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BEACH SAND: KNOWING PATHOGEN LEVELS, THEIR POTENTIAL TO HARM HUMAN HEALTH AND PREVENTIVE ACTIONS

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For fun activities, beaches are essential. This is especially true in northern countries, where people spend more time on the beaches than in the water because the water is cold. Millions of people from around the world visit beaches yearly for fun. The picture-perfect look of these beach spots, on the other hand, can hide health risks. Pathogens found in beach sand are a significant cause for worry. Microorganisms like bacteria, viruses, and parasites that can make people sick are called pathogens. In beach sand, they can harm people's and the earth's health.

Understanding the pathogen levels in beach sand is critical for various reasons. First and foremost, it aids in the protection of public health. Sand contamination can cause various health concerns, including gastrointestinal infections, skin difficulties, and respiratory ailments. Identifying and measuring viruses in beach sand can assist authorities and beachgoers in making educated judgements about whether swimming and playing on the sand is safe. Furthermore, understanding pathogen levels in beach sand is critical for coastal ecosystem protection.

Contaminated sand can introduce diseases into the surrounding water, harming marine life and disrupting the ecological balance. Pathogen levels in beach sand can be monitored and managed to improve the general health of coastal habitats. This topic emphasises the importance of knowing pathogen levels in beach sand, their potential to harm human health, and preventive actions that must be considered for public health and environmental sustainability. As beach-related activities become more popular, preventive steps and continued research are critical to ensuring that beaches remain pleasurable, safe, and environmentally sustainable destinations for future generations.

Sources of Pathogens in Beach Sand

The Centers for Disease Control and Prevention (CDC) recently said that the number of infections linked to recreational water has slowly gone up over the last few decades. This is because new pathogens have become more common, more people are doing activities in the water, and more diseases are being reported. Infectious disease transmission on terrestrial beaches can occur through direct exposure to microbes present in sand or by the flux of pathogens from water to sand within the swash or intertidal zone. Pathogen exposure can occur by skin contact, eye and ears contact, inhalation, and ingestion.

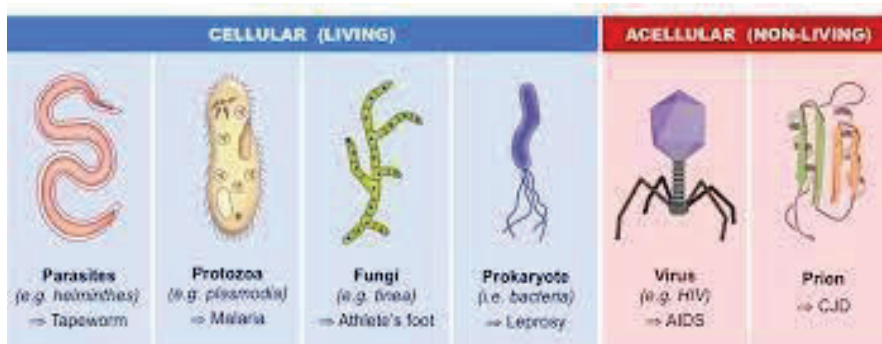


Figure 1: Types of pathogens found in beach sand (Source: bioninja.com)

There have been many studies that show pathogenic bacteria can be found in beach sands. This suggests that sand could be where disease-causing agents live (Whitman et al., 2014). Many harmful organisms can be found in sand, such as viruses, bacteria, protozoa, helminths (worms), and fungi (Solo-Gabriele et al., 2015). Figure 1 shows the types of pathogens found in beach sand.

Microbial pollution is affected by the beach's geographical location—its proximity to urban areas and thus to effluents from treated or untreated sewage discharges. It depends on how wet the sand is (water is vital for microorganisms) and the quality of the water that is attached to it (polluted water will spread pathogens to the sand). Because of increased stormwater discharges, heavy to extreme precipitation events are responsible for greater levels of bacterial and fungal pollutants in sandy beaches. Human activities are a significant source of bacterial infections in beach sand. Swimming, picnicking, sunbathing, and playing in the sand are all activities that can introduce infections to the beach. Water contaminated by swimming or inappropriate waste disposal can spread bacteria to the sand, posing health dangers. Beaches near urban areas or with poor sewage treatment systems may be contaminated by wastewater and sewage discharges. Pathogens and faecal coliform bacteria can be carried into the sand via, leaking septic system, sewage



