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FOUR-ZONE SMART TOWEL A NOVEL APPROACH TO IMPROVE HYGIENIC PRACTICES

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ABSTRACT

Background: Personal hygiene is essential for infection prevention, yet the role of body towels in microbial cross-contamination remains underexplored. Using the same towel for multiple anatomical regions may transfer microorganisms from heavily colonized areas, such as the feet and lower body, to relatively sensitive areas, including the face and neck.
Objective: This theoretical framework proposes a four-zone microfiber towel to promote hygienic body drying and minimize potential microbial cross-contamination among healthcare workers and the general population.
Methodology: The proposed towel is made from lightweight, quick-drying microfiber fabric and divided into four anatomically designated, colour-coded zones: Zone 1 for the face and neck, Zone 2 for the upper and anterior body, Zone 3 for the lower body and feet, and Zone 4 for the back and posterior body. The framework is based on established principles of personal hygiene, microbial transmission, textile hygiene, and infection prevention.
Results: Conceptual analysis suggests that anatomical separation through designated towel zones may reduce the transfer of microorganisms between body regions, particularly from the feet and lower body to the face and upper body. Microfiber may facilitate faster drying, while colour coding could improve correct usage and adherence. The concept may benefit healthcare professionals, students, athletes, hostel residents, travellers, and the general public. However, these potential benefits remain hypothetical and require empirical validation.
Conclusion: The four-zone microfiber towel represents a simple, affordable, and potentially scalable innovation for improving personal hygiene. Comparative studies are needed to evaluate its effectiveness in reducing microbial counts and transfer, drying time, durability, user acceptance, and compliance. Further research is essential before recommending its widespread implementation.

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INTRODUCTION

Hygiene in general is one of the most basic and affordable means of stopping the spread of infections caused by microorganisms in the community as well as in the hospital setting. While much attention has been paid to hand hygiene, relatively little has been done regarding the hygiene of personal bath towels, even though they are commonly used and come into contact with different parts of the body. Moisture, particles of dead skin, bodily fluids, and microorganisms can be collected in the towels after use, creating favorable conditions for the growth and transfer of microorganisms between body sites. [1]

The skin of the human body is inhabited by a heterogeneous community of microorganisms such as bacteria, fungi, viruses, and mites that help in maintaining the equilibrium of the skin. The density of these microorganisms varies significantly between different parts of the body due to variations in temperature, moisture,

sebum secretion, sweating, and exposure to the environment. The feet, groin, axillae, and lower extremities have a higher microbial load than dry regions like the face and forearms. The resident microflora consists of microorganisms like Staphylococcus epidermidis, Cutibacterium acnes, and Corynebacterium species, along with transient microorganisms [2,8]. After washing, many people often use one towel to dry the entire body without taking into account different microbial loads across the body. This approach can result in transferring microorganisms that are found in greater numbers in some parts of the body like legs and feet to other parts of the body that are comparatively clean like the face and neck. Though the skin is naturally protected against many conditions, contamination of the skin with a dirty towel surface can result in skin problems [3].

Towels, by their own nature, can act as fomites if they do not dry completely after being used. Dampness in the fibers of the towel will encourage microbe growth and reproduction in particular when towels continue to be used over and over again. The Centers for Disease Control and Prevention advise against sharing personal items like towels because microbes, like MRSA, can thrive on fabrics for quite some time [4]. Healthcare associated infections continue to pose significant global problems even with consistent improvements in the measures of infection control procedures. Much focus has been placed on hand washing, cleaning of environment, and sterilization of medical equipment, but personal hygiene tools have not yet garnered enough scientific interest. The WHO acknowledges that towels must be kept properly stored and fully dried as contamination of fabrics may increase microbial survival [5].

Interest in the technology of microfibers has been rising owing to its distinctive features in terms of structure. The material is made of extremely fine polyester and polyamide fibers, which have a big surface area, good absorbability, quick drying ability, and are capable of removing germs and microbes from surfaces [6]. Research carried out on the effectiveness of microfiber products in the healthcare setting shows higher efficiency of microbial removal compared to traditional textile products. While most research has been done on the environment cleaning, the same can be applied to hygiene products [6,12].

