Volume 10, Issue 8, August – 2025 International Journal of Innovative Science and Research Technology
ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25aug572

Microbial Safety on Ready-to-Eat Chicken Products Sold in Retailer Shops - Shawarma, and Alfahm

Latha Sukumaran[1*]; Gokul Govindharaj[2]; Abishek Ilaiyaraja[3]

[1,2,3] Department of Biotechnology, Rathinam College of Arts and Science (Autonomous), Affiliated to Bharathiar University, Coimbatore-641021, Tamil Nadu, India

Publication Date: 2025/08/20

Abstract: The study investigates the safety of two ready-to-eat chicken-based food items-Shawarma and Alfahm procured from three distinct food service establishments. The microbiological assessments included total viable count (TVC), and the presence of *Salmonella, Shigella,* and *Escherichia coli*. Physicochemical analyses encompass pH, titratable acidity, total soluble solids (°Brix), and total protein content. Shawarma samples, particularly those from Restaurants 1 and 2, exhibited elevated microbial loads, with *Salmonella* ranging from 2.8×10^6 to 3.0×10^6 CFU/g and *E. coli* levels up to 5.2×10^6 CFU/g. These microbiological findings coincided with significantly decreased pH and °total soluble solids values, indicative of advanced spoilage, likely attributable to the utilization of improperly stored raw materials, suboptimal thermal processing (<65°C), and inadequate hygienic practices. In contrast, Alfahm samples demonstrated substantially lower microbial counts and comparatively stable physicochemical parameters, which can be attributed to the elevated cooking temperatures (~200°C) typically employed in their preparation, facilitating effective microbial inactivation. The study establishes a clear inverse relationship between microbial contamination and key physicochemical indices, underscoring the necessity for stringent control measures, including the use of fresh raw materials, adherence to validated cooking protocols, and implementation of rigorous sanitary practices in ready-to-eat chicken products. Strengthened regulatory oversight and routine microbiological surveillance are imperative to mitigate public health risks associated with contaminated fast food.

Keywords: *Ready -to- Eat Chicken Products; E.Coli; Salmonella; Shigella; Food Safety.*

How to Cite: Latha Sukumaran; Gokul Govindharaj; Abishek Ilaiyaraja (2025) Microbial Safety on Ready-to-Eat Chicken Products Sold in Retailer Shops - Shawarma, and Alfahm. *International Journal of Innovative Science and Research Technology*, 10(8), 665-669. https://doi.org/10.38124/ijisrt/25aug572

I. INTRODUCTION

The consumption of meat in world increased in recent years compared to that before 1980s by the result of the income and population growths [1]. Among the different ready to eat products the chicken products are apparently consumed as most common meat types in many countries. However, there is no much care about the investigation on safety of these products. The most common bits of a chicken are derived from legs, breast, wings, and their transformation makes different consumable. Some of the poultry meat products include the chicken sausage, chicken skin-meat cutlets, chicken steaks, dehydrated chicken soup mix, shami, chicken kabab, fried chicken, wings etc.

Chickens showed more balanced nutrient profile, particularly protein (29.5 %/ 100 g) and amino acids. Thus increased the market demand for this product [2]. The chicken products not only provide high-quality protein, but also important source of vitamins and minerals. The chicken meat also provides essential polyunsaturated fatty acids (PUFAs), such as omega (n)-3 fatty acids. Moreover, the chicken liver is rich source of vitamin A. Among the macro-elements, phosphorous (2,934.46 mg/g) were generally higher, followed by potassium, sodium, magnesium and calcium are sourced from chicken products. The liver part of chicken had higher amounts of K, Na and P, hence the cecum and crop had higher amount of Ca and Mg, respectively [1].