Figure 2: Pets and birds that may potentially leave faecal matter on the sand (Source: AI-generated image)

overflows, and rainfall runoff. Pathogen contamination on beaches can be worsened by animals, particularly birds, dogs, and wildlife. Pathogens in bird droppings, in particular, can be deposited on the sand (Efstratiou, 2019). Pets visiting the beach may potentially leave behind faecal matter carrying hazardous bacteria. Figure 2 shows pets and birds that may leave faecal matter containing bacteria on the sand.

Health Implications: Infectious Diseases Related to Contact with Beach Sand

Gastrointestinal is one of the common sicknesses caused by consuming contaminated water or sand containing enteric pathogens such as norovirus,

rotavirus, and other bacterial species (e.g., *E. coli*, *Salmonella*), diarrhoea, vomiting, and abdominal pain are among the symptoms. Respiratory disease, rash, eye problems, earache, infection of existing cuts, and fungal infections have all been observed. *S. aureus*, *Vibrio*, *Candida*, and dermatophytes enter through wounds/injuries, even minor skin abrasions, or through direct touch. Mouth mucous membranes can become contaminated. Sand can contain irritants and bacteria that can readily enter these orifices and cause serious diseases such as eye infections. Rubbing our eyes with sandy hands can introduce pollutants into our eyes,

resulting in conjunctivitis. Pathogenic bacteria and fungi can potentially cause ear infections (otitis externa) when water becomes retained in the ear canal, producing a moist environment suitable for bacteria or fungal growth. Children are more vulnerable to sickness due to their undeveloped immune systems and, probably, a lack of appropriate hygiene practices (Efstratiou, 2019). Children under ten are more likely than adults or older children to get sand in their mouths.

Preventive actions

Studies on the microbiological quality of sand have revealed that boosting overall levels of hygiene resulted in a significant improvement. Other practical measures include washing hands with soap and clean water after playing in the sand, swimming, or before eating; using clean towels; sitting on the surface of the towel that has not come into contact with the sand; thorough washing and drying of the towels, using a new towel for the next visit to the beach, avoiding using straw beach mats, and practising good personal hygiene, including showering before leaving the beach area, to achieve a faster removal of at least some of the potential contaminants.

Cover any open wounds or sores with waterproof bandages or dressings to keep sand from getting into them. Apply a waterproof sunscreen to your skin to protect it from sunburn and to

lower the chance of skin infections. When swimming in the ocean, be careful not to drink too much seawater, which may contain dangerous microorganisms. The foregoing procedures are basic yet crucial and effective in reducing the microbial flora of the shoreline. Another factor to consider is the human load or the number of people visiting the beach. Furthermore, the cleanliness of the specific beach area may be evaluated, even if the microbiological quality of the bathing water of the respective beach complies with international or national requirements, as well as other factors. Figure 3 shows an action of washing hands with soap and clean water after playing in the sand.



Figure 3: An action of washing hands with soap and clean water (Source: Author's own collection)

In conclusion, because beaches are so peaceful and beautiful, where the sun meets the water, it is easy to forget about the risks that lie beneath the soft sand. Pathogens, like bacteria, viruses, and parasites, can hide in beach sand and pose a quiet health risk to people. It is crucial for public safety to know how many of these microorganisms are in beach sand; it is also our duty to keep these seaside paradises looking their best. As we have seen, bacteria in beach sand can be very bad for people's health and cause a wide range of illnesses, from minor irritations to severe infections. People who go to the beach and touch dirty sand could get stomach problems, skin problems, breathing problems, and eye and ear diseases. When these unseen dangers take centre stage, the beach can quickly go from peaceful to a health risk. Recognising and managing the presence of viruses in beach sand is not just a question of health and safety but also a vow to preserve our beaches' natural treasures. We can ensure that beautiful coastal places remain a source of joy and serenity for future generations by finding a harmonious balance between our love for the beach and our responsibility to conserve it. The interrelated nature of the Sustainable Development Goals emphasizes the significance of considering many factors to achieve holistic and long-term improvements in health and well-being.