Journal of Animal Research*, *47*(3), 262–264.

Baracho, M. S., Camargo, G. A., Lima, A. M. C., Mentem, J. F., Moura, D. J., Moreira, J., & Nääs, I. A. (2006). Variables impacting poultry meat quality from production to pre-slaughter: A review. *Revista Brasileira de Ciencia Avicola*, *8*(4), 201–212. https://doi.org/10.1590/S1516-635X2006000400001

Ceuppens, S., Johannessen, G. S., Allende, A., Tondo, E. C., El-Tahan, F., Sampers, I., Jacxsens, L., & Uyttendaele, M. (2015). Risk factors for Salmonella, shiga toxin-producing Escherichia coli and Campylobacter occurrence in primary production of leafy greens and strawberries. *International Journal of Environmental Research and Public Health*, *12*(8), 9809–9831. https://doi.org/10.3390/ijerph120809809

Courrol, L. C., & Vallim, M. A. (2021). Spectroscopic Analysis of Chicken Meat Contaminated with E. coli, Salmonella, and Campylobacter. *Food Analytical Methods*, *14*(3). https://doi.org/10.1007/s12161-020-01888-z

Dahal, N., Ellerbroek, L., & Poosaran, N. (2007). Prevalence and antimicrobial resistance of Salmonella in imported chicken carcasses in Bhutan. *National Cent Anim Health*, *1*(April), 1–92.

Edi, S., & Rahmah, R. S. N. (2018). PENGARUH LAMA PENYIMPANAN DAGING AYAM PADA SUHU RUANG DAN REFRIGERATOR TERHADAP ANGKA LEMPENG TOTAL BAKTERI DAN ADANYA BAKTERI Salmonella sp. *JURNAL BIOSAINS*, *4*(1). https://doi.org/10.24114/jbio.v4i1.9452

El-Seedy, F. R., Abed, A. H., Yanni, H. A., & Abd El-Rahman, S. A. A. (2016). Prevalence of Salmonella and E. coli in neonatal diarrheic calves. *Beni-Suef University Journal of Basic and Applied Sciences*, *5*(1), 45–51. https://doi.org/10.1016/j.bjbas.2015.11.010

Faecal indicator organisms for red meat and poultry. (2006). In *Microbiological Analysis of Red*

Meat, Poultry and Eggs. CRC Press. https://doi.org/10.1201/9781439823880.ch4

Fletcher, D. L. (2002). Poultry meat quality. *World's Poultry Science Journal*, *58*(2), 131–145. https://doi.org/10.1079/WPS20020013

Hafez, H. M., Schroth, S., Stadler, A., & Schulze, D. (2001). Detection of salmonella, campylobacter, and verotoxin producing E. Coli in turkey flocks during rearing and processing. *Archiv Fur Geflugelkunde*, *65*(3), 130–136.

Hidayat, C., Sumiati, S., Jayanegara, A., & Wina, E. (2021). Supplementation of Dietary Nano Zn-Phytogenic on Performance, Antioxidant Activity, and Population of Intestinal Pathogenic Bacteria in Broiler Chickens. *Tropical Animal Science Journal*, *44*(1). https://doi.org/10.5398/tasj.2021.44.1.90

Journal, B., Science, P., & Brasileira, R. (2004). *Microbiological quality of poultry meat : a review **.

Kagambèga, A., Haukka, K., Siitonen, A., Traoré, A. S., & Barro, N. (2011). Prevalence of Salmonella enterica and the hygienic indicator Escherichia coli in raw meat at markets in Ouagadougou, Burkina Faso. *Journal of Food Protection*, *74*(9), 1547–1551. https://doi.org/10.4315/0362-028X.JFP-11-124

Kakooza, S., Muwonge, A., Nabatta, E., Eneku, W., Ndoboli, D., Wampande, E., Munyiirwa, D., Kayaga, E., Tumwebaze, M. A., Afayoa, M., Ssajjakambwe, P., Tayebwa, D. S., Tsuchida, S., Okubo, T., Ushida, K., Sakurai, K., & Mutebi, F. (2021). A retrospective analysis of antimicrobial resistance in pathogenic Escherichia coli and Salmonella spp. isolates from poultry in Uganda. *International Journal of Veterinary Science and Medicine*, *9*(1), 11–21. https://doi.org/10.1080/23144599.2021.1926056

Kuria, J. K. N., Ngethe, E. W., Kabuage, L. W., & Gathura, P. B. (2018). Isolation of campylobacter sppand escherichia coli 0157: H7 from free-range indigenous chicken value chain in Kenya. *East African Medical Journal*, *95*(1).

Kuźmińska-Bajor, M., Śliwka, P., Ugorski, M., Korzeniowski, P., Skaradzińska, A., Kuczkowski, M., Narajaczyk, M., Wieliczko, A., & Kolenda, R. (2021). Genomic and functional characterization of five novel Salmonella-targeting bacteriophages. *Virology Journal*, *18*(1). https://doi.org/10.1186/s12985-021-01655-4

Lubote, R., Shahada, F., Research, A. M.-A. J. of, & 2014, undefined. (2014). Prevalence of Salmonella spp. and Escherichia coli in raw milk value chain in Arusha, Tanzania. *Citeseer*, *2*(9), 1. https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.1064.5426&rep=rep1&type=pdf

Maripandi, A., & Al-Salamah, A. A. (2010). Multiple-antibiotic resistance and plasmid profiles of Salmonella enteritidis isolated from retail chicken meats. *American Journal of Food Technology*, *5*(4). https://doi.org/10.3923/ajft.2010.260.268

