RESEARCH PAPER

Comparison Of Rapid Atp Bioluminescence With Colony Count As A Surface Cleaning Compliance Marker For Food Stalls.

G.V.Venkatakarthikeswari[1] and Sathish Sankar[2]*

[1]Undergraduate Department of microbiology Saveetha Dental College and Hospitals Saveetha Institute of Medical and Technical Science (SIMATS), Chennai – 600077 Tamil nadu, India, Email ID: 152001068.sdc@saveetha.com
2*Professor Department of microbiology Saveetha Dental College and Hospitals Saveetha Institute of Medical and Technical sciences Chennai – 600077 Tamil nadu, India

*Corresponding Author: G.V.Venkatakarthikeswari
*Undergraduate Department of microbiology Saveetha Dental College and Hospitals Saveetha Institute of Medical and Technical Science (SIMATS) Chennai – 600077 Tamil nadu, India Email ID: 152001068.sdc@saveetha.com

INTRODUCTION

Contaminated food stall surfaces act as important environmental sources of microorganisms and may increase the risk of infection transmission. Cleaning and disinfection are essential procedures used to remove organic debris and reduce microbial contamination on environmental surfaces (1). Cleaning refers to the removal of dirt and organic matter that may support microbial growth, while disinfection involves the reduction or inactivation of microorganisms present on surfaces (2).

The Adenosine Triphosphate (ATP) bioluminescence assay is a commonly used method for evaluating environmental cleanliness on hospital and food-contact surfaces (3,4). ATP bioluminescence detects the presence of ATP from microorganisms and organic residues through a luciferin–luciferase reaction that produces light. The emitted light is measured using a luminometer and expressed as Relative Light Units (RLU) (9,10). Higher RLU values indicate increased contamination on the tested surface.

ATP bioluminescence is considered a rapid and sensitive method for assessing cleanliness because results can be obtained within a few minutes, unlike conventional microbiological culture techniques that require 24–48 hours for interpretation (5). The presence of ATP on a surface may indicate inadequate cleaning and contamination from food residue, organic matter, or microorganisms (6).

Several previous studies compared ATP bioluminescence with conventional culture methods to determine whether ATP monitoring could be used as a substitute for microbiological assessment of surface contamination (7). Visual inspection alone is often insufficient for evaluating hygiene standards because it may fail to accurately predict microbial contamination and infection risk (8). Therefore, ATP bioluminescence has gained importance as a rapid tool for monitoring environmental cleanliness in hospitals and food preparation areas.

The present study aimed to compare rapid ATP bioluminescence with colony count analysis as a surface cleaning compliance marker in food stalls and to evaluate the effectiveness of 1% sodium hypochlorite solution as a disinfectant.

KEY WORDS: ATP, bioluminescence, disinfectant, bacteria, food stalls, hygiene, microbial contamination.

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MATERIALS AND METHODS

Sample Collection

Samples were collected from the serving surfaces of food stalls using the swabs provided in the Hygiena ATP kit. Initially, the surfaces were tested before cleaning. The surfaces were then disinfected using 1% sodium hypochlorite solution, and post-cleaning samples were collected from the same area to evaluate the effectiveness of the disinfectant and the efficiency of ATP bioluminescence testing.

Before testing, the luminometer was switched on, and the UltraSnap swab was allowed to equilibrate to room temperature (21–25°C). The swab was removed carefully without touching the tip or the inside of the tube. A standard 10 × 10 cm surface area was swabbed thoroughly using vertical, horizontal, and diagonal strokes while rotating the swab to ensure maximum sample collection.

After sample collection, the swab was returned to the tube and activated by breaking the Snap-Valve and squeezing the bulb twice to release the reagent onto the swab tip. After 5–10 seconds, the sample was inserted into the Hygiena luminometer and the RLU value was recorded within 30 seconds.

Culture Plating

In parallel, sterile swabs were used to collect samples from nearby areas of the same surface for microbiological culture analysis. The swabs were inoculated onto nutrient agar plates and incubated overnight at 37°C. Colony counts were then recorded and compared with the RLU values obtained from ATP bioluminescence testing.

