ART & TECHNOLOGY PUBLISHING PTE. LTD.

Progress in Applied Microbiology

2021 Volume 2, Issue 1

ISSN: 2630-4791

Bacterial Contamination in Disposable Wet Wipes in Restaurants (2nd Paper)

Moo-Sang Chong*

Department of Clinical Laboratory Science, Cheju Halla University, Jeju, Republic of Korea

***Corresponding author:** Moo-Sang Chong, chong@chu.ac.kr

Abstract

Disposable wet wipes provided by restaurants in the Jeju Special Self-Governing Province were evaluated for compliance with the labeling requirements and the degree of bacterial contamination set by the Ministry of Food and Drug Safety. Of the 32 types of disposable wipes, five types of disposable wipes did not indicate the name and location of the manufacturing company. Only 12 types of wet wipes were marked with the date of manufacture and expiration date. Bacterial contamination was seen in 9 types of wet wipes through bacterial culture but these were absent in the remaining 23 types (71.9%). The results of the antimicrobial susceptibility test for the 9 identified strains showed no methicillin-resistant coagulase-negative staphylococci (MRCNS) or multidrug-resistant bacteria. Through this study, it is recommended that the date of manufacture and expiration date must be indicated on the surface of disposable wet wipes, and clean uncontaminated wet wipes must be stored according to relevant standards. In addition, this paper aims to contribute to the enhancement and improvement of hygiene management supervision, personal hygiene management, and national health.

Keywords

Bacterial contamination
Disposable wipes
Restaurant

1. Introduction

In 2017, the media reported that disposable wipes used in restaurants were contaminated with bacteria. It was reported that 50 out of 55 types of disposable wipes supplied by restaurants were contaminated with bacteria, the average bacterial count was 4.14×10^3 CFU/mL, and 15 strains of *Staphylococcus aureus* and 3 strains of *Pseudomonas aeruginosa* were identified [1]. The report was disseminated by various media outlets and online news outlets, alerting the public to the contamination of disposable wipes.

In April 2018, single-use wipes for food service establishments were classified as hygiene products, with the aim of enhancing public hygiene standards and contributing to the promotion of health [2]. In order to establish standards for harmful substances such as ingredients and heavy metals that can be used in each product, the law was modified from the Public Health

Act to the Sanitary Products Management Act. This revision designates these products as items necessitating specialized oversight to ensure health and hygiene. When a product is designated as a hygiene product, it must be labeled with the words "hygiene product," along with the name of the product, the name and location of the sales office, the amount of product, the date of manufacture, the name of the raw material or ingredient, the type of hygiene product, and other matters prescribed by the Ministry of Food and Drug Safety.

It is common for restaurants, coffee shops, fast food restaurants, etc. to provide and use disposable wipes for customers. However, not many people read the labeling or check the date of manufacture and expiry date when using disposable wipes.

This paper evaluated whether disposable wipes comply with the labeling requirements set by the Ministry of Food and Drug Safety and the level of bacterial contamination after they are designated as disposable products subject to the Sanitary Products Control Act. This study aims to contribute to the improvement of personal hygiene management and public health by checking whether disposable wipes supplied by restaurants are properly managed.

2. Materials and methods

2.1. Materials

Disposable wipes provided by restaurants in Jeju Special Self-Governing Province from April to May 2021 were evaluated for bacterial contamination. 32 types of wipes that were supplied by restaurants were investigated. The wipes were supplied by 17 companies, 14 from Gyeonggi-do, 2 from Daegu, 1 from Incheon, 7 from Jeollanam-do, and 3 from Jeju. There were five types of wipes of which the location of the manufacturer was not stated.

2.2. Methods

To determine the number of bacteria in disposable wipes, a portion of the plastic wrapping of the wipes was cut off in a sterilized cup, and a pseudo-sample of 1–2 mL was collected by grasping and twisting both ends of the wipes with sterile gloves to prevent contamination. The collected samples were inoculated into blood broth (Asan BAP I; Asan Pharmaceutical, Seoul, Korea) and MacConkey broth (Asan Mac II; Asan Pharmaceutical, Seoul, Korea) in 200 μL aliquots using a pipette without centrifugation for quantitative culture. The inoculated media were incubated in an oxygenated incubator at 35°C for 18 hours. The colonies of bacteria quantitatively cultured in the blood broth and the McConkey's broth were counted using a colony counter multiplied by the dilution factor and expressed as CFU/mL (CFU, colony forming unit).

