

# BACTERIAL ANALYSIS OF HORSE STABLES EQUIPPED WITH THE BIOVITAE LAMP

BIOVITAE®



UNIVERSITY OF  
BIRMINGHAM

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## 1. Introduction

During a conversation with some racehorse owners regarding the BIOVITAE technology and that they are specially designed to safeguard the environmental microbial balance, acting for the elimination of pathogens and maximally preserving commensals. The principle of continuous sanitation is promoted through BIOVITAE technology to help balance the environmental microbial load through the promotion of competitive antagonism, Prevention of the risk of recontamination, and Contrast to the phenomenon of bacterial resistome. The question raised could this technology be deployed in a stable environment where the care of horses is provided.

It was agreed to approach a Top Racing Syndicate Owner to trial the BIOVITAE technology. Noel Fehily Racing Syndicate agreed to the trial at his home stable, Hagg Hill Farm, Semington, Trowbridge

## 2. Brief introduction to the world of microorganisms

The term biosecurity in the context of animal welfare has historically been associated with cattle, pig, and poultry farms; species that, due to their breeding characteristics, were frequently subject to epidemic phenomena involving consequent stringent prophylaxis to counteract their spread.

In recent times, sensitivity has also increased for horse breeders due to the West Nile virus epidemics supported by herpesvirus (EHV1) in its neurological form and the ever increasing cases of infectious anemia.

In the case of horses, the health rules imposed in relation to international exchanges have contributed to increasing attention to biosecurity, this has led to a prompt general adaptation of the structures, as well as the adoption of behaviours aimed at limiting the spread or introduction of possible diseases. Infectious.

The correct sanitary management of the Stable, together with the identification of risk factors such as: animals, means of transport, quality of nutrition and pastures, behaviour related to the treatment of water, land and manure, and the adoption of procedures and measures capable of significantly lowering the risk of infectious diseases contribute to achieving adequate levels of biosecurity.

The continuous movement of horses, followed by the promiscuity of the environments frequented by different people and the continuous contact between Equidae from various Stables during sporting events, makes them particularly exposed to infectious diseases.

The transmission of pathogens between animals and humans, or vice versa, occurs mainly by aerosol, by mouth, direct contact, indirect contact or through vectors. Many microorganisms can survive in soil and organic material for prolonged periods and then be transmitted to animals or humans, even after some time.

The peculiar constructive characteristics of the stables offer a very favourable environment for microorganisms. The most used materials, such as wood, the inability to perform thorough cleaning and sanitising routines, the prolonged contact between horses and their droppings, the conditions of humidity and heat transform them into an environmental incubator.

Microorganisms have always coexisted with living beings; indeed, they have almost certainly allowed their development, interact in a profound way with them, establishing, in most cases, a symbiotic relationship (symbiosis) that brings benefits to all actors. Thinking, therefore, of totally eliminating microorganisms is a strategy that is not only impracticable but very dangerous.

The concept of disinfection is frequently confused with that of sanitisation, letting the message pass that a germ-free environment is safe for health. A safe environment is obtained when the quantity of microorganisms present does not reach the infectious doses, putting the health of living beings at risk.

The BIOVITAE technology allows you to continuously monitor the quantity of microorganisms in the environments in which it is installed, lowering the risk of infections both those transmitted through aerosol and those by contact.

### 3. Project.

Noel Fehily Racing home stables. Layout Fig. 1



**Stables Blocks.**

1). Upper Stable Block 1, 22 Singles Boxes

Stable Block 1 was selected for Biovitae lighting upgrade, One side of the block has Biovitae installed 11 stalls.

The tack room was selected as this equipment is used a racing meetings and to control bring back issues to the stables, Biovitae was selected to sanitise the equipment before and after racing.

**Fig 1: Layout of the Stable Complex**

It was agreed that the trials would be conducted in building one. For the trail Biovitae® technology baton fittings would be installed over each Horse stall as recommended by Nextsense, this was conducted in advance of the trails. The building layout is shown in **Fig 2**. Due to the nature of the daily operation of the stable, the tack room was also included in the testing, so this area would also be fitted with Biovitae technology as it's a common store location for all equipment used by the horses. The staff tending to the horses also used this communal area as a common room/office. Fig 3: shows the installation of the Biovitae® technology in Building 1, Fig 5 shows the Tack room layout and Biovitae® technology installation.