Mead, G. C. (2006). Faecal indicator organisms for red meat and poultry. In *Microbiological Analysis of Red Meat, Poultry and Eggs: A volume in Woodhead Publishing Series in Food Science, Technology and Nutrition*. https://doi.org/10.1533/9781845692513.83

Mengistu, S., Abayneh, E., & Shiferaw, D. (2017). E. coli O157:H7 and Salmonella Species:

Public Health Importance and Microbial Safety in Beef at Selected Slaughter Houses and Retail Shops in Eastern Ethiopia. *Journal of Veterinary Science & Technology*, *8*(5). https://doi.org/10.4172/2157-7579.1000468

Moawad, A. A., Hotzel, H., Awad, O., Tomaso, H., Neubauer, H., Hafez, H. M., & El-Adawy, H. (2017). Occurrence of Salmonella enterica and Escherichia coli in raw chicken and beef meat in northern Egypt and dissemination of their antibiotic resistance markers. *Gut Pathogens*, *9*(1), 1–13. https://doi.org/10.1186/s13099-017-0206-9

Naing, L., Nordin, R. Bin, Rahman, H. A., & Naing, Y. T. (2022). Sample size calculation for prevalence studies using Scalex and ScalaR calculators. *BMC Medical Research Methodology*, 1–8. https://doi.org/10.1186/s12874-022-01694-7

Newell, D. G., Koopmans, M., Verhoef, L., Duizer, E., Aidara-Kane, A., Sprong, H., Opsteegh, M., Langelaar, M., Threfall, J., Scheutz, F., der Giessen, J. van, & Kruse, H. (2010). Food-borne diseases - The challenges of 20years ago still persist while new ones continue to emerge. *International Journal of Food Microbiology*, *139*(SUPPL. 1), S3–S15. https://doi.org/10.1016/j.ijfoodmicro.2010.01.021

Permana, A., & W, R. B. (2019). THE DIFFERENCE OF E.COLI CONTENT IN THE CHICKEN MEAT IN THE SOUTH KEPUTRAN TRADITIONAL MARKET AND SUPERMARKET ' X ' OF SURABAYA CITY. *The Indonesian Journal of Public Health*, *14*(1). https://doi.org/10.20473/ijph.v14i1.2019.25-37

Pleskacheva, M. A., Artamonova, M. P., Litvinova, E. V, Gergel, M. A., & Davydova, E. E. (2020). *Methodology for identification and quantification of chicken meat in food products*. *8*(1), 98–106.

Pulido-Landínez, M. (2019). Food safety - Salmonella update in broilers. In *Animal Feed Science and Technology* (Vol. 250). https://doi.org/10.1016/j.anifeedsci.2019.01.008

Rabhi-Essafi, I., Sadok, A., Khalaf, N., & Fathallah, D. M. (2007). A strategy for high-level expression of soluble and functional human interferon α as a GST-fusion protein in E.coli. *Protein Engineering, Design and Selection*, *20*(5). https://doi.org/10.1093/protein/gzm012

Roberts, T. A., MacFie, H. J. H., & Hudson, W. R. (1980). The effect of incubation temperature and site of sampling on assessment of the numbers of bacteria on red meat carcasses at commercial abattoirs. *Journal of Hygiene*, *85*(3), 371–380. https://doi.org/10.1017/S0022172400063440

Samir Hanafy, A., Khalafalla, F., Abdel-Atty, N., Abdel-Wanis, S. A., & Hanafy, A. S. (2015). Food Poisoning Microorganisms in Chicken Broiler Meat Reference Lab for Veterinary Quality Control on Poultry Production. *Global Veterinaria*, *14*(2).

Schaffner, D. W., & Smith-Simpson, S. (2014). Indicator Organisms in Meat. In *Encyclopedia of Meat Sciences*. https://doi.org/10.1016/B978-0-12-384731-7.00068-4

Sengupta, R., Das, R., Ganguly, S., & Mukhopadhayay, S. K. (2011). Survey on microbial quality of chicken meat in Kolkata, India. *International Journal of Research in Pure and Applied Microbiology*, *1*(3).

Sher, A. A., Mustafa, B. E., Grady, S. C., Gardiner, J. C., & Saeed, A. M. (2021). Outbreaks of

foodborne Salmonella enteritidis in the United States between 1990 and 2015: An analysis of epidemiological and spatial-temporal trends. *International Journal of Infectious Diseases, 105*. https://doi.org/10.1016/j.ijid.2021.02.022

Shinashal, R. Z. (2019). A review on Salmonella bacteria in human and animal. In *International Journal of Research in Pharmaceutical Sciences* (Vol. 10, Issue 1, pp. 531–536). J. K. Welfare and Pharmascope Foundation. https://doi.org/10.26452/ijrps.v10i1.1876

Sire, J. M., Garin, B., Chartier, L., Fall, N. K., Tall, A., Seck, A., Weill, F. X., Breurec, S., Vray, M., Onyeka, L. O., Adesiyun, A. A., Keddy, K. H., Madoroba, E., Manqele, A., Thompson, P. N., Ebomah, K. E., Pavlinac, P. B., John-Stewart, G. C., Naulikha, J. M., … Shimamoto, T. (2020). Ireland's first One Health Report on Antimicrobial Use and Antimicrobial Resistance. *J Water Health*, *5*(1).

