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Original Research Article

Evaluation of the Efficacy of Some Selected Disinfectants Using the Chick-Martin Test

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ABSTRACT

Disinfectants are vital in infection control as they inactivate or kill harmful germs. Their efficacy, however, is in question, particularly in the presence of organic waste. The aim of the study is the application of the Chick-Martin phenol coefficient test to determine the antimicrobial efficacy of locally manufactured and foreign-made disinfectants from Awka and Onitsha markets, Nigeria. A total of ten (10) disinfectants- (4 foreign and 6 local) were tested for their effectiveness against some microorganisms, including *Salmonella spp., Pseudomonas aeruginosa,* and *Staphylococcus aureus*. They were compared for their effectiveness as a bactericidal agent with that of phenol using the Chick-Martin test to ascertain their phenol coefficient. The results indicated notable differences in antimicrobial activity. Tetmosol and Septol were most active against *Staphylococcus aureus* (phenol coefficient = 2), while Dettol and Jik were moderately active (coefficient = 1). Lysol, Dr. Johnson, and Septol were most active against *Pseudomonas aeruginosa* (coefficient = 8). Against *Salmonella spp*., Dettol, Dr Johnson, and Jik were most active (coefficient = 8), while Tetmosol and Divitol were poorly active (coefficient = 1). Foreign disinfectants had greater mean Chick-Martin coefficients than local brands in general, indicating their superior efficacy. However, the fact that some local disinfectants, such as Tetmosol and Septol, had performances comparable to foreign brands indicates that they may be efficacious at lower prices. The study highlights the prospects of some local disinfectants (e.g., SEPTOL and TETMOSOL) as effective substitutes for costly foreign brands, advancing affordability without undercutting effectiveness.

Keywords: Disinfectants, Chick-Martin phenol coefficient, Efficacy evaluation, Cost-effective alternatives, Disinfectant performance comparison

Introduction

Disinfectants are chemical compounds designed to inactivate or destroy disease-causing microorganisms. Disinfectants are important in infection control and domestic, occupational, hospital, and public hygiene. [1] Proper disinfectant use and proper healthcare waste disposal are important elements of effective infection control to avoid nosocomial infections. [2] The increasing hospital and community-acquired infection rate has spurred the global demand for effective disinfectants, a trend that the COVID-19 pandemic has further accelerated. [3] Despite this, concerns regarding their effectiveness, particularly in the presence of organic matter, persist. Standard methods to assess the effectiveness of disinfection are the Rideal-Walker phenol coefficient (R.W.C) test, Chick-Martin and Garrod's test, Kesley and Maurer's in-use tests, the capacity uses dilution test by Kelsey and Sykes and other miscellaneous microbial time-kill assays. [4] The chick-Martin phenol coefficient test is a standard technique employed to assess the disinfecting ability of chemical agents against phenol in experimental conditions. The test utilises the phenol coefficient, a fundamental measure of the strength of a disinfectant, to evaluate its effectiveness against specific pathogens.

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This study entails the evaluation of the efficacy of foreign and locally sourced disinfectants from markets in Awka and Onitsha, Nigeria, using the Chick-Martin phenol coefficient. The pathogens employed are *Staphylococcus aureus, Pseudomonas aeruginosa, and Salmonella spp*., which are public health microorganisms of interest due to their causation of nosocomial and community-acquired infections and diseases. This study assesses the efficacy of various brands of disinfectants against *Staphylococcus aureus, Pseudomonas aeruginosa, and Salmonella spp.* by determining their phenol coefficients. A higher coefficient indicates greater disinfectant efficacy relative to phenol. Recent evaluations of disinfectants highlight differences in antimicrobial performance based on chemical composition, with alcohol-based and chlorhexidine-based formulations demonstrating varied effectiveness. [3] Furthermore, the World Health Organisation (WHO) and the Food and Drug Administration (FDA) emphasise stringent quality control to ensure disinfectant reliability. [1, 3] This study aims to provide comparative insights into the efficacy of local and foreign brands to inform consumer choice and regulatory policies.

Materials and Methods

Disinfectants
The disinfectants were painstakingly collected from the markets of Awka and Onitsha in Anambra State, Nigeria. Foreign (LYSOL, DETTOL and DR. JOHNSON) and local brands (SEPTOL, TETMOSOL, IZOLA, DIVITOL, SAVLON, ISOL, and JIK) were the brands used in this study.