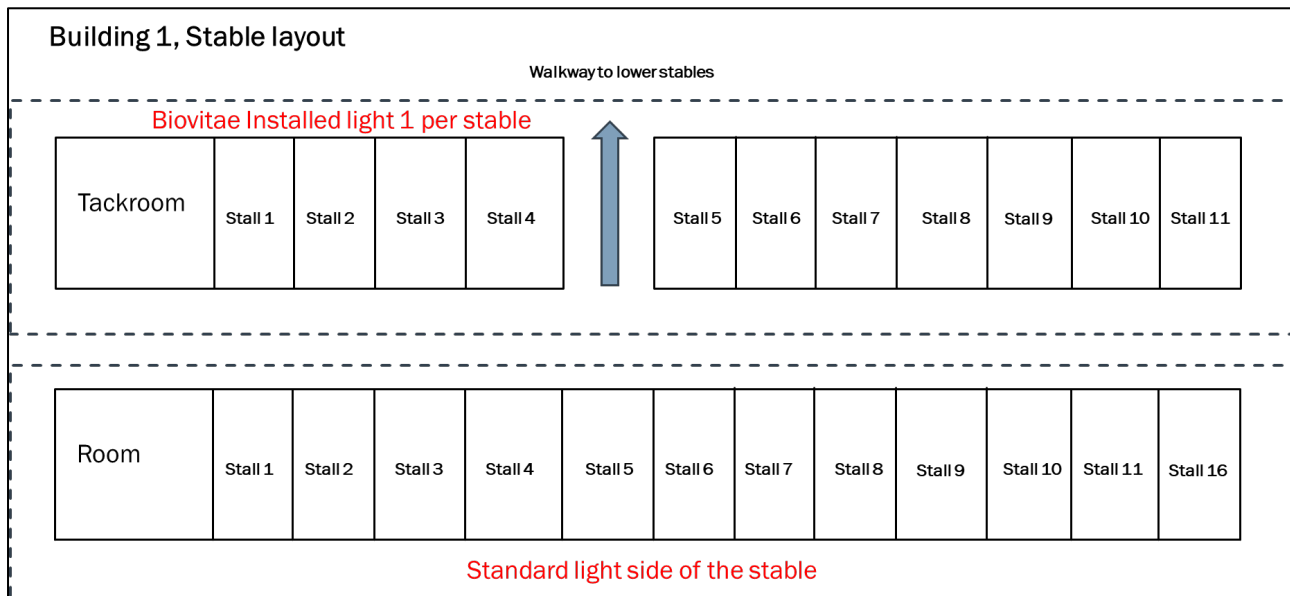


Fig 2: Building layout, Biovitae® technology installed in Stall 1 to 11. Standard lighting remained on the non Biovitae side of the building.



Biovitae Lighting installed over each Stalls 1 to 11

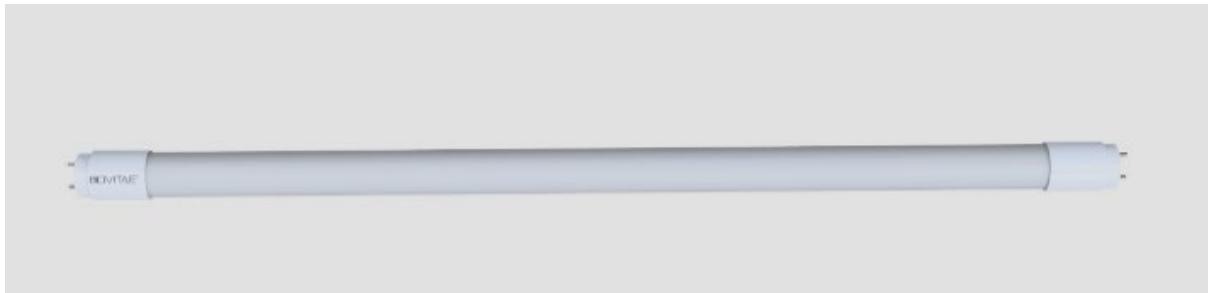


Biovitae lighting  
1.5mtr baton per stall.  
Recommendation lighting to be on for 4 hours per day

Fig 3: Installation of the Biovitae® technology lighting

**Biovitae® technology lighting used in the installation**

Biovitae LED tube 150cm ref. 5ft KVG



Rated power: **24.7W**

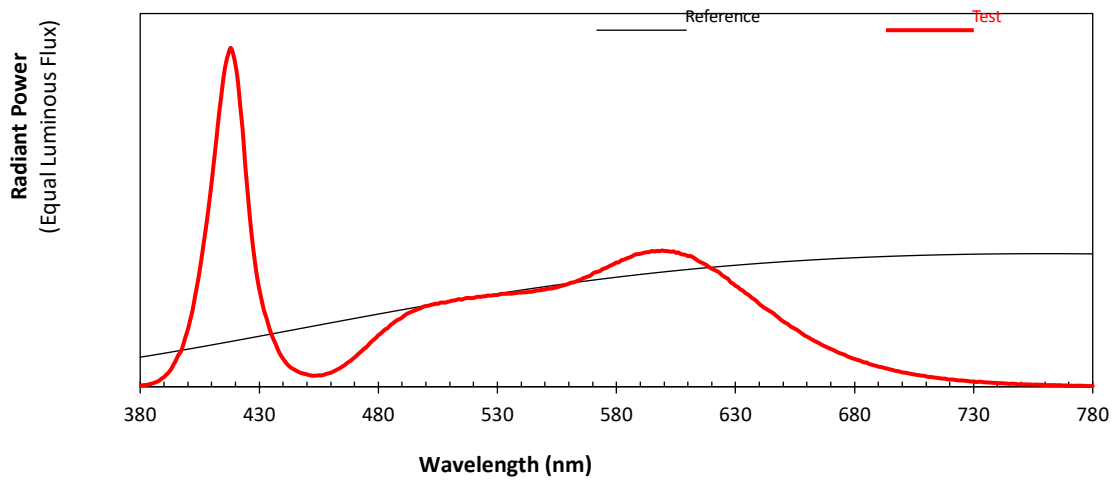
Rated spectral radiated power: **9.1 W**