Suryadevara, N., Yong, K. B., Ganapathy, B., Subramonie, S., Ragavan, N. D., Ramachandiran, M., Shanmugam, G., & Ponmurugan, P. (2020). Molecular characterization of escherichia coli from chickens in poultry farms of malaysia. *Research Journal of Biotechnology*, *15*(10).

Szmolka, A., & Nagy, B. (2013). Multidrug resistant commensal Escherichia coli in animals and its impact for public health. *Frontiers in Microbiology*, *4*(SEP), 1–13. https://doi.org/10.3389/fmicb.2013.00258

Tan, S. J., Nordin, S., Esah, E. M., & Mahror, N. (2022). Salmonella spp. in Chicken: Prevalence, Antimicrobial Resistance, and Detection Methods. *Microbiology Research*, *13*(4), 691–705. https://doi.org/10.3390/microbiolres13040050

Tarabees, R., Elsayed, M. S. A., Shawish, R., Basiouni, S., & Shehata, A. A. (2017). Isolation and characterization of Salmonella Enteritidis and Salmonella Typhimurium from chicken meat in Egypt. *Journal of Infection in Developing Countries*, *11*(4). https://doi.org/10.3855/jidc.8043

Uddin, M. N. (2018). Antibiotic assays of Salmonella isolated from poultry chicken of various locations in districts Swat. *Pure and Applied Biology*, *7*(1). https://doi.org/10.19045/bspab.2018.70010

Uses, T. (2001). Laboratory analyses and their uses. *CEVA Sante Animal*, 99–129. http://www.sapoultry.co.za/pdf-training/Vaccines-lab-analysis.pdf

Yalda Lucero, A. (2014). Etiology and management of acute infectious gastroenteritis in children and adults. *Revista Medica Clinica Las Condes*, *25*(3), 463–472. https://doi.org/10.1016/S0716-8640(14)70063-X

Yulistiani, R., Praseptiangga, D., Supyani, & Sudibya. (2019). Occurrences of Salmonella spp. and Escherichia coli in chicken meat, intestinal contents and rinse water at slaughtering place from traditional market in Surabaya, Indonesia. *IOP Conference Series: Materials Science and Engineering*, *633*(1). https://doi.org/10.1088/1757-899X/633/1/012007

Zakaria, Z., Hassan, L., Sharif, Z., Ahmad, N., Ali, R. M., Husin, S. A., Hazis, N. H. binti A., Sohaimi, N. F. M., Bakar, S. A., & Garba, B. (2020). Analysis of Salmonella enterica serovar Enteritidis isolates from chickens and chicken meat products in Malaysia using

PFGE, and MLST. *BMC Veterinary Research*, *16*(1). https://doi.org/10.1186/s12917-020-02605-y

Zeinhom, M. M. A., & Abdel-Latef, G. K. (2014). Public health risk of some milk borne pathogens. *Beni-Suef University Journal of Basic and Applied Sciences*, *3*(3), 209–215. https://doi.org/10.1016/j.bjbas.2014.10.006

Adeyanju, G. T., & Ishola, O. (2014). Salmonella and escherichia coli contamination of poultry meat from a processing plant and retail markets in Ibadan, Oyo state, Nigeria. *SpringerPlus*, *3*(1), 1–9. https://doi.org/10.1186/2193-1801-3-139

Andoh, L. A., Ahmed, S., Olsen, J. E., Obiri-danso, K., Newman, M. J., Opintan, J. A., Barco, L., & Dalsgaard, A. (2017). *Prevalence and characterization of Salmonella among humans in Ghana*. 1–11. https://doi.org/10.1186/s41182-017-0043-z

Anonimous. (2013). *KENYA, WHERE GMOS ARE BANNED | NW Resistance Against Genetic Engineering*. Epoch Times.

Aworh, M. K., Kwaga, J. K. P., Hendriksen, R. S., Okolocha, E. C., & Thakur, S. (2021). Genetic relatedness of multidrug resistant Escherichia coli isolated from humans, chickens and poultry environments. *Antimicrobial Resistance and Infection Control*, *10*(1). https://doi.org/10.1186/s13756-021-00930-x

Badhe, S. R., Fairoze, N., & Sudarshan, S. (2013). Prevalence of food borne pathogens in market samples of chicken meat in Bangalore, India. *Indian Journal of Animal Research*, *47*(3), 262–264.

Baracho, M. S., Camargo, G. A., Lima, A. M. C., Mentem, J. F., Moura, D. J., Moreira, J., & Nääs, I. A. (2006). Variables impacting poultry meat quality from production to pre-slaughter: A review. *Revista Brasileira de Ciencia Avicola*, *8*(4), 201–212. https://doi.org/10.1590/S1516-635X2006000400001

Ceuppens, S., Johannessen, G. S., Allende, A., Tondo, E. C., El-Tahan, F., Sampers, I., Jacxsens, L., & Uyttendaele, M. (2015). Risk factors for Salmonella, shiga toxin-producing Escherichia coli and Campylobacter occurrence in primary production of leafy greens and strawberries. *International Journal of Environmental Research and Public Health*, *12*(8), 9809–9831. https://doi.org/10.3390/ijerph120809809

Courrol, L. C., & Vallim, M. A. (2021). Spectroscopic Analysis of Chicken Meat Contaminated with E. coli, Salmonella, and Campylobacter. *Food Analytical Methods*, *14*(3). https://doi.org/10.1007/s12161-020-01888-z

Dahal, N., Ellerbroek, L., & Poosaran, N. (2007). Prevalence and antimicrobial resistance of Salmonella in imported chicken carcasses in Bhutan. *National Cent Anim Health*, *1*(April), 1–92.