*Author for Corresponden 152001068.sdc@saveetha.com

Image A-Hygiena luminometer Image B- surface microbial analysis

RESULT

The present study evaluated the effectiveness of surface disinfection in food stalls using ATP bioluminescence assay and colony count analysis. ATP bioluminescence is a rapid method used to detect organic residues and microbial contamination on surfaces. ATP levels were measured before and after cleaning with 1% sodium hypochlorite solution, and the results were expressed in Relative Light Units (RLU). Higher RLU values indicated greater surface i. A total of 11 food stall surfaces were analysed, and the pre-cleaning readings showed significant contamination.

After disinfection, a reduction in RLU values was observed in all stalls, indicating the effectiveness of sodium hypochlorite in reducing contamination. However, only a limited reduction was observed within 3–5 minutes after cleaning, suggesting the persistence of residual contamination. The post-cleaning RLU values ranged from 4 to 346, with an average value of approximately 200 RLU, which may be considered as a threshold limit for acceptable cleanliness. Similar findings were reported in previous studies where ATP bioluminescence was used for rapid hygiene assessment.

The colony count values also confirmed microbial contamination on the tested surfaces. Some stalls showed higher colony counts despite reduced ATP values, supporting previous studies that reported no direct correlation between ATP readings and microbiological culture results. Previous studies also suggested that surfaces can become rapidly recontaminated after cleaning. Overall, the present study supports ATP bioluminescence as a rapid and effective method for monitoring hygiene and surface cleanliness in food stalls.

Bioluminescence ATP sampling test was carried out for all the stalls. The value given below are in Relative Light Units (RLU)

Food stalls	Pre-cleaning	Post-cleaning with 1% Hypo	Colony count
Stall 1	1949	215	27
Stall 2	777	270	6
Stall 3	4308	755	14
Stall 4	225	19	3
Stall 5	360	120	20
Stall 6	547	50	8
Stall 7	815	17	7
Stall 8	250	4	3
Stall 9	1477	212	18
Stall 10	2869	205	1
Stall 11	1384	346	15

DISCUSSION

The present study assessed surface contamination in food stalls using ATP bioluminescence and colony count analysis. ATP bioluminescence is a rapid method used to detect ATP from microorganisms and organic residues present on environmental surfaces. In this study, contamination was assessed before and after disinfection with 1% sodium hypochlorite solution using a hygiene ATP luminometer (1,13). The ATP luminometer provided results within three to five minutes, making it useful for rapid hygiene monitoring in food stall environments (14,15).

The findings showed higher RLU values before cleaning, indicating increased microbial and organic contamination on food contact surfaces. After disinfection, a reduction in RLU values was observed, demonstrating the effectiveness of sodium hypochlorite in reducing contamination. Similar findings were reported in previous studies where ATP bioluminescence was used to assess cleanliness in hospitals and food preparation areas. Earlier researchers also reported that ATP bioluminescence provides faster results compared to conventional microbiological culture techniques, which require 24–48 hours for interpretation.

Previous studies suggested that there is often no direct correlation between ATP bioluminescence readings and anaerobic colony count values (10,16). ATP

bioluminescence measures total organic contamination, whereas culture methods specifically detect viable microorganisms. In the present study, some surfaces showed reduced ATP values after cleaning but still demonstrated microbial growth, supporting earlier findings that both methods evaluate different aspects of contamination.

Another important observation was that cleaned surfaces can become rapidly recontaminated due to repeated handling and environmental exposure. Similar findings were observed in the current study, where microbial contamination increased shortly after disinfection. Previous authors also suggested that the accuracy of ATP testing can be improved using more sensitive swabs during sample collection. Overall, the present study supports ATP bioluminescence as a rapid, practical, and reliable method for monitoring hygiene and surface cleanliness in food stalls.

CONCLUSION

The present study concludes that ATP bioluminescence is a rapid and effective method for evaluating surface cleanliness and microbial contamination in food stalls. The hygiene ATP luminometer provided immediate results and helped assess the effectiveness of cleaning and disinfection procedures. A reduction in RLU values after the application of 1% sodium hypochlorite confirmed its effectiveness as a disinfectant for reducing contamination on food contact surfaces.

ATP bioluminescence offers several advantages, including rapid analysis, easy interpretation, cost effectiveness, and suitability for routine hygiene monitoring. Although ATP readings may not always directly correlate with microbiological culture results, ATP monitoring remains a valuable method for assessing overall surface hygiene.

Regular monitoring of food stall surfaces using ATP luminometry can help improve cleanliness standards and reduce the risk of microbial contamination and foodborne infections. Proper disinfection procedures and continuous hygiene assessment are essential for maintaining a safe food handling environment.

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