Test Organisms
Microbial strains utilised for the antimicrobial investigations include *Salmonella spp., Staphylococcus aureus,* and *Pseudomonas*

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aeruginosa. The organisms were collected from the Pharmaceutical Microbiology and Biotechnology Laboratory, Nnamdi Azikiwe University, Awka, Nigeria. The organisms were purified on each of their respective selective agar plates. They were identified according to Cheesbrough's procedures.[5] Fresh cultures of bacteria were obtained by seeding single colonies into 5 ml of nutrient broth in sterile, labelled Bijou bottles. The cultures of bacteria were incubated at 37ºC for 24 hours before antimicrobial sensitivity testing. Mueller-Hinton Agar was utilised for the storage of stock cultures.

Culture Media

Media used throughout this study were Salmonella Shigella Agar (SSA) (Accumedia, Karnataka), Mannitol Salt Agar (MSA) (Oxoid Limited, England), Cetrimide Agar (ReadyMed, India), Nutrient Broth (Oxoid Limited, England), and Mueller-Hinton Agar (MHA) (Oxoid Limited, England). Media were procured according to the manufacturer's instructions.

Preparation of Disinfectant Dilutions

The individual disinfectants and Phenol solution were prepared to a concentration of 2% individually (2 ML of phenol /disinfectants in 100 mL of water), and a 2-fold serial dilution was carried out for each of the disinfectants (1:10 up to 1:10000 to obtain 1%, 0.5%, 0.25%, 0.125%).[4] For the serial dilutions, 3 ML of each of the stock concentrations of disinfectant was added to a test tube that had 3 ML of sterile nutrient broth. A 3 ML sample of the broth-disinfectant mixture was diluted further into another tube that had a 3ML sterile broth, and the process was repeated to make a total of five (5) series of dilutions of disinfectants for every sample. The same dilution was also carried out for the phenol solution.[4] To mimic organic contamination, 1 ML of 5% yeast solution was added to all five dilutions of disinfectants. 0.5 ML of each test organism culture suspension, prepared to a McFarland 0.5 turbidity standard, was added to each disinfectant-yeast dilution. The mixtures were incubated at room temperature for 30 minutes. Following the 30-minute contact time, a routine loopful of the disinfectant-culture-yeast mixture was inoculated into their respective recovery media in duplicates. The broth tubes were incubated at 37ºC for 48 hours. After incubation, growth or no growth with (presence or absence of turbidity) was noted. [4] The Chick-Martin Phenol coefficient was determined as follows:

$$\text{Phenol coefficient} = \frac{\text{Mean highest concentration showing growth in the phenol}}{\text{Mean highest concentration showing growth in the test disinfectant}}$$

…………………………………………………………… Equation 1

This was calculated for each disinfectant sample and the three test organisms. [4]

Data Analysis

Data was analysed using GraphPad Prism version 5 (GraphPad Software, San Diego, CA, USA). The mean chick martin coefficients were calculated and presented in bar charts. The one–way ANOVA was used to evaluate the level of significance. The p-values of greater than or equal to 0.05 (α≥0.05) were regarded as statistically significant.

Results and Discussion

Disinfectants are employed in the prevention and control of multidrug-resistant gram-negative bacteria (MDR-GNB) spread in a hospital environment, but their effectiveness could be undermined by bacterial mechanisms capable of acting against both disinfectants and antimicrobials.[6] The isolates tested here have already been implicated as agents of hospital-acquired infection (HAI). .[7, 8] The current Environmental Protection Agency (EPA) testing protocols for registering healthcare disinfectants intended for use on hard, non-porous surfaces require evaluation only against the two standard control strains (*Staphylococcus aureus* and *P. aeruginosa*) used in this study.[9] Proper disinfection depends on several factors, such as the contact time (exposure time) of the disinfectant on pathogens, potency, and the concentration of the disinfectant.[10] This study evaluates the antimicrobial activity of various disinfectants against three significant bacterial pathogens: *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Salmonella* spp. The disinfectants were tested at concentrations (2%, 1%, 0.5%, 0.25%, and 0.125%) to determine their minimum inhibitory levels.