Edi, S., & Rahmah, R. S. N. (2018). PENGARUH LAMA PENYIMPANAN DAGING AYAM PADA SUHU RUANG DAN REFRIGERATOR TERHADAP ANGKA LEMPENG TOTAL BAKTERI DAN ADANYA BAKTERI Salmonella sp. *JURNAL BIOSAINS*, *4*(1). https://doi.org/10.24114/jbio.v4i1.9452

El-Seedy, F. R., Abed, A. H., Yanni, H. A., & Abd El-Rahman, S. A. A. (2016). Prevalence of

Salmonella and E. coli in neonatal diarrheic calves. *Beni-Suef University Journal of Basic and Applied Sciences*, *5*(1), 45–51. https://doi.org/10.1016/j.bjbas.2015.11.010

Faecal indicator organisms for red meat and poultry. (2006). In *Microbiological Analysis of Red Meat, Poultry and Eggs*. CRC Press. https://doi.org/10.1201/9781439823880.ch4

Fletcher, D. L. (2002). Poultry meat quality. *World's Poultry Science Journal*, *58*(2), 131–145. https://doi.org/10.1079/WPS20020013

Hafez, H. M., Schroth, S., Stadler, A., & Schulze, D. (2001). Detection of salmonella, campylobacter, and verotoxin producing E. Coli in turkey flocks during rearing and processing. *Archiv Fur Geflugelkunde*, *65*(3), 130–136.

Hidayat, C., Sumiati, S., Jayanegara, A., & Wina, E. (2021). Supplementation of Dietary Nano Zn-Phytogenic on Performance, Antioxidant Activity, and Population of Intestinal Pathogenic Bacteria in Broiler Chickens. *Tropical Animal Science Journal*, *44*(1). https://doi.org/10.5398/tasj.2021.44.1.90

Journal, B., Science, P., & Brasileira, R. (2004). *Microbiological quality of poultry meat : a review *.*

Kagambèga, A., Haukka, K., Siitonen, A., Traoré, A. S., & Barro, N. (2011). Prevalence of Salmonella enterica and the hygienic indicator Escherichia coli in raw meat at markets in Ouagadougou, Burkina Faso. *Journal of Food Protection*, *74*(9), 1547–1551. https://doi.org/10.4315/0362-028X.JFP-11-124

Kakooza, S., Muwonge, A., Nabatta, E., Eneku, W., Ndoboli, D., Wampande, E., Munyiirwa, D., Kayaga, E., Tumwebaze, M. A., Afayoa, M., Ssajjakambwe, P., Tayebwa, D. S., Tsuchida, S., Okubo, T., Ushida, K., Sakurai, K., & Mutebi, F. (2021). A retrospective analysis of antimicrobial resistance in pathogenic Escherichia coli and Salmonella spp. isolates from poultry in Uganda. *International Journal of Veterinary Science and Medicine*, *9*(1), 11–21. https://doi.org/10.1080/23144599.2021.1926056

Kuria, J. K. N., Ngethe, E. W., Kabuage, L. W., & Gathura, P. B. (2018). Isolation of campylobacter sppand escherichia coli 0157: H7 from free-range indigenous chicken value chain in Kenya. *East African Medical Journal*, *95*(1).

Kuźmińska-Bajor, M., Śliwka, P., Ugorski, M., Korzeniowski, P., Skaradzińska, A., Kuczkowski, M., Narajaczyk, M., Wieliczko, A., & Kolenda, R. (2021). Genomic and functional characterization of five novel Salmonella-targeting bacteriophages. *Virology Journal*, *18*(1). https://doi.org/10.1186/s12985-021-01655-4

Lubote, R., Shahada, F., Research, A. M.-A. J. of, & 2014, undefined. (2014). Prevalence of Salmonella spp. and Escherichia coli in raw milk value chain in Arusha, Tanzania. *Citeseer*, *2*(9), 1. https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.1064.5426&rep=rep1&type=pdf

Maripandi, A., & Al-Salamah, A. A. (2010). Multiple-antibiotic resistance and plasmid profiles of Salmonella enteritidis isolated from retail chicken meats. *American Journal of Food Technology*, *5*(4). https://doi.org/10.3923/ajft.2010.260.268

Mead, G. C. (2006). Faecal indicator organisms for red meat and poultry. In *Microbiological*

Analysis of Red Meat, Poultry and Eggs: A volume in Woodhead Publishing Series in Food Science, Technology and Nutrition. https://doi.org/10.1533/9781845692513.83

Mengistu, S., Abayneh, E., & Shiferaw, D. (2017). E. coli O157:H7 and Salmonella Species: Public Health Importance and Microbial Safety in Beef at Selected Slaughter Houses and Retail Shops in Eastern Ethiopia. *Journal of Veterinary Science & Technology*, *8*(5). https://doi.org/10.4172/2157-7579.1000468

Moawad, A. A., Hotzel, H., Awad, O., Tomaso, H., Neubauer, H., Hafez, H. M., & El-Adawy, H. (2017). Occurrence of Salmonella enterica and Escherichia coli in raw chicken and beef meat in northern Egypt and dissemination of their antibiotic resistance markers. *Gut Pathogens*, *9*(1), 1–13. https://doi.org/10.1186/s13099-017-0206-9

Naing, L., Nordin, R. Bin, Rahman, H. A., & Naing, Y. T. (2022). Sample size calculation for prevalence studies using Scalex and ScalaR calculators. *BMC Medical Research Methodology*, 1–8. https://doi.org/10.1186/s12874-022-01694-7