The building blocks of protein such as amino acids (AAs), which are the main dry matter of chickens and eggs [3]. Totally 17 amino acids including essential amino acids and non-essential amino acids with different levels were found in chicken products. Among them the eight are essential amino acids which includes; threonine, methionine, valine, isoleucine, leucine, histidine, phynylalanine and lysine were detected in all

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25aug572

by-products of chicken [4]. In addition to essential amino acids, taurine- a nonproteinogenic amino Acid, which is present abundantly in poultry tissues, itis important for the integrity and function of the eyes, heart and skeletal muscle, as well as the nervous, digestive, immune, and reproductive systems. Therefore, the consumption of chicken products has numerous benefits to the consumers. Hence, the existing studies reported the prevalence of various pathogens, mainly *Shigella* and *Salmonella* are majorly reported in chicken products. The human pathogens of *Shigella* and *Salmonella* are present at high loads, even after cooking, it is crucial to detect the pathogens [5]. Hence, the present study investigating the safety in ready to eat chicken products by microbiological and physicochemical qualities.

II. MATERIAL AND METHODS

The chicken products of shawarma and alfaham were collected from 3 different restaurants (rated above 3.5) on three different days in Coimbatore, India. The FSSAI manual on method of microbiological testing (2016) was followed for the cultivation of microorganisms from chicken products. According to the procedure the procured sample of 25 g were evenly sliced from all the sides and transferred into 250 ml nutrient broth under hygienic condition for the pre-enrichment process. For the cultivation of *Salmonella* the pre-enriched sample was incubated at 37°C for 60 minutes. Thereafter, the 1 ml of inoculum was transferred into rappaport-vassiliadis broth and kept at 37± 1°C for 24 h incubation for selective enrichment. The suspected food pathogenic *Salmonellae* in these products were grown on the XLD (Himedia, India). The *Shigella* was enumerated from the pre-enrichment broth, adjusted from the pH of 6 to 7, and allowed for incubation at 37± 1°C for 18 h. Thereafter, the loopful culture spread in XLD MEDIA and it is further incubated for 24 hours. Pre-enriched (25 g sample in nutrient broth) sample was allowed for incubation at 37°C for 24 h for *E.Coli* cultivation. After pre-enrichment 5 ml of loopful culture transferred into violet red bile agar and incubated for 24 hours at 37°C. The sample (25 g) in 250 ml of nutrient broth were serially diluted. After serial dilution the sample with dilution of 10^{-6} and 10^{-7} was taken and plated using spread plate method in particular media for total viable count analysis. Aseptically drawn samples were analyzed for pH, soluble solids, total acidity through ELICO pH meter (L1 120 – model), hand-held refractometer (RHB-55ATC) and 0.1 N NaOH with the addition of a phenolphthalein indicator. The protein content of the chicken sample was analyzed in lowry's method.

III. RESULTS AND DISCUSSION

➢ *Salmonella in Ready-to-Eat Food Products*

The *Salmonella* pathogen were detected in the product of Shwarma, sampled from the two different retailers and had count of $3.0x10^{6}$ *to* $2.8x10^{6}$ CFU/g (Table 1). This count is the indication of Shwarma were prepared from restraint 1 and 2 are used stored chicken [6]. Their presence is a hazard indication, and source of foodborne diseases, this means that among the three restaurants, two were not following food standards [7]. In addition to the storage the cooking temperature applied in Shawarma preparation (65° C) not eventually reached at all the surface of the product [8]. The results indicated that the product produced from a stored chicken, rather than the fresh chicken. The stored chicken has the high chance of various microbes, that introduce *Salmonella* in Shawarma. The results align with WHO of New Zealand and Australia (2017) guidelines for the microbiological examination. The results confirmed with the report of RTE foods standards of 2001 which states that *Salmonella* were detected in RTE food sample of shawarma [9]. Hence their possibilities were less in the product of Alfahm, the cooking temperature about 200 °C were completely eradicate the pathogenic microbes, and it not detected in two samples.