Considering the fundamental principles behind infection prevention and cross contamination, a new innovation of a four zone microfiber body towel has been suggested. Here each colored zone of the towel is reserved for a particular area of the body including the face and neck, the upper body, the lower body, and the back body. Through limiting the use of each part of the towel to a fixed part of the body, the risk of microbial transfer from one part to another could be significantly reduced.Regarding infection prevention, the suggested towel design may prove to be particularly beneficial to health workers because not only do they regularly have occupational exposure to microorganisms, but they also understand better the need for infection control. The use of the towel by health workers will make it possible to assess user compliance and feasibility prior to implementation among the general public. If its efficacy is established through further microbiological and clinical research, the suggested idea might help to reduce self-contamination and standardize personal hygiene habits in hospitals, residential care centers, sports centers, hostels, schools, and homes [1,4,11].

There are currently no standardized guidelines concerning the use of towels for different body regions, even though there has been an increased realization of the presence of microbial contamination via textiles. This proposed four-quadrant microfiber towel is hence a low-cost innovation, based on behaviour, aimed at supplementing the current hygiene practices, rather than replacing them. Though there is currently little microbiological evidence to support this idea, it is based on the current knowledge of microbial ecology, textile hygiene and infection prevention. Further research in laboratories and clinics is needed to prove its efficacy [9,10].

Introduction of this microfiber towel divided into four zones is used here as the basis for infection control in the present paper. This paper does not describe any results of experiments; rather, it gives the scientific explanation behind using such towels and their possible use by healthcare workers first and then by the whole community.

MATERIAL & METHODS

Concept Development

The suggested concept of the towel was developed using the concept of minimizing microorganism exchange between the different regions of the body with varying microbial densities. Four zones for the towel were developed:

Zone 1: Face and neck

Zone 2: Chest, abdominal area, and upper limbs

Zone 3: Lower limbs and feet

Zone 4: Posterior side of the trunk, shoulder region, and spine

Each zone was assigned to a particular part of the body considering the microbial burden described in literature.The hypothesis that lies behind this proposed design is that the restriction of each portion of the towel to one particular anatomical area would prevent the transfer of resident and transient microorganisms from those areas having relatively higher colonization of microbes to those areas that are comparatively cleaner. Microfiber material, which has properties like quick drying, high absorption, and effective particulate elimination, can be considered.The four-zoned microfiber towel is suggested to be used mainly by healthcare practitioners due to their greater concern for infection control along with their professional exposure to microbes. After future validation tests, the design will also have applications among medical students, laboratory technicians, athletes, travellers, elderly people, immune-compromised patients, and the general public (Figure 01).