Newell, D. G., Koopmans, M., Verhoef, L., Duizer, E., Aidara-Kane, A., Sprong, H., Opsteegh, M., Langelaar, M., Threfall, J., Scheutz, F., der Giessen, J. van, & Kruse, H. (2010). Food-borne diseases - The challenges of 20years ago still persist while new ones continue to emerge. *International Journal of Food Microbiology*, *139*(SUPPL. 1), S3–S15. https://doi.org/10.1016/j.ijfoodmicro.2010.01.021

Permana, A., & W, R. B. (2019). THE DIFFERENCE OF E.COLI CONTENT IN THE CHICKEN MEAT IN THE SOUTH KEPUTRAN TRADITIONAL MARKET AND SUPERMARKET ' X ' OF SURABAYA CITY. *The Indonesian Journal of Public Health*, *14*(1). https://doi.org/10.20473/ijph.v14i1.2019.25-37

Pleskacheva, M. A., Artamonova, M. P., Litvinova, E. V, Gergel, M. A., & Davydova, E. E. (2020). *Methodology for identification and quantification of chicken meat in food products*. *8*(1), 98–106.

Pulido-Landínez, M. (2019). Food safety - Salmonella update in broilers. In *Animal Feed Science and Technology* (Vol. 250). https://doi.org/10.1016/j.anifeedsci.2019.01.008

Rabhi-Essafi, I., Sadok, A., Khalaf, N., & Fathallah, D. M. (2007). A strategy for high-level expression of soluble and functional human interferon α as a GST-fusion protein in E.coli. *Protein Engineering, Design and Selection*, *20*(5). https://doi.org/10.1093/protein/gzm012

Roberts, T. A., MacFie, H. J. H., & Hudson, W. R. (1980). The effect of incubation temperature and site of sampling on assessment of the numbers of bacteria on red meat carcasses at commercial abattoirs. *Journal of Hygiene*, *85*(3), 371–380. https://doi.org/10.1017/S0022172400063440

Samir Hanafy, A., Khalafalla, F., Abdel-Atty, N., Abdel-Wanis, S. A., & Hanafy, A. S. (2015). Food Poisoning Microorganisms in Chicken Broiler Meat Reference Lab for Veterinary Quality Control on Poultry Production. *Global Veterinaria*, *14*(2).

Schaffner, D. W., & Smith-Simpson, S. (2014). Indicator Organisms in Meat. In *Encyclopedia of Meat Sciences*. https://doi.org/10.1016/B978-0-12-384731-7.00068-4

Sengupta, R., Das, R., Ganguly, S., & Mukhopadhayay, S. K. (2011). Survey on microbial

quality of chicken meat in Kolkata, India. *International Journal of Research in Pure and Applied Microbiology*, *1*(3).

Sher, A. A., Mustafa, B. E., Grady, S. C., Gardiner, J. C., & Saeed, A. M. (2021). Outbreaks of foodborne Salmonella enteritidis in the United States between 1990 and 2015: An analysis of epidemiological and spatial-temporal trends. *International Journal of Infectious Diseases*, *105*. https://doi.org/10.1016/j.ijid.2021.02.022

Shinashal, R. Z. (2019). A review on Salmonella bacteria in human and animal. In *International Journal of Research in Pharmaceutical Sciences* (Vol. 10, Issue 1, pp. 531–536). J. K. Welfare and Pharmascope Foundation. https://doi.org/10.26452/ijrps.v10i1.1876

Sire, J. M., Garin, B., Chartier, L., Fall, N. K., Tall, A., Seck, A., Weill, F. X., Breurec, S., Vray, M., Onyeka, L. O., Adesiyun, A. A., Keddy, K. H., Madoroba, E., Manqele, A., Thompson, P. N., Ebomah, K. E., Pavlinac, P. B., John-Stewart, G. C., Naulikha, J. M., … Shimamoto, T. (2020). Ireland's first One Health Report on Antimicrobial Use and Antimicrobial Resistance. *J Water Health*, *5*(1).

Suryadevara, N., Yong, K. B., Ganapathy, B., Subramonie, S., Ragavan, N. D., Ramachandiran, M., Shanmugam, G., & Ponmurugan, P. (2020). Molecular characterization of escherichia coli from chickens in poultry farms of malaysia. *Research Journal of Biotechnology*, *15*(10).

Szmolka, A., & Nagy, B. (2013). Multidrug resistant commensal Escherichia coli in animals and its impact for public health. *Frontiers in Microbiology*, *4*(SEP), 1–13. https://doi.org/10.3389/fmicb.2013.00258

Tan, S. J., Nordin, S., Esah, E. M., & Mahror, N. (2022). Salmonella spp. in Chicken: Prevalence, Antimicrobial Resistance, and Detection Methods. *Microbiology Research*, *13*(4), 691–705. https://doi.org/10.3390/microbiolres13040050

Tarabees, R., Elsayed, M. S. A., Shawish, R., Basiouni, S., & Shehata, A. A. (2017). Isolation and characterization of Salmonella Enteritidis and Salmonella Typhimurium from chicken meat in Egypt. *Journal of Infection in Developing Countries*, *11*(4). https://doi.org/10.3855/jidc.8043

Uddin, M. N. (2018). Antibiotic assays of Salmonella isolated from poultry chicken of various locations in districts Swat. *Pure and Applied Biology*, *7*(1). https://doi.org/10.19045/bspab.2018.70010

Uses, T. (2001). Laboratory analyses and their uses. *CEVA Sante Animal*, 99–129. http://www.sapoultry.co.za/pdf-training/Vaccines-lab-analysis.pdf