➢ *Shigella in Ready-to-Eat Food Products*

In this study *Shigella* count is $2.7x10^{4}$ CFU/g in shawarma product (Table 1). The survival of *Shigella* was cruises, because it was the third most reported foodborne bacterial pathogen reported by centers for Disease Control. The *Shigella* were sourced from infected food handler who practices poor personal hygiene [10]. In this current study *Shigella* can survive at high levels in shawarma, and it was not detected two of the Alfahm product.

Table 1: Microbial Analysis of Total Count, *Salmonella, Shigella*, and *E.coli* in Ready to Eat Chicken Food Products

Samples	**Total viable count** *CFU/g*	**Salmonella** CFU */g*	**Shigella** CFU */g*	**E. coli** CFU/*g*
Shawarma Restaurant 1	8.08×10^{5}	2.8×10^{6}	2.7×10^{4}	4.8×10^{6}
Shawarma Restaurant 2	7.58×10^{5}	3.0×10^{6}	3.0×10^{4}	5.2×10^{6}
Shawarma Restaurant 3	6.08×10^{5}	ND	ND	$1.\ 2\times10^{6}$
Alfahm Restaurant 1	6.08×10^{5}	1.8×10^{6}	2.0×10^{4}	2.8×10^{6}
Alfahm Restaurant 2	4.58×10^{5}	ND	ND	1.2×10^{6}
Alfahm Restaurant 3	5.08×10^{5}	ND	ND	$1.\ 2\times10^{6}$

Note: Not Detected (ND) Growth in Cultured Plates

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25aug572

➢ *E. Coli in Ready-to-Eat Food Products*

Dysentery and enteric fever also significant public health problems throughout the world [11]. The table 1 shows the mean counts of *E. coli* which ranged from 1.2 to 5.2 *x10* ^{6} CFU/g (Table 1) and the similar results observed in RTE foods. The results indicated the highest range is possibility in shawarma thus causes Enteric diseases to the consumers. Their count indicates that the product of shawarma was prepared from stored or spoiled chicken [12]. Hence the product of Alfahm reveled the least population of *E. coli* that states that the product was prepared from good quality and ensure the effective cooking methodology.

➢ *Physiochemical Properties of Shawarma and Alfahm*

The physiochemical analysis of Shawarma and Alfahm from three different restaurants reveals critical differences in pH, total acidity, °total soluble solids, and protein content, which reflect not only ingredient variation but also the impact of microbial spoilage, particularly by *Salmonella.*, *Shigella.*, and *Escherichia coli*. These parameters serve as indirect indicators of food freshness, hygiene practices, and microbial safety. The pH values of Shawarma samples varied significantly between restaurants, indicating potential microbial activity (Fig 1). The control Shawarma (CS) had a near-neutral pH of 5.98, while Shawarma Restaurant 2 (SR2) showed a markedly lower pH of 4.49, followed by Shawarma Restaurant 1 (SR1) at 4.89. In contrast, Shawarma from Restaurant 3 (SR3) was closer to the control at 5.79.

These lower pH values in SR1 and SR2 may result from acid production by spoilage microbes, particularly *Salmonella* and *E. coli*, which ferment available carbohydrates and proteins into various acids thereby it acidifying the product [13]. This acidification process is a feature of microbial spoilage and typically accompanies off-odors and texture degradation. The significantly lower pH values align with the microbial findings of *Salmonella* and their detected high levels (3.0×10^{6}-2.8×10^{6} CFU/g) in SR1 and SR2, and *E. coli* counts reached up to 5.2×10^{6} CFU/g, indicating the likely use of stored or improperly handled chicken [14]. In contrast, Alfahm samples exhibited pH values much closer to their control (CA–6.06), with AR1 at 5.73, AR2 at 5.89, and AR3 at 5.90. These values reflect better microbial stability, likely due to higher cooking temperatures (reaching ~200°C) that effectively destroy pathogens and their metabolism [15].