2.3. Bacterial identification and antimicrobial susceptibility testing

Colonies grown on flat plate media were subjected to Gram stain and catalase tests, positive colonies were subcultured on blood broth, and Gram-negative colonies were subcultured on McConkey's broth. Identification of the cultures was performed using a VITEK II automated identification system (bioMérieux, France) and the identification cards used were gram-positive card (GP card; bioMérieux) and gram-negative card (GN card; bioMérieux).

Bacterial colonies formed after subculturing on blood broth and McConkey's broth was inoculated on a VITEK 2 AST-P601 (bioMérieux) card for antimicrobial susceptibility testing and AST-N225 (bioMerieux) card for AST. Minimum inhibitory concentration (MIC) results were classified into clinical categories of susceptible, intermediate, or resistant according to CLSI guidelines [3,4].

3. Results

3.1. Labelling

All 32 types of disposable wipes supplied by restaurants were labeled with the product name (company name), but 5 of the 32 types of disposable wipes did not indicate

the name and location of the manufacturer. Only 12 types of wipes were labeled with the date of manufacture. Among them, the expiry dates were mentioned for all 12 types of wipes, with 11 variants specifying usage within 12 months, and one variant indicating usage within 10 months (see **Table 1**).

3.2. Number of bacteria in disposable wipes

Of the 32 types of disposable wipes in restaurants, 9 types of wipes had bacterial colonies, and 23 types (71.9%) had no bacteria. Two wipes (6.2%) grew more than 5,000 CFU/mL, and both wipes had no expiration date. Three wipes (9.4%) had bacteria counts between 5 and 50 CFU/mL, one wipe (3.1%) had bacteria counts between 50 and 500 CFU/mL, and three wipes (9.4%) had bacteria counts between 500 and 5,000 CFU/mL (**Table 2**).

3.3. Bacterial identification of disposable wipes

Bacterial colonies were cultured from nine of the 32 disposable wipes, and Gram staining of the colonies revealed eight gram-positive bacteria and one gram-negative membrane bacterium. The colonies were grown on streaks and identified using a VITEK2 automated identification system (bioMérieux, France), and the gram-positive bacteria were identified as four strains of *Staphylococcus haemolyticus*, one strain of *Staphylococcus hominis*, three strains of *Staphylococcus warneri*, and one strain of *Pseudomonas fluorescens* (**Figure 1**).

3.4. Antimicrobial susceptibility testing

The gram-positive bacilli were identified as *Staphylococcus haemolyticus* (4 isolates), *Staphylococcus hominis* (1 isolate), and *Staphylococcus warneri* (3 isolates). Antimicrobial susceptibility testing indicated that none of these strains were methicillin-resistant coagulase-negative *Staphylococci* (MRCNS). They exhibited susceptibility to both oxacillin and vancomycin. Among the gram-negative bacteria, *Pseudomonas fluorescens* was tested and found to be susceptible to both imipenem and meropenem. It was also observed that this isolate was not multidrug-resistant (**Tables 3 and 4**).

Table 1. Whether or not to comply with the description of disposable wet wipes supplied by general restaurants

Category	Comply with the description	
	Yes	No
Product name (company name)	32	0
Name and location of the office	27	5
Date of manufacture	12	20
Expiration date	12	20

Table 2. The number of bacteria in disposable wet wipes

The number of bacteria (×5 CFU/mL)	N	%
< 1	23	71.9
3	2	6.3
6	1	3.1
11	1	3.1
112	1	3.1
120	1	3.1
230	1	3.1
> 1,000	2	6.3