Yalda Lucero, A. (2014). Etiology and management of acute infectious gastroenteritis in children and adults. *Revista Medica Clinica Las Condes*, *25*(3), 463–472. https://doi.org/10.1016/S0716-8640(14)70063-X

Yulistiani, R., Praseptiangga, D., Supyani, & Sudibya. (2019). Occurrences of Salmonella spp. and Escherichia coli in chicken meat, intestinal contents and rinse water at slaughtering place from traditional market in Surabaya, Indonesia. *IOP Conference Series: Materials Science and Engineering*, *633*(1). https://doi.org/10.1088/1757-899X/633/1/012007

Zakaria, Z., Hassan, L., Sharif, Z., Ahmad, N., Ali, R. M., Husin, S. A., Hazis, N. H. binti A., Sohaimi, N. F. M., Bakar, S. A., & Garba, B. (2020). Analysis of Salmonella enterica serovar Enteritidis isolates from chickens and chicken meat products in Malaysia using PFGE, and MLST. *BMC Veterinary Research*, *16*(1). https://doi.org/10.1186/s12917-020-02605-y

Zeinhom, M. M. A., & Abdel-Latef, G. K. (2014). Public health risk of some milk borne pathogens. *Beni-Suef University Journal of Basic and Applied Sciences*, *3*(3), 209–215. https://doi.org/10.1016/j.bjbas.2014.10.006

Adeyanju, G. T., & Ishola, O. (2014). Salmonella and escherichia coli contamination of poultry meat from a processing plant and retail markets in Ibadan, Oyo state, Nigeria. *SpringerPlus*, *3*(1), 1–9. https://doi.org/10.1186/2193-1801-3-139

Andoh, L. A., Ahmed, S., Olsen, J. E., Obiri-danso, K., Newman, M. J., Opintan, J. A., Barco, L., & Dalsgaard, A. (2017). *Prevalence and characterization of Salmonella among humans in Ghana*. 1–11. https://doi.org/10.1186/s41182-017-0043-z

Anonimous. (2013). *KENYA, WHERE GMOS ARE BANNED | NW Resistance Against Genetic Engineering*. Epoch Times.

Aworh, M. K., Kwaga, J. K. P., Hendriksen, R. S., Okolocha, E. C., & Thakur, S. (2021). Genetic relatedness of multidrug resistant Escherichia coli isolated from humans, chickens and poultry environments. *Antimicrobial Resistance and Infection Control*, *10*(1). https://doi.org/10.1186/s13756-021-00930-x

Badhe, S. R., Fairoze, N., & Sudarshan, S. (2013). Prevalence of food borne pathogens in market samples of chicken meat in Bangalore, India. *Indian Journal of Animal Research*, *47*(3), 262–264.

Baracho, M. S., Camargo, G. A., Lima, A. M. C., Mentem, J. F., Moura, D. J., Moreira, J., & Nääs, I. A. (2006). Variables impacting poultry meat quality from production to pre-slaughter: A review. *Revista Brasileira de Ciencia Avicola*, *8*(4), 201–212. https://doi.org/10.1590/S1516-635X2006000400001

Ceuppens, S., Johannessen, G. S., Allende, A., Tondo, E. C., El-Tahan, F., Sampers, I., Jacxsens, L., & Uyttendaele, M. (2015). Risk factors for Salmonella, shiga toxin-producing Escherichia coli and Campylobacter occurrence in primary production of leafy greens and strawberries. *International Journal of Environmental Research and Public Health*, *12*(8),

9809–9831. https://doi.org/10.3390/ijerph120809809

Courrol, L. C., & Vallim, M. A. (2021). Spectroscopic Analysis of Chicken Meat Contaminated with E. coli, Salmonella, and Campylobacter. *Food Analytical Methods*, *14*(3). https://doi.org/10.1007/s12161-020-01888-z

Dahal, N., Ellerbroek, L., & Poosaran, N. (2007). Prevalence and antimicrobial resistance of Salmonella in imported chicken carcasses in Bhutan. *National Cent Anim Health*, *1*(April), 1–92.

Edi, S., & Rahmah, R. S. N. (2018). PENGARUH LAMA PENYIMPANAN DAGING AYAM PADA SUHU RUANG DAN REFRIGERATOR TERHADAP ANGKA LEMPENG TOTAL BAKTERI DAN ADANYA BAKTERI Salmonella sp. *JURNAL BIOSAINS*, *4*(1). https://doi.org/10.24114/jbio.v4i1.9452

El-Seedy, F. R., Abed, A. H., Yanni, H. A., & Abd El-Rahman, S. A. A. (2016). Prevalence of Salmonella and E. coli in neonatal diarrheic calves. *Beni-Suef University Journal of Basic and Applied Sciences*, *5*(1), 45–51. https://doi.org/10.1016/j.bjbas.2015.11.010

Faecal indicator organisms for red meat and poultry. (2006). In *Microbiological Analysis of Red Meat, Poultry and Eggs*. CRC Press. https://doi.org/10.1201/9781439823880.ch4

Fletcher, D. L. (2002). Poultry meat quality. *World's Poultry Science Journal*, *58*(2), 131–145. https://doi.org/10.1079/WPS20020013

Hafez, H. M., Schroth, S., Stadler, A., & Schulze, D. (2001). Detection of salmonella, campylobacter, and verotoxin producing E. Coli in turkey flocks during rearing and processing. *Archiv Fur Geflugelkunde*, *65*(3), 130–136.