From the result presented in Table 1, against *Staphylococcus aureus*, Phenol, Dettol, and Tetmosol exhibited strong antibacterial activity, inhibiting growth at concentrations up to 0.5%. Savlon and Divitol showed limited effectiveness, with bacterial growth observed at concentrations below 1%. Dr. Johnson, Isol, and other disinfectants displayed varied efficacy, with some losing their inhibitory effect at 0.5% or 0.25%.

Table 1: Evaluation of the disinfectants against the *Staphylococcus aureus*

Disinfectants	2%		1%		0.5%		0.25%		0.125%	
	Tube 1	Tube 2	Tube 1	Tube 2	Tube 1	Tube 2	Tube 1	Tube 2	Tube 1	Tube 2
Phenol	-	-	-	-	-	-	+	+	+	+
Dettol	-	-	-	-	-	-	+	+	+	+
Tetmosol	-	-	-	-	-	-	-	-	+	+
Savlon	-	-	+	+	+	+	+	+	+	+
Izola	-	-	-	-	-	-	-	-	+	+
Divitol	-	-	+	+	+	+	+	+	+	+
Dr. Johnson	-	-	-	+	+	+	+	+	+	+
Lysol	-	-	-	-	-	-	-	-	+	+
Septol	-	-	-	-	-	-	-	-	+	+
Isol	-	-	+	+	+	+	+	+	+	+
Jik	-	-	-	-	-	-	-	-	+	+

Key (-) =Negative; (+) =Positive.

From the result presented in Table 2, which is the effect of the disinfectants against *Pseudomonas aeruginosa*, Phenol was effective at 2% but lost activity at 1%. Dettol and Tetmosol showed superior activity, inhibiting growth at concentrations up to 0.5%. Savlon and Izola exhibited moderate efficacy, with growth detected at 0.25%. Other disinfectants, including Jik and Lysol, showed limited efficacy at lower concentrations.

Table 2: Evaluation of the disinfectants against the *Pseudomonas aeruginosa*

Disinfectants	2%		1%		0.5%		0.25%		0.125%	
	Tube 1	Tube 2	Tube 1	Tube 2	Tube 1	Tube 2	Tube 1	Tube 2	Tube 1	Tube 2
Phenol	-	-	+	+	+	+	+	+	+	+
Dettol	-	-	-	-	+	+	+	+	+	+
Tetmosol	-	-	-	-	-	-	-	-	+	+
Savlon	-	-	-	-	-	-	-	-	+	+
Izola	-	-	+	+	+	+	+	+	+	+
Divitol	-	-	-	-	-	-	+	+	+	+
Dr. Johnson	-	-	-	-	-	-	-	-	+	+
Lysol	-	-	-	-	-	-	-	-	+	+
Septol	-	-	-	-	-	-	-	-	+	+
Isol	-	-	-	-	+	+	+	+	+	+
Jik	-	-	-	-	+	+	+	+	+	+

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Key (-) =No microbial growth; (+) =Presence of microbial growth

The result presented in Table 3 is the effect of the disinfectants against *Salmonella* spp Phenol was effective only at 2%, with bacterial growth observed at 1% and lower. Dettol and Tetmosol demonstrated strong antimicrobial action, inhibiting bacterial growth up to 0.5%. Divitol, Septol, and Isol showed mixed efficacy, with some bacterial growth detected at lower concentrations. Jik and Lysol maintained effectiveness at higher concentrations but failed at 0.25% and 0.125%. The results in Tables 1-3 show differences in the effectiveness of disinfectants against different bacterial species. *Staphylococcus aureus* was more susceptible to the majority of the disinfectants, as shown by inhibition at lower concentrations. This result is in line with the report of West et al. [11] who reported the efficacy of similar disinfectants on *Staphylococcus aureus*. *Pseudomonas aeruginosa*, due to its inherent mechanisms of resistance, was more resistant, and concentrations for inhibition were higher. The resistance could be attributed to its efflux pump system and protective outer membrane.[12] *Salmonella spp*. were moderately susceptible, and disinfectants such as Dettol and Tetmosol were more effective. The results show that although certain disinfectants, including Dettol and Tetmosol, are effective for all, others like Savlon and Izola might need greater concentrations or longer exposure to reach maximum levels of efficiency.