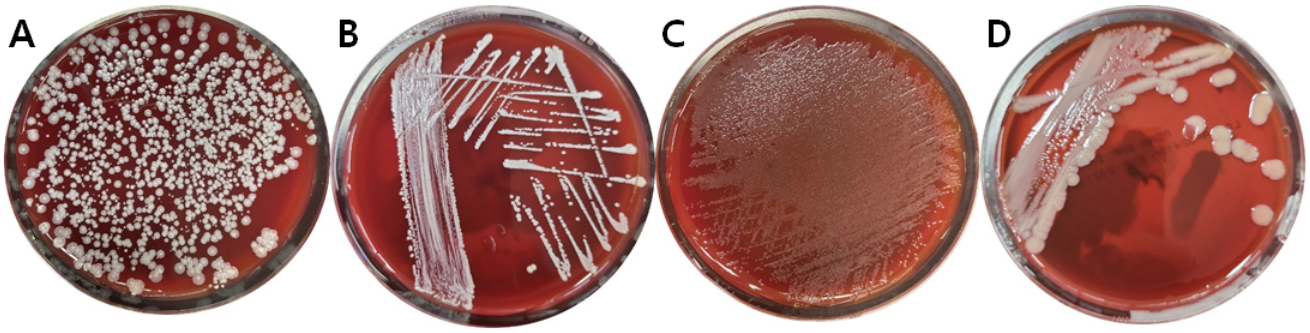

Figure 1. Bacteria identified in disposable wet wipes. (A) *Staphylococcus haemolyticus* (BAP); (B) *Staphylococcus haemolyticus* (sub-culture, BAP); (C) *Pseudomonas fluorescens* (BAP); (D) *Pseudomonas fluorescens* (sub-culture, BAP).

Table 3. Antimicrobial susceptibility test result of gram-positive cocci identified in disposable wet wipes in restaurants

Antimicrobial	*Staphylococcus haemolyticus*	*Staphylococcus hominis*	*Staphylococcus warneri*
Oxacillin	S	S	S
Gentamicin	S	S	S
Ciprofloxacin	S	S	S
Erythromycin	R	S	S
Clindamycin	S	S	S
Teicoplanin	S	S	S
Vancomycin	S	S	S
Tetracyclin	S	S	S
Nitrofurantoin	S	S	S
Rifampicin	S	S	S
Trimethoprim/sulfamethoxazole	S	S	S

Table 4. Antimicrobial susceptibility test result of gram-negative rod identified in disposable wet wipes in restaurants

Antimicrobial	*Pseudomonas fluorescens*
Ampicillin/sulbactam	R
Ticarcillin/clavulanic acid	R
Piperacillin	I
Piperacillin/tazobactam	S
Cefotaxime	R
Ceftazidime	S
Aztreonam	S
Imipenem	I
Meropenem	S
Amikacin	S
Gentamicin	S
Ciprofloxacin	S
Colistin	S
Trimethoprim/sulfamethoxazole	R

4. Discussion

We are exposed to many types of bacteria and viruses in our daily lives. Due to COVID-19, people have become more aware of the importance of hand hygiene, as many infectious diseases can be prevented by washing our hands [5,6]. However, many people fail to do so before eating at restaurants. Three years after disposable wipes were designated as a sanitary product for food service establishments, disposable wipes are still widely used in restaurants. The manufacturing process of disposable wipes consists of soaking a non-woven fabric with a chemical solution and packaging it [7]. When using disposable wipes, people often overlook crucial details such as the product name (company name), the business office's name and location, the manufacturing date, and the expiry date mentioned on the packaging. Since disposable wipes are usually provided in individual packaging, consumers might not be aware of whether the information adheres to the regulations set by the Ministry of Food and Drug Safety. In addition, disposable wipes used for promotional purposes do not have detailed labeling because they are labeled with promotional wording. In addition, disposable wipes are generally made of plastic materials, which may cause environmental issues [8-10], and in the case of infant wipes, there are concerns about their safety [11,12].

In this paper, we evaluated 32 types of disposable wipes provided in restaurants for compliance with labeling and bacterial contamination. As a result, we found that 5 of the 32 types of disposable wipes were not labeled with the name and location of the manufacturer. In addition, 23 of the 32 disposable wipes (71.9%) were free of bacteria, meaning that the majority of the wipes were free of bacteria. The bacteria cultured from nine wipes (28.1%) were eight Gram-positive bacteria and one Gram-negative membrane bacteria, and no multidrug-resistant bacteria were isolated. Two disposable wipes (6.2%) were found to contain more than 5,000 CFU/mL of bacteria, both from wipes with no expiry date stated. In 2016, bacteria were cultured in 50 out of 55 disposable wipes (90.9%), with an average bacterial count of 4.14×10^3 CFU/mL, and 5 wipes were free of bacteria. In addition, 15 strains of *Staphylococcus aureus* (21.13%) and 3 strains of *Pseudomonas aeruginosa* (4.23%) were identified, which gained attention from the media. It can be said that disposable wipes designated as hygiene products are relatively well-managed, but disposable wipes that are individually wrapped without expiry dates were found to be highly contaminated with bacteria.

Given the COVID-19 pandemic, measures have been taken to prevent infections like using hand sanitizers and disposable wipes to maintain personal hygiene. Alcohol-based hand sanitizers have been widely used due to their convenience and effective disinfection properties. However, it is important to note that hand sanitizers should be used cautiously and not excessively reused, as they can become contaminated over time. [13-15].