Hidayat, C., Sumiati, S., Jayanegara, A., & Wina, E. (2021). Supplementation of Dietary Nano Zn-Phytogenic on Performance, Antioxidant Activity, and Population of Intestinal Pathogenic Bacteria in Broiler Chickens. *Tropical Animal Science Journal*, *44*(1). https://doi.org/10.5398/tasj.2021.44.1.90

Journal, B., Science, P., & Brasileira, R. (2004). *Microbiological quality of poultry meat : a review *.*

Kagambèga, A., Haukka, K., Siitonen, A., Traoré, A. S., & Barro, N. (2011). Prevalence of Salmonella enterica and the hygienic indicator Escherichia coli in raw meat at markets in Ouagadougou, Burkina Faso. *Journal of Food Protection*, *74*(9), 1547–1551. https://doi.org/10.4315/0362-028X.JFP-11-124

Kakooza, S., Muwonge, A., Nabatta, E., Eneku, W., Ndoboli, D., Wampande, E., Munyiirwa, D., Kayaga, E., Tumwebaze, M. A., Afayoa, M., Ssajjakambwe, P., Tayebwa, D. S., Tsuchida, S., Okubo, T., Ushida, K., Sakurai, K., & Mutebi, F. (2021). A retrospective analysis of antimicrobial resistance in pathogenic Escherichia coli and Salmonella spp. isolates from poultry in Uganda. *International Journal of Veterinary Science and Medicine*, *9*(1), 11–21. https://doi.org/10.1080/23144599.2021.1926056

Kuria, J. K. N., Ngethe, E. W., Kabuage, L. W., & Gathura, P. B. (2018). Isolation of campylobacter sppand escherichia coli 0157: H7 from free-range indigenous chicken value chain in Kenya. *East African Medical Journal*, *95*(1).

Kuźmińska-Bajor, M., Śliwka, P., Ugorski, M., Korzeniowski, P., Skaradzińska, A., Kuczkowski, M., Narajaczyk, M., Wieliczko, A., & Kolenda, R. (2021). Genomic and functional characterization of five novel Salmonella-targeting bacteriophages. *Virology Journal*, *18*(1). https://doi.org/10.1186/s12985-021-01655-4

Lubote, R., Shahada, F., Research, A. M.-A. J. of, & 2014, undefined. (2014). Prevalence of Salmonella spp. and Escherichia coli in raw milk value chain in Arusha, Tanzania. *Citeseer*, *2*(9), 1. https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.1064.5426&rep=rep1&type=pdf

Maripandi, A., & Al-Salamah, A. A. (2010). Multiple-antibiotic resistance and plasmid profiles of Salmonella enteritidis isolated from retail chicken meats. *American Journal of Food Technology*, *5*(4). https://doi.org/10.3923/ajft.2010.260.268

Mead, G. C. (2006). Faecal indicator organisms for red meat and poultry. In *Microbiological Analysis of Red Meat, Poultry and Eggs: A volume in Woodhead Publishing Series in Food Science, Technology and Nutrition*. https://doi.org/10.1533/9781845692513.83

Mengistu, S., Abayneh, E., & Shiferaw, D. (2017). E. coli O157:H7 and Salmonella Species:

Public Health Importance and Microbial Safety in Beef at Selected Slaughter Houses and Retail Shops in Eastern Ethiopia. *Journal of Veterinary Science & Technology*, *8*(5). https://doi.org/10.4172/2157-7579.1000468

Moawad, A. A., Hotzel, H., Awad, O., Tomaso, H., Neubauer, H., Hafez, H. M., & El-Adawy, H. (2017). Occurrence of Salmonella enterica and Escherichia coli in raw chicken and beef meat in northern Egypt and dissemination of their antibiotic resistance markers. *Gut Pathogens*, *9*(1), 1–13. https://doi.org/10.1186/s13099-017-0206-9

Naing, L., Nordin, R. Bin, Rahman, H. A., & Naing, Y. T. (2022). Sample size calculation for prevalence studies using Scalex and ScalaR calculators. *BMC Medical Research Methodology*, 1–8. https://doi.org/10.1186/s12874-022-01694-7

Newell, D. G., Koopmans, M., Verhoef, L., Duizer, E., Aidara-Kane, A., Sprong, H., Opsteegh, M., Langelaar, M., Threfall, J., Scheutz, F., der Giessen, J. van, & Kruse, H. (2010). Food-borne diseases - The challenges of 20years ago still persist while new ones continue to emerge. *International Journal of Food Microbiology*, *139*(SUPPL. 1), S3–S15. https://doi.org/10.1016/j.ijfoodmicro.2010.01.021

Permana, A., & W, R. B. (2019). THE DIFFERENCE OF E.COLI CONTENT IN THE CHICKEN MEAT IN THE SOUTH KEPUTRAN TRADITIONAL MARKET AND SUPERMARKET ' X ' OF SURABAYA CITY. *The Indonesian Journal of Public Health*, *14*(1). https://doi.org/10.20473/ijph.v14i1.2019.25-37

Pleskacheva, M. A., Artamonova, M. P., Litvinova, E. V, Gergel, M. A., & Davydova, E. E. (2020). *Methodology for identification and quantification of chicken meat in food products*. *8*(1), 98–106.