Table 3: Evaluation of the disinfectants against the *Salmonella spp*

Disinfectants	2%		1%		0.5%		0.25%		0.125%	
	Tube 1	Tube 2	Tube 1	Tube 2	Tube 1	Tube 2	Tube 1	Tube 2	Tube 1	Tube 2
Phenol	-	-	+	+	+	+	+	+	+	+
Dettol	-	-	-	-	-	-	-	-	+	+
Tetmosol	-	-	+	+	+	+	+	+	+	+
Savlon	-	-	-	-	-	-	+	+	+	+
Izola	-	-	-	-	+	+	+	+	+	+
Divitol	-	-	-	+	+	+	+	+	+	+
Dr. Johnson	-	-	-	-	-	-	-	-	+	+
Lysol	-	-	-	-	-	-	-	-	+	+
Septol	-	-	+	+	+	+	+	+	+	+
Isol	-	-	-	-	-	-	+	+	+	+
Jik	-	-	-	-	-	-	-	-	+	+

Key (-) =No microbial growth; (+) =Presence of microbial growth

The result presented in Table 4 presents the phenol coefficient values for different disinfectant brands against three significant bacterial pathogens: *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Salmonella* spp. A phenol coefficient greater than 1 indicates that the disinfectant is more effective than phenol, while a coefficient of less than 1 suggests lower efficacy. The results provide insights into the relative performance of various disinfectants and aid in selecting the most effective agents for microorganisms. Independent sample test as indicated in Figure 1 detected the existence of a non-significant difference between the mean Chick-Martin coefficients of foreign and local disinfectants (t-statistic = 1.91, p-value 0.114). This indicates that there is no significant difference in the effectiveness of foreign and local disinfectants, as the P-value is higher than the standard significance level ($\alpha = 0.05$). The relative effectiveness of the local and foreign disinfectants, as measured by the Chick-Martin Coefficient, showed a mixture of effectiveness and variability. Notably, the foreign group of disinfectants exhibited a higher mean Chick-Martin Coefficient of 5.03, compared to the local group of disinfectants, which had a mean coefficient of 3.27. Yet, closer analysis of the data showed that this difference in means is not statistically significant, meaning that the two groups are comparable when it comes to effectiveness. This result has important implications, as it suggests that local disinfectants can be a viable alternative to foreign ones, and they might be a more available and affordable option for areas where foreign products would be either too costly or impossible to obtain. Additionally, the analysis also indicated a big difference in the variability of the two groups, with the local disinfectant group recording a larger standard deviation of 1.57, as opposed to the foreign group, whose standard deviation was 1.21. This greater variability within the local disinfectant group is due to variability in use, quality, or formulation and highlights the need for further study to make the local disinfectant products more consistent and reliable.

Table 4: Chick-Martin phenol coefficient of each disinfectant sample for the various organisms

Disinfectants	***Staphylococcus aureus***	***Pseudomonas aeruginosa***	***Salmonella spp***
DETTOL	1	2	8
TETMOSOL	2	8	1
SAVLON	0.25	8	4
IZOLA	2	1	2
DIVITOL	0.25	4	1
DR. JOHNSON	0.25	8	8
LYSOL	2	8	8
SEPTOL	2	8	8
ISOL	0.25	2	4
JIK	1	2	8

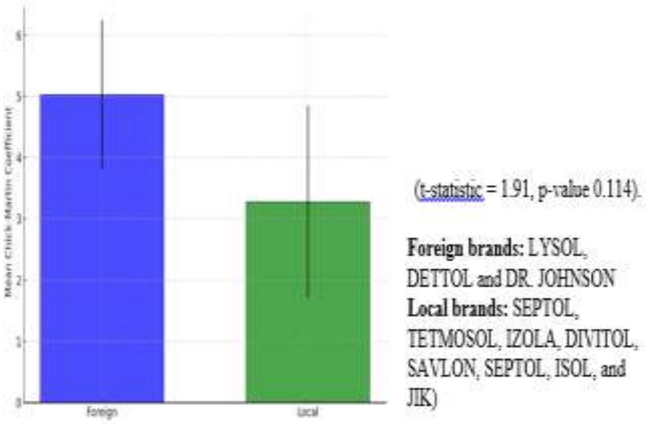

Figure 1: Comparison of the mean Chick-Martin coefficient of the foreign and local disinfectants