Total acidity values further support the pH trends in analysed products. Shawarma from SR2 and SR1 showed the increased acidity (0.42 and 0.39 mg/L), while the control sample had 0.20 mg/L, suggesting microbial degradation of buffering compounds (Fig 1). Atypical acid profiles may also be associated with the accumulation of metabolites such as acids produced by bacteria [16]. In contrast, the Alfahm control had the least acidity (0.32 mg/L), while restaurant samples of AR1 revealed as 0.46 mg/L, suggests that microbial metabolic contribution to acidity was minimal [17]. The range of acidity from 0.35 to 0.36 mg/L indicates absence of such spoilage microbial (*Salmonella* and *E. coli*) existence in Alfahm samples of restaurant 2 and 3.

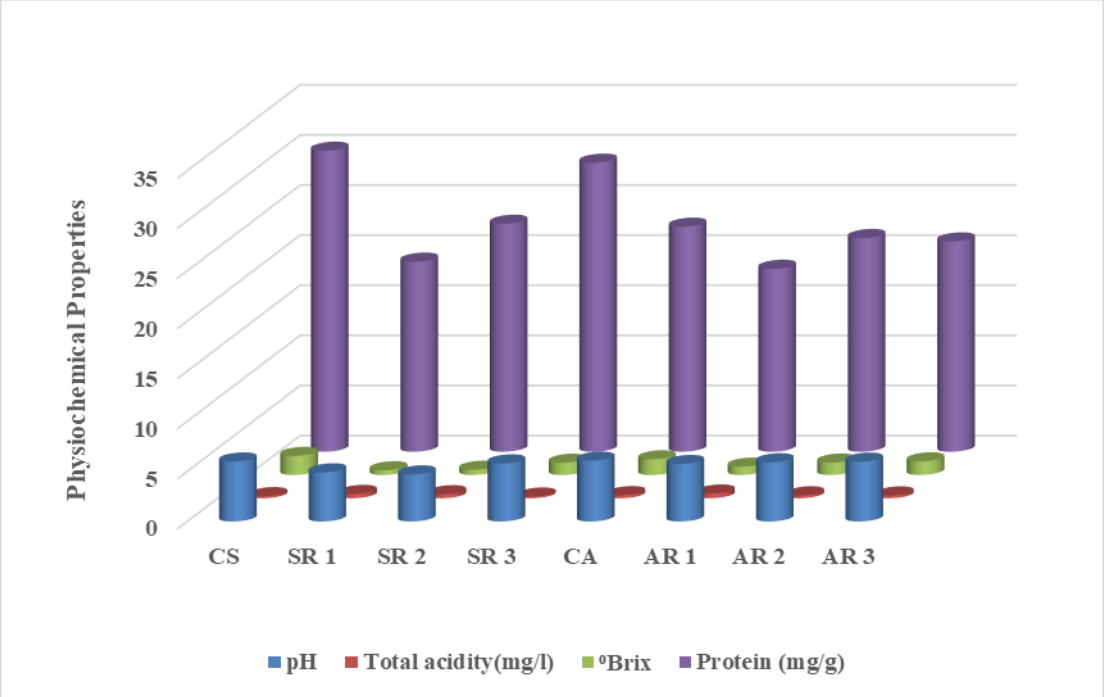

Fig :1 Physiochemical Properties of Shawarma and Alfahm from 3 Different Restaurants CS – Control Shawarma; SR 1 – Shawarma Restaurant 1; SR 2 – Shawarma Restaurant 2; SR 3 – Shawarma Restaurant 3; CA – Control Alfahm ; AR 1 – Alfahm Restaurant 1 ; AR 2 – Alfahm Restaurant 2 ; AR 3 – Alfahm Restaurant 3

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25aug572

The soluble solid values, which indicate levels of soluble sugars, were notably lower in the spoiled Shawarma samples (Fig 1). SR1 and SR2 had values of 0.46 and 0.52 °Brix, respectively, compared to the control Shawarma at 1.9. The decline sugars is likely due to fermentation of sugars by bacteria such as *E. coli*, and produce acidic by products, further affecting the food's flavor and stability [18;19]. The Alfahm control (CA) showed a °Brix of 1.56, while AR2–AR3 ranged from 1.23 to 1.35°Brix, showing more stable sugar retention. This stability supports the microbiological data, which indicated lower *E. coli, Salmonella and Shigella* levels in Alfahm. Hence, the reduced sugar fermentation reported only in AR1 sample as 0.72°Brix in was least changes than that of Shawarma sample (0.46°Brix).