Pulido-Landínez, M. (2019). Food safety - Salmonella update in broilers. In *Animal Feed Science and Technology* (Vol. 250). https://doi.org/10.1016/j.anifeedsci.2019.01.008

Rabhi-Essafi, I., Sadok, A., Khalaf, N., & Fathallah, D. M. (2007). A strategy for high-level expression of soluble and functional human interferon α as a GST-fusion protein in E.coli. *Protein Engineering, Design and Selection*, *20*(5). https://doi.org/10.1093/protein/gzm012

Roberts, T. A., MacFie, H. J. H., & Hudson, W. R. (1980). The effect of incubation temperature

and site of sampling on assessment of the numbers of bacteria on red meat carcasses at commercial abattoirs. *Journal of Hygiene*, *85*(3), 371–380. https://doi.org/10.1017/S0022172400063440

Samir Hanafy, A., Khalafalla, F., Abdel-Atty, N., Abdel-Wanis, S. A., & Hanafy, A. S. (2015). Food Poisoning Microorganisms in Chicken Broiler Meat Reference Lab for Veterinary Quality Control on Poultry Production. *Global Veterinaria*, *14*(2).

Schaffner, D. W., & Smith-Simpson, S. (2014). Indicator Organisms in Meat. In *Encyclopedia of Meat Sciences*. https://doi.org/10.1016/B978-0-12-384731-7.00068-4

Sengupta, R., Das, R., Ganguly, S., & Mukhopadhayay, S. K. (2011). Survey on microbial quality of chicken meat in Kolkata, India. *International Journal of Research in Pure and Applied Microbiology*, *1*(3).

Sher, A. A., Mustafa, B. E., Grady, S. C., Gardiner, J. C., & Saeed, A. M. (2021). Outbreaks of foodborne Salmonella enteritidis in the United States between 1990 and 2015: An analysis of epidemiological and spatial-temporal trends. *International Journal of Infectious Diseases*, *105*. https://doi.org/10.1016/j.ijid.2021.02.022

Shinashal, R. Z. (2019). A review on Salmonella bacteria in human and animal. In *International Journal of Research in Pharmaceutical Sciences* (Vol. 10, Issue 1, pp. 531–536). J. K. Welfare and Pharmascope Foundation. https://doi.org/10.26452/ijrps.v10i1.1876

Sire, J. M., Garin, B., Chartier, L., Fall, N. K., Tall, A., Seck, A., Weill, F. X., Breurec, S., Vray, M., Onyeka, L. O., Adesiyun, A. A., Keddy, K. H., Madoroba, E., Manqele, A., Thompson, P. N., Ebomah, K. E., Pavlinac, P. B., John-Stewart, G. C., Naulikha, J. M., … Shimamoto, T. (2020). Ireland's first One Health Report on Antimicrobial Use and Antimicrobial Resistance. *J Water Health*, *5*(1).

Suryadevara, N., Yong, K. B., Ganapathy, B., Subramonie, S., Ragavan, N. D., Ramachandiran, M., Shanmugam, G., & Ponmurugan, P. (2020). Molecular characterization of escherichia coli from chickens in poultry farms of malaysia. *Research Journal of Biotechnology*, *15*(10).

Szmolka, A., & Nagy, B. (2013). Multidrug resistant commensal Escherichia coli in animals and

its impact for public health. *Frontiers in Microbiology*, *4*(SEP), 1–13. https://doi.org/10.3389/fmicb.2013.00258

Tan, S. J., Nordin, S., Esah, E. M., & Mahror, N. (2022). Salmonella spp. in Chicken: Prevalence, Antimicrobial Resistance, and Detection Methods. *Microbiology Research*, *13*(4), 691–705. https://doi.org/10.3390/microbiolres13040050

Tarabees, R., Elsayed, M. S. A., Shawish, R., Basiouni, S., & Shehata, A. A. (2017). Isolation and characterization of Salmonella Enteritidis and Salmonella Typhimurium from chicken meat in Egypt. *Journal of Infection in Developing Countries*, *11*(4). https://doi.org/10.3855/jidc.8043

Uddin, M. N. (2018). Antibiotic assays of Salmonella isolated from poultry chicken of various locations in districts Swat. *Pure and Applied Biology*, *7*(1). https://doi.org/10.19045/bspab.2018.70010

Uses, T. (2001). Laboratory analyses and their uses. *CEVA Sante Animal*, 99–129. http://www.sapoultry.co.za/pdf-training/Vaccines-lab-analysis.pdf

Yalda Lucero, A. (2014). Etiology and management of acute infectious gastroenteritis in children and adults. *Revista Medica Clinica Las Condes*, *25*(3), 463–472. https://doi.org/10.1016/S0716-8640(14)70063-X

Yulistiani, R., Praseptiangga, D., Supyani, & Sudibya. (2019). Occurrences of Salmonella spp. and Escherichia coli in chicken meat, intestinal contents and rinse water at slaughtering place from traditional market in Surabaya, Indonesia. *IOP Conference Series: Materials Science and Engineering*, *633*(1). https://doi.org/10.1088/1757-899X/633/1/012007

Zakaria, Z., Hassan, L., Sharif, Z., Ahmad, N., Ali, R. M., Husin, S. A., Hazis, N. H. binti A., Sohaimi, N. F. M., Bakar, S. A., & Garba, B. (2020). Analysis of Salmonella enterica serovar Enteritidis isolates from chickens and chicken meat products in Malaysia using PFGE, and MLST. *BMC Veterinary Research*, *16*(1). https://doi.org/10.1186/s12917-020-02605-y

Zeinhom, M. M. A., & Abdel-Latef, G. K. (2014). Public health risk of some milk borne pathogens. *Beni-Suef University Journal of Basic and Applied Sciences*, *3*(3), 209–215.