Disposable wipes have become commonly used by consumers in their daily lives due to the COVID-19 pandemic. Nonetheless, due to the fact that disposable wipes are often packaged and distributed within boxes, there are instances where the manufacturing and expiry dates are not indicated on individually used wipes.

We aspire for the establishment of a culture where disposable wipes can be employed with confidence. This can be achieved by stipulating the information required by the Ministry of Food and Drugs on each wrapper. Such markings would allow consumers to readily verify the manufacturing and expiration dates. Additionally, we aim to play a role in reinforcing hygiene oversight and enhancement measures, thereby elevating personal hygiene management and public health standards.

Disclosure statement

The authors declare no conflict of interest

References

[1] Chong MS, 2016, Bacterial Contamination in Disposable Wet Wipes from General Restaurants. Korean J Clin Lab Sci, 48: 237–241. https://doi.org/10.15324/kjcls.2016.48.3.237

[2] Ministry of Food and Drug Safety, 2017, Sejong [Hygiene Products Control Act], Act No. 19474, viewed March 2, 2022, https://www.lawnb.com/Info/ContentView?sid=L000012863

[3] Clinical and Laboratory Standards Institute, 2014, Performance Standards for Antimicrobial Susceptibility Testing: 24th Informational Supplement, M100-S24.

[4] Park KG, Yu YB, Yook KD, et al., 2017, An Evaluation of the Rapid Antimicrobial Susceptibility Test by VITEK MS and VITEK 2 Systems in Blood Culture. Korean J Clin Lab Sci., 49: 279–284. https://doi.org/10.15324/kjcls.2017.49.3.279

[5] Kang EJ, Choi HJ, 2013, A study on hand washing of health science college students. J Dent Hyg Sci., 13: 449–456. https://doi.org/10.13065/jksdh.2013.13.3.449

[6] Jang YJ, Lee MS, Na BJ, et al., 2007, A Study on the Knowledge, Attitude and Practice of Handwashing of Middle School Students. Korean J Health Educ Promot, 24: 1–22. https://doi.org/10.14367/kjhep.2017.34.3.71

[7] Ahn JW, 2018, Life cycle Assessment on Process of Wet Tissue Production. Clean Technol, 24: 269–274. https://doi.org/10.7464/ksct.2018.24.4.269

[8] Yoo HJ, Hwang HS, Song EG, 2014, A Study on the Improvement for Safe Consumption of Wet Tissue: Focusing on Consumer's Subjective Safety Assessment and Labeling Condition. Crisisonomy, 10: 81–97.

[9] Hu T, Shen M, Tang W, 2022, Wet Wipes and Disposable Surgical Masks are Becoming New Sources of Fiber Microplastic Pollution During Global COVID-19. Environ Sci Pollut Res Int., 29: 284–292. htts://doi.org/10.1007/s11356-021-17408-3

[10] Briain OO, Marques Mendes AR, McCarron S, et al., 2020, The Role of Wet Wipes and Sanitary Towels as a Source of White Microplastic Fibres in the Marine Environment. Water Res., 182: 116021. https://doi.org/10.1016/j.watres.2020.116021

[11] Rodriguez KJ, Cunningham C, Foxenberg R, et al., 2020, The Science Behind Wet Wipes for Infant Skin: Ingredient Review, Safety, and Efficacy. Pediatr Dermatol, 37: 447–451. https://doi.org/10.1111/pde.14112

[12] Lazzarini R, Hafner FS, Proença CC, et al., 2021, Analysis of the Components and pH of a Sample of Wet Wipers Used for the Hygiene of Newborns and Infants. An BrasDermatol., 96: 774–776. https://doi.org/10.1016/j.abd.2020.09.011

[13] Chong MS, Lee JJ, Kim JR, 2019, Comparison of Bacterial Removal Effectiveness by Different Hand Washing Methods. Journal of the Korea Convergence Society, 10: 69–74. https://doi.org/10.15207/JKCS.2019.10.9.069

[14] Hong SB, 2020, Investigation of Bacterial Contamination of Liquid Soaps Used in Public Restroom. Korean J Clin Lab Sci., 52: 214–220. https://doi.org/10.15324/kjcls.2020.52.3.214

[15] Zapka CA, Campbell EJ, Maxwell SL, et al., 2011, Bacterial Hand Contamination and Transfer After Use of Contaminated Bulk-Soap-Refillable Dispensers. Appl Environ Microbiol., 77: 2898–2904. https://doi.org/10.1128/AEM.02632-10.