The results of this research, as presented in Table 4, show marked differences in the effectiveness of local and foreign disinfectants against *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Salmonella spp*. Using the Chick-Martin phenol coefficient. In the activity against *Staphylococcus aureus*, values of 0.25 to 2 were obtained with local disinfectants TETMOSOL and SEPTOL, having similar activities to foreign brands LYSOL. Weaker disinfectants, i.e., SAVLON, DIVITOL, DR. JOHNSON, and ISOL (0.25), need to be improved in formulation to increase their effectiveness. The values for *Pseudomonas aeruginosa* varied from 1 (IZOLA) to 8 (LYSOL, DR. JOHNSON, SEPTOL, TETMOSOL, and DETTOL), i.e., the majority of the disinfectants were satisfactory except IZOLA, which was the least. Activity against *Staphylococcus aureus*, Izola, Tetmosol, Septol, and Lysol were most effective (coefficient = 2) and was, hence, two times more effective than phenol. Dettol and Jik were moderately effective (coefficient = 1) with the same activity as phenol. Savlon, Divitol, Dr Johnson, and Isol were the least effective (coefficient = 0.25), with weak bactericidal activity against *S. aureus*. Against *Pseudomonas aeruginosa*, Tetmosol, Savlon, Dr. Johnson, Lysol, and Septol were the most effective (coefficient = 8) with excellent efficacy.

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Divitol was quite effective (coefficient = 4). Dettol and Isol were relatively less effective (coefficient = 2), and Izola was the least effective (coefficient = 1). Against *Salmonella spp*, Dettol, Dr. Johnson, Lysol, Septol, and Jik were the most effective (coefficient = 8). Savlon and Isol were moderately active (coefficient = 4). Izola was poorly effective (coefficient = 2), while Tetmosol and Divitol were the least effective (coefficient = 1). Lysol, Septol, and Dr Johnson were uniformly highly effective against all organisms and are promising candidates for broad-spectrum disinfection. Tetmosol was highly effective against *Pseudomonas aeruginosa* but not so against *Salmonella spp*. and *Staphylococcus aureus*. Nevertheless, Savlon, Divitol, and Isol were not very effective, especially on *Staphylococcus aureus*. Likewise, in a study conducted by Akabueze *et al.*, [4] DETTOL was tested against *Pseudomonas aeruginosa* to obtain a Chick-Martin coefficient of 2, which is exactly as obtained in this research. For *Salmonella spp*., values varied from 1 to 8, with LYSOL, DR. JOHNSON, SEPTOL, DETTOL, and JIK having the highest, suggesting their potential as broad-spectrum disinfectants in foodborne pathogen-prone areas. The report of this work is also in line with the report of Mohammed [13], who reported similar effects on microbial isolates. Reports of this study align with the report of Kohler *et al*. ([14] who reported that Sodium hypochlorite (same class as JIK) was effective against multidrug-resistant *P. aeruginosa*. This report contradicts the reports from Saudi Arabia, with reports of hypochlorite-containing disinfectants being less effective on Gram-negative isolates, especially *P.aeruginosa.*[3, 15, 16, 17] Compared to the local and imported disinfectants, foreign products LYSOL and DR. JOHNSON showed more effective and consistent activity against all the microorganisms. Local products such as SEPTOL and TETMOSOL were equally effective in some instances, suggesting that some local products can be used as cheaper alternatives. Lysol, Septol, and Dr Johnson showed consistently high effectiveness against all the bacterial species, suggesting their use for broad-spectrum disinfection. Tetmosol was very effective against *Pseudomonas aeruginosa* but relatively less effective against *Staphylococcus aureus* and *Salmonella spp*. The findings of this study support the reports of Reichel *et al. (*[18] who found surface disinfectants to be effective against Gram-negative bacteria. Savlon, Divitol, and Isol were comparatively less effective, especially against *Staphylococcus aureus*. This result also agrees with the report of Sangwan *et al. (*[19], who observed reduced effectiveness of Savlon against *Staphylococcus aureus*. This work is in line with the report of Fadeyibi *et al*. ([20] who reported the effectiveness of similar disinfectants on *Pseudomonas aeruginosa* and *S.aureus*.

F-statistic of 0.73;
p-value (0.676).