Protein content serves as a key indicator of both nutritional quality and microbial degradation. Control Shawarma had the highest protein level (28.05 mg/g), followed by SR3 (27.04 mg/g), while SR1 and SR2 had the lowest value of 23.74 mg/g and 22.96 mg/g respectively (Fig 1). The reduced protein content in SR1 and SR2 reflects proteolytic degradation by microbial enzymes, particularly from *Salmonella* and *Shigella*, which break down muscle proteins into ammonia and other volatile during spoilage [20;21]. In Alfahm, the control sample (CA) showed 22.45 mg/g, with restaurant samples ranging between 18.25 and 21.32 mg/g, suggesting moderate variations possibly due to differences in marination or moisture content, rather than microbial degradation. The high cooking temperature of Alfahm likely denatured microbial enzymes and limited spoilage [15].

IV. CONCLUSION

The comparative analysis of Shawarma and Alfahm from three different restaurants reveals significant variations in microbial load and physiochemical quality, underscoring the impact of ingredient handling, storage, and cooking practices on food safety. Shawarma samples, particularly from Restaurants 1 and 2, exhibited high levels of *Salmonella spp.* (up to 3.0×10^6 CFU/g), *Shigella spp.* (up to 3.0×10^4 CFU/g), and *E. coli* (up to 5.2×10^6 CFU/g), along with notable declines in pH, soluble solids, and protein content, strongly suggesting microbial spoilage likely due to the use of stored or spoiled chicken, suboptimal cooking temperatures (<65°C), and poor hygiene practices. In contrast, Alfahm samples generally maintained better microbial profiles with lower pathogen counts and more stable physiochemical properties. This is attributed to higher cooking temperatures (~200°C), which were effective in eliminating pathogens and preserving the chemical integrity of the meat. The results emphasize that proper thermal processing, fresh raw materials, and hygienic food handling are crucial to preventing foodborne pathogens and ensuring product quality in ready-to-eat chicken dishes. Therefore, Shawarma from some restaurants poses a greater public health risk, while Alfahm, when cooked properly, demonstrates superior microbial safety and quality retention. These findings align with food safety guidelines from WHO, FSANZ, and CDC, and reinforce the need for rigorous compliance with microbiological standards in food service operations.

ACKNOWLEDGEMENT

This project is the outcome of research work carried out in the Department of Biotechnology under the DBT Star College Scheme. The authors are grateful to the Department of Biotechnology (DBT), Ministry of Science and Technology, Govt. of India, New Delhi, and the Department of Biotechnology for the support.

- *Funding Sources*

The Authors received from seed grant from Rathinam college of arts and science, Coimbatore for doing this project in Department of Biotechnology.

- *Conflict of Interest*

The authors declare no conflict of interest

REFERENCES

[1]. Pil-Nam, S., Seon-Tea, J., & Ki-Chang, N. (2015). Characterization of chicken by-products by means of proximate and nutritional compositions. *Korean Journal of Food Science of Animal Resources*, 35(2), 179.

[2]. Kleyn, R., Chrystal, P., & Shirley, R. (2008). Feeding the young broiler chicken in practice: A review. Presented at: *23rd World's Poultry Congress*, Brisbane, Australia.

[3]. Baker, R. S. J. d., & Yacef, K. (2009). The state of educational data mining: A review and future visions. *Journal of Educational Data Mining*, 1(1), 3–17.

[4]. Spackman, D. H., Stein, W. H., & Moore, S. (1958). Automatic recording apparatus for use in chromatography of amino acids. *Analytical Chemistry*, 30(7), 1190–1206.