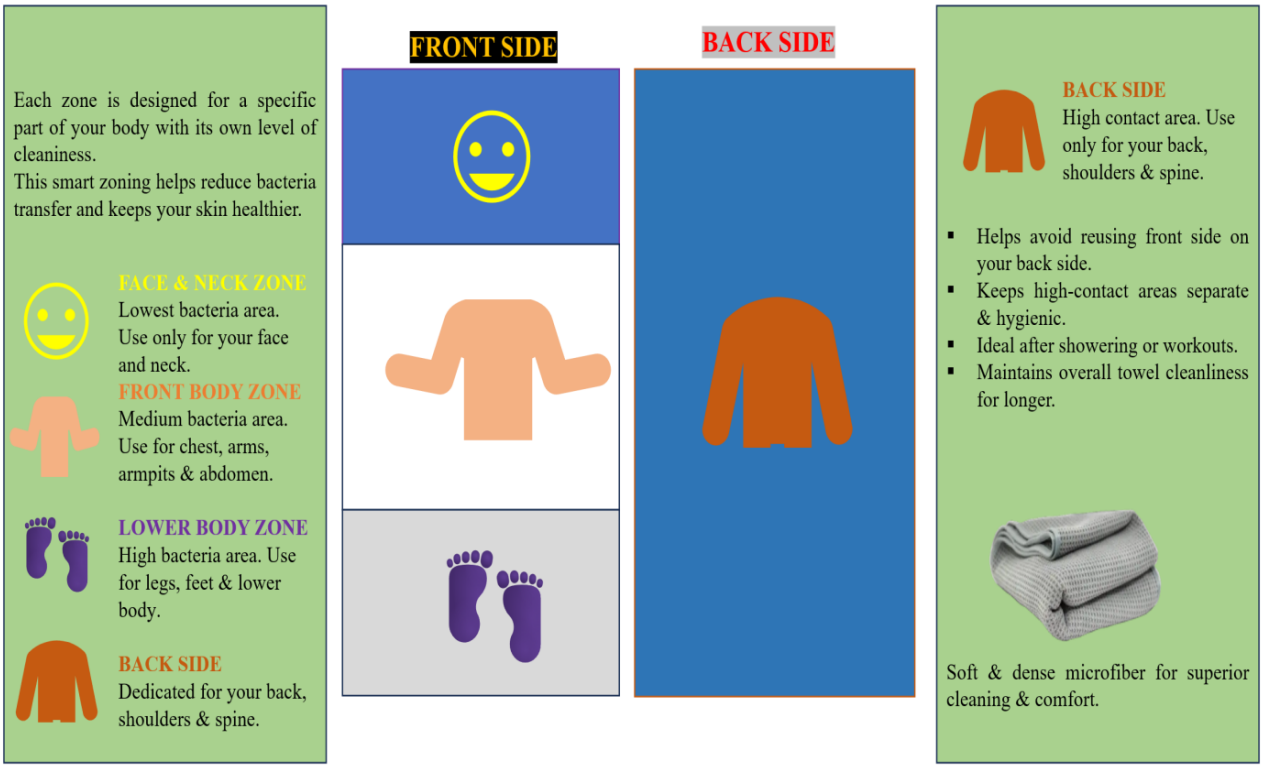


Figure 01: Conceptual Design of the 4 Zone towel

RESULT

The current conceptual framework suggests that the use of a four-region microfiber body towel has the ability to promote good hygiene habits by decreasing the transfer of microorganisms among different body zones. This is because unlike the regular body towel that is used randomly to dry various body regions, the new towel uses a different body-drying approach. This change in behavior is likely to result in decreased microbial transfer from body regions carrying high microbial loads to cleaner body regions.

This four-part structure ensures that there are separate zones for drying the face and neck area, the upper body, the lower body, and the rear of the body. This system allows the user to use the same sequence each time while drying the body, thus preventing the clean areas of the body from being exposed to microorganisms from other areas, such as feet and legs. This zoning may hinder the path of indirect microbial transmission during bathing.

Among the most sensitive parts of the human body is the face that is commonly plagued by various diseases like acne vulgaris, folliculitis, irritative conjunctivitis, and surface skin infections. In normal circumstances, people often make use of the same part of the towel while drying their faces after having dried their lower limbs or feet with it. The new design of the towel prevents this from happening by reserving a special area for the purpose of drying the face. Likewise, the upper parts of the body such as the chest, abdomen, shoulder, and upper limbs are supposed to be separated through towels since these are not supposed to come into contact with the parts that harbor more microbes. This can preserve the natural balance of the skin flora without transmitting transient microorganisms. The lower parts of the body, particularly the feet, have been recognized as being one of the body areas with high numbers of microorganisms because of high production of sweat, frequent use of shoes, and presence of environmental microorganisms. Microorganisms that result in infections such as athlete's foot normally occur in this particular body part. Therefore, through creation of another towel area for this specific body part, the design will reduce the probability of spreading of the microorganisms to other parts of the body.

The other side of the towel for the back and posterior parts of the body reinforces the idea of segregating the body. The reason is that the back is normally hard to access when washing and drying, hence the idea of setting apart another part of the towel.

Another potential benefit of the design is the use of microfiber material. In comparison to normal cotton material, microfiber has better absorbent, quick drying capability, and higher capacity of removing moisture and particles from the skin surface. This could create an unfavorable environment for survival of microbes, and hence provide better hygiene of the towel after each wash before its next usage. The light weight of the microfiber also makes it portable enough to be used at home and during travels, sports, health institutions, hostels, etc.Another way that the designed towel will help in promoting compliance is in terms of the body zones assigned specific colours on the towel. The visual identification of these zones will make it easy for users to know how to use the towel in order to maintain proper hygiene without having to go through any changes in their behaviour.

Healthcare practitioners are the ideal target group for introducing this concept. Medical practitioners, nurses, lab technicians, physiotherapists, medical students, and all other members of the health care team encounter various microbes in their daily practice. While preventive mechanisms focus on hand washing and wearing PPEs, very little consideration is given to proper body drying once the day's work is over. The four zone hand towel, therefore,

can be used as an additional preventive mechanism to promote personal hygiene.