The results in Figures 1 and 2 present a comparative analysis of the efficacy of foreign and locally manufactured disinfectants based on their Chick-Martin coefficients. The graph compares the mean values of the Chick-Martin coefficient for foreign and local disinfectants. A higher coefficient indicates greater efficacy in neutralising microbial contaminants. The results suggest that foreign disinfectants generally have a higher mean Chick-Martin coefficient compared to local disinfectants, implying superior performance under test conditions. The One-Way ANOVA plot of Figure 2 gives useful information on how different brands of disinfectants perform on three test organisms, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Salmonella spp*. The average Chick-Martin Coefficients vary from 1.67 (IZOLA) to 6.00 (LYSOL and SEPTOL), suggesting some variation in the performance of disinfectants. Foreign disinfectants (DETTOL, DR. JOHNSON, and LYSOL) have higher mean coefficients compared to some of the local samples, indicating superior overall performance. LYSOL and SEPTOL have the highest mean coefficients (6.00), indicating good and consistent activity against the three organisms. DR. JOHNSON, a foreign sample, is next with a mean coefficient of 5.42, indicating the strength of foreign brands. Conversely, IZOLA (1.67) and DIVITOL (1.75) possess the lowest mean coefficients, indicating comparatively poorer performance than other samples. These disinfectants would need to be reformulated or upgraded so that they can match more effective brands. Bar heights indicate differences in mean coefficients but are not statistically significant, as indicated by the One-Way ANOVA p-value (0.676). The absence of significant differences implies that, though some disinfectants seem to be more effective, these variations could be by chance and not because of any disparity in their formulation. One-way ANOVA test between the average coefficients of all the brands of disinfectants yielded an F-statistic of 0.73 and a p-value of 0.676. As the p-value is far larger than the conventional significance level (α = 0.05), we fail to reject the null hypothesis. It means there exist no significant differences in mean Chick-Martin Coefficients for all disinfectants under testing. This translates to the fact that in the testing conditions, all the disinfectants have the same performance, even though certain brands have numerically larger mean coefficients. Local disinfectants such as IZOLA and DIVITOL may be enhanced with better formulations to be more efficient and on par with foreign brands. The heat map is a graphical representation of the effectiveness of different disinfectants against several test microorganisms. It highlights differences in antimicrobial efficacy between different formulations. The heat map uses a gradient colour to represent the efficacy of disinfectants, with darker or deeper colours for higher efficacy. The results show that a limited number of disinfectants are effective against a wide range of organisms, effectively killing several organisms, while others show selective efficacy. Patterns of resistance emerge as some organisms are less susceptible to certain disinfectants.