[5]. Amélie, C., Tresse, O., & Zagorec, M. (2017). Bacterial contaminants of poultry meat: Sources, species, and dynamics. *Microorganisms*, 5(3), 50.

[6]. Wang, M., Qian, W., Zhang, Y., et al. (2021). Overview of rapid detection methods for *Salmonella* in foods: Progress and challenges. *Foods*, 10(10), 2402. Available from: https://doi.org/10.3390/foods10102402

[7]. Ehuwa, O., Jaiswal, A. K., & Jaiswal, S. (2021). *Salmonella*, food safety and food handling practices. *Foods*, 10(5), 907. Available from: https://doi.org/10.3390/foods10050907

[8]. Darwish, W. S., El-Ghareeb, W. R., Alsayeqh, A. F., & Morshdy, A. E. M. (2022). Foodborne intoxications and toxicoinfections in the Middle East. In: *Food Safety in the Middle East* (pp. 109–141). Academic Press.

[9]. DeSousa, E. A., Albert, R. H., & Kalman, B. (2002). Cognitive impairments in multiple sclerosis: A review. *American Journal of Alzheimer's Disease & Other Dementias*, 17(1), 23–29.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25aug572

[10]. Ahmed, A. M., & Shimamoto, T. (2014). Isolation and molecular characterization of *Salmonella enterica*, *Escherichia coli* O157:H7 and *Shigella* spp. from meat and dairy products in Egypt. *International Journal of Food Microbiology*, 168, 57–62.
[11]. Nethathe, B., Matsheketsheke, P. A., Mashau, M. E., & Ramashia, S. E. (2023). Microbial safety of ready-to-eat food sold by retailers in Thohoyandou, Limpopo province, South Africa. *Cogent Food & Agriculture*, 9(1), 2185965.
[12]. Agarwal, M. (2014). Prevalence of pathogens and indicators in foods ordered from online vendors [Dissertation, Rutgers University-Graduate School]. New Brunswick, NJ.
[13]. Forsythe, S. J. (2010). *The Microbiology of Safe Food* (2nd ed.). Wiley-Blackwell.
[14]. Food Standards Australia New Zealand (FSANZ). (2001). *Microbiological Guidelines for Ready-To-Eat Food Products*. Available from: https://www.foodstandards.gov.au/ [Accessed on 2025 May 2].
[15]. Buncic, S., & Sofos, J. (2012). Microbial pathogens in meat and poultry. In: Motarjemi, N., & Moy, G. (Eds.), *Food Safety Management: A Practical Guide for the Food Industry* (pp. 267–304). Academic Press.
[16]. Jay, J. M., Loessner, M. J., & Golden, D. A. (2005). *Modern Food Microbiology* (7th ed.). Springer.
[17]. Scallan, E., Hoekstra, R. M., & Angulo, F. J. (2011). Foodborne illness acquired in the United States—Major pathogens. *Emerging Infectious Diseases*, 17(1), 7–15. Available from: https://doi.org/10.3201/eid1701.P11101
[18]. Todar, K. (2012). *Todar's Online Textbook of Bacteriology*. Available from: http://www.textbookofbacteriology.net [Accessed on 2025 May 2].
[19]. Doyle, M. P., & Buchanan, R. L. (2013). *Food Microbiology: Fundamentals and Frontiers* (4th ed.). ASM Press.
[20]. Ahmed, A., Anjum, F. M., & Butt, M. S. (2020). Influence of marinades on physicochemical and sensory properties of chicken meat. *Food Chemistry*, 318, 126475. Available from: https://doi.org/10.1016/j.foodchem.2020.126475
[21]. Khan, M. I., Jo, C., & Tariq, M. R. (2017). Meat marination: Effects on physicochemical quality and microbial safety. *Meat Science*, 134, 130–135. Available from: https://doi.org/10.1016/j.meatsci.2017.08.007