Rated spectral radiated power (400-420nm): **1.45 W**

Rated Flux: 2500 lm

Beam Angle: 200°

Spectral Emission:



**CRI: 85**

**CCT: 4000k**

## 4. Methods:

It was decided to pick locations in the Stall that would come into contact with the horse during normal time spent in the stall, the 6 Points selected were feed and water location along with a number of points where the Horse were observed contacting. The location is shown in **Fig:4**

### Stable sample area

- Feed trough
- Water trough
- Back wall
- Gate
- Front Brick Fence
- Iron Grill-bars



**Fig 4: Location swabbed.**

### Tack-room sample area

- Disk on Bridle
- Kitchen counter
- Bench
- Desk
- Bridle
- Saddle

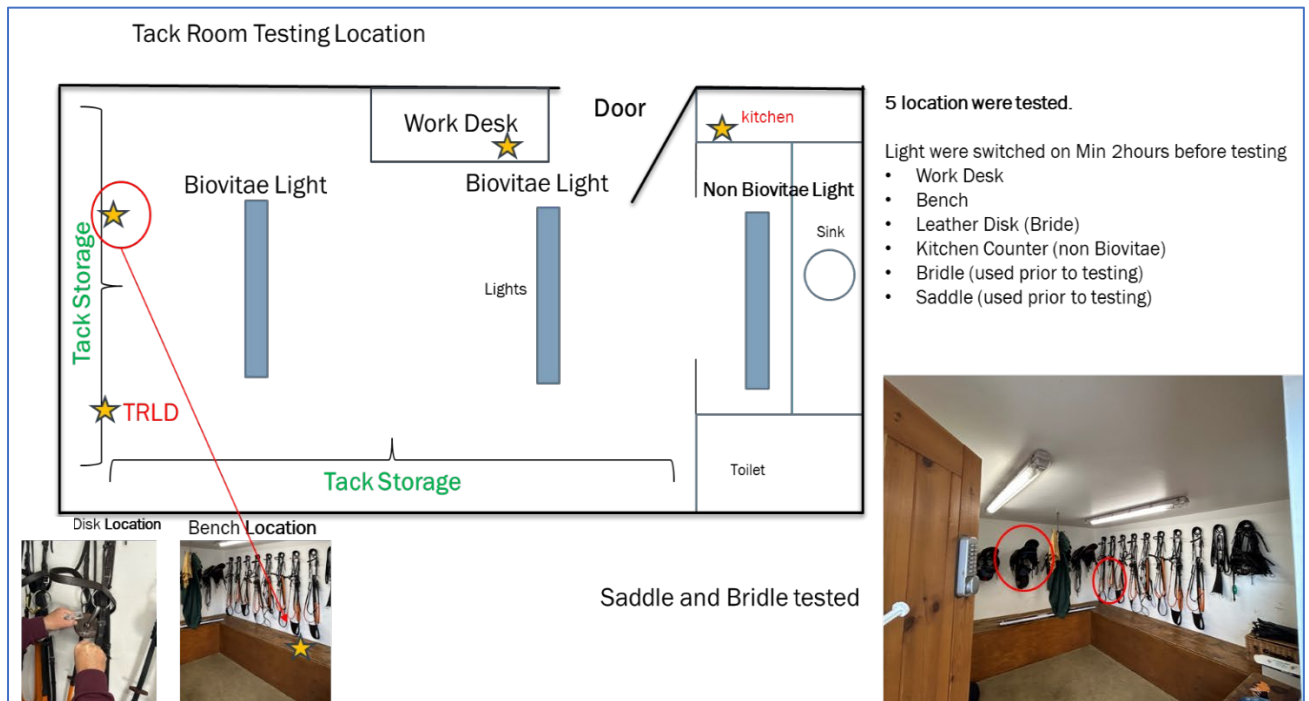


Fig 5. Locations of testing in the tack room

### Samples collection

All areas (indicated above) were sampled. On the day of testing duplicate samples were collected using sterile swab sticks moistened in Buffered peptone water and Difco neutralising buffer. Each swab sample was collected from an area of 25 square centimetres (cm<sup>2</sup>). Collected samples were then transported in a cool box using drying ice until laboratory analysis.

### Sample analysis

Serial dilutions of collected samples were undertaken using sterile PBS. Total aerobic colony counts were obtained by culturing onto Nutrient agar. Total coliform count was obtained using selective Chromocult coliform agar. All samples were incubated at 30°C for 24 hours. Resultant colonies were counted using a digital colony counter.

## 5. Results