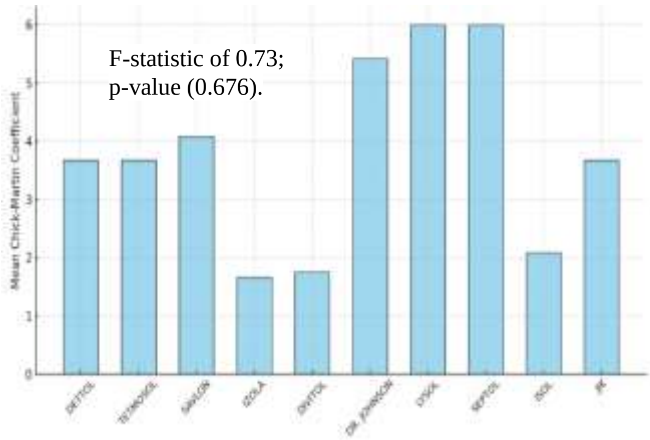

Figure 2: Mean Chick-Martin coefficient of the different disinfectant samples

Figure 3 heat map ranks the disinfectants based on their Chick-Martin phenol coefficients versus *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Salmonella spp.*, with greater efficacy being indicated by lighter shading and reduced efficacy by darker shading. TETMOSOL, IZOLA, LYSOL, and SEPTOL ranked 1 (most effective) against *Staphylococcus aureus*, while SAVLON, ISOL, DIVITOL, and DR. JOHNSON ranked 7 (least effective). Against *Pseudomonas aeruginosa*, IZOLA was the least (ranked 10), but TETMOSOL, SAVLON, DR. JOHNSON, LYSOL, and SEPTOL were the best (ranked 1). Against *Salmonella spp*., LYSOL, SEPTOL, DR. JOHNSON, and DETTOL were the best (ranked 1), but TETMOSOL and DIVITOL were the least effective (ranked 9). Overall, LYSOL and SEPTOL were always ranked first against all microorganisms and thus were the best disinfectants, with IZOLA being the worst against *Pseudomonas aeruginosa*, and TETMOSOL, while highly effective against *Staphylococcus aureus*, being ineffective against *Salmonella spp.* LYSOL and SEPTOL were the most broadly effective disinfectants, followed by DR. JOHNSON'S. The most effective disinfectants against different microorganisms were identified, with TETMOSOL, IZOLA, LYSOL, and SEPTOL being the most effective (ranked 1) against *Staphylococcus aureus*, whereas SAVLON, ISOL, DIVITOL, and DR. JOHNSON were the least effective (ranked 7). Against *Pseudomonas aeruginosa*, IZOLA was least effective (ranked 10) while TETMOSOL, SAVLON, DR. JOHNSON, LYSOL, and SEPTOL were most effective (ranked 1). Against *Salmonella spp*, LYSOL, SEPTOL, DR. JOHNSON, and DETTOL were most effective (ranked 1) while TETMOSOL and DIVITOL were least effective (ranked 9). In general, LYSOL and SEPTOL were the best disinfectants overall, placing first in all the microorganisms tested, whereas IZOLA was the worst against *Pseudomonas aeruginosa*, and TETMOSOL was relatively very good against *Staphylococcus aureus* but relatively

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poorly against *Salmonella spp*. Ranking analysis indicated that LYSOL and SEPTOL are the best disinfectants against all three microorganisms, followed by DR. JOHNSON'S. This study is also in agreement with the study conducted by other authors, including Chima *et al*.,[21]; Singh *et al.,*[22] and Haruta *et al.,*[23] in which they reported the same disinfectant activity against the same isolates reported in this study. The findings of this work are also in line with the work of Aminu and Abdullahi, who reported similar phenol coefficient and efficiency of disinfectants on the microbial isolates[24] The findings of this study are in line with the reports of Jalal *et al*., who recorded efficacy of similar group of disinfectants with similar isolates as the ones used in this study.[25]

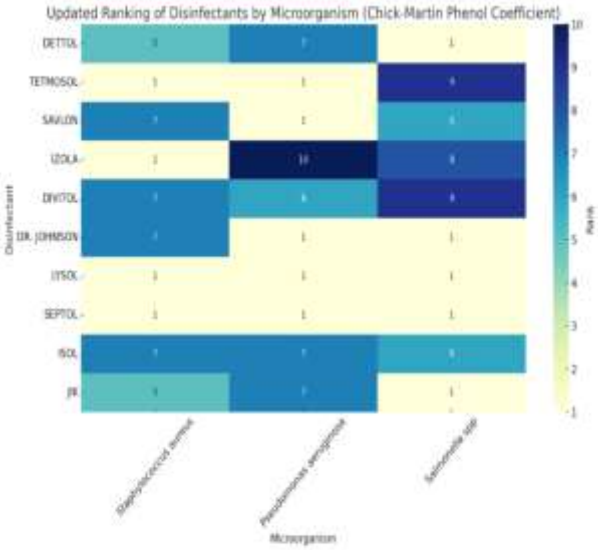

Figure 3: Heat map showing disinfectant efficacy against each organism

Overall, findings validate both foreign and local disinfectants as feasible options given availability and affordability. Lastly, the findings highlight the necessity of carrying out additional studies to maximise the effectiveness of disinfectants, e.g., using a wider variety of organisms, carrying out several replicates, and using various test conditions to mimic actual scenarios. Interference with organic material and pathogen-specific resistance highlights the need for rigorous quality control testing. Findings concur with global reporting of strict efficacy testing and WHO and FDA adherence.[1]

Conclusion

In this research, locally and foreign-produced disinfectants were compared in terms of their efficacy using the Chick-Martin test to ascertain their effectiveness against *Staphylococcus aureus, Pseudomonas aeruginosa,* and *Salmonella spp*. The findings demonstrated considerable disagreement in antimicrobial efficacy, where a few local brands matched the foreign disinfectants in terms of effectiveness. Although foreign disinfectants showed higher mean Chick-Martin coefficients, statistical comparison indicated that there was no appreciable difference between the general efficacy of foreign and local brands. These results show that some disinfectants in local use are efficient, economical substitutes for microbial control. Regular tests of efficacy and quality control procedures are, however, still necessary to guarantee the effectiveness of disinfectants in practice.

Conflict of Interest

The authors declare no conflict of interest.

Authors' Declaration

The authors hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them.

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