After acceptance by healthcare practitioners, the idea can eventually be used for the larger population. People living in hostels, military camps, sports institutes, rehabilitation centers, nursing homes, and other long-term stay places would especially benefit from it due to the close quarters and chances of microorganism transfer. In addition, people who sweat excessively while exercising can make use of this body-zoning method to prevent skin infections. The suggested towel might be of use to people with various illnesses, such as diabetes, immunodeficiencies, obesity, and skin diseases, since in these cases the protection of their integumentary system becomes especially necessary. People of old age suffering from immobility might appreciate the simplified classification of body zones, while caregivers can take advantage of the colour code when helping their clients with hygiene. Considering public health aspects, the practice of body zone-specific towels can also lead to increased awareness of towel hygiene, which is less discussed as compared to hand hygiene. Through such public awareness campaigns based on this concept, people may be able to realize that towels may act as vectors of microbes and therefore should be used with caution.

Another significant consequence of this theoretical construct is its ability to trigger innovation in the field of textile design and infection prevention technology. In particular, the four zones microfiber towel can be used as a blueprint for developing innovative hygiene products in the future that might contain antimicrobial textiles, moisture sensors, washable and color-coded designs, antimicrobial coating, and hygiene monitoring systems based on sensors.

CONCLUSION

In summary, the microfiber towel divided into four zones can be regarded as a useful, affordable, and convenient invention that combines behavioral modification and textile technology in the improvement of one often-neglected element of personal hygiene. While the potential advantages of such a towel are still merely hypothetical at this stage, the idea has a good scientific basis and can serve as a starting point for microbiological research and further testing. In case this hypothesis is backed up by scientific evidence, the invention will prove to be an effective complement to current infection control strategies, first within the medical community and then among the general population.

CONFLICT OF INTEREST

No conflict of interest was declared by the authors.

FINANCIAL DISCLOSURE

The authors declared that this study received no financial support.

AUTHOR'S CONTRIBUTIONS

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

REFERENCES

1. World Health Organization. WHO Guidelines on Hand Hygiene in Health Care. Geneva: WHO; 2009.
2. Asuquo AE, Ibeneme E, Umoh NO, Eyo A, Bebia G, Okon P, et al. Body Towels as Reservoirs of Antibiotic Resistant Bacteria: Wellness Implications. Ibom Med J [Internet]. 2025;18(4):634–8. Available from: https://ibommedicaljournal.org/index.php/imjhome/article/download/803/1400/5030
3. Bloomfield SF, Exner M, Signorelli C, Nath KJ, Scott EA. The infection risks associated with clothing and household linens in home and everyday life settings, and the role of laundry [Internet]. International Scientific Forum on Home Hygiene. 2011. Available from: http://europeantissue.com/wp-content/uploads/The-infection-risks-associated-with-clothing-and-household-linens.pdf
4. Centers for Disease Control and Prevention. Preventing Methicillin-resistant Staphylococcus aureus (MRSA). Atlanta: CDC; 2025.
5. Huang C, Ma W, Stack S. The Hygienic Efficacy of Different Hand-Drying Methods: A Review of the Evidence. Mayo Clin Proc [Internet]. 2012 [cited 2026 Apr 19];87(8):791. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC3538484/
6. Mishra P. Towels can contain germs; follow these hygiene tips. 2020; Available from: https://indianexpress.com/article/lifestyle/life-style/towels-can-contain-germs-hygiene-tips-6334159/
7. Group ET. Single-use towels offer the most hygienic way to reduce the risk of the transmission of viruses when drying hands in the washroom [Internet]. 2018. Available from: https://europeantissue.com/hygiene/studies/hand-dryingsingleuse-towels/
8. Towel Hygiene 101: Preventing Skin Damage from Bacterial Growth – Doctor Towels [Internet]. [cited 2026 Jun 3]. Available from: https://www.doctortowels.com/blogs/bath-towel/towel-hygiene-101-preventing-skin-damage-from-bacterial-growth-8
9. World Health Organization. Normal bacterial flora on hands. In: WHO Guidelines on Hand Hygiene in Health Care. Geneva: WHO; 2009
10. Centers for Disease Control and Prevention. Hand Hygiene Frequently Asked Questions. Atlanta: CDC; 2024.
11. Centers for Disease Control and Prevention. Fundamental Elements Needed to Prevent Transmission of Infectious Agents in Healthcare Settings. Atlanta: CDC.
12. Centers for Disease Control and Prevention. Disinfection of Healthcare Equipment: Microfiber Cleaning Systems. Atlanta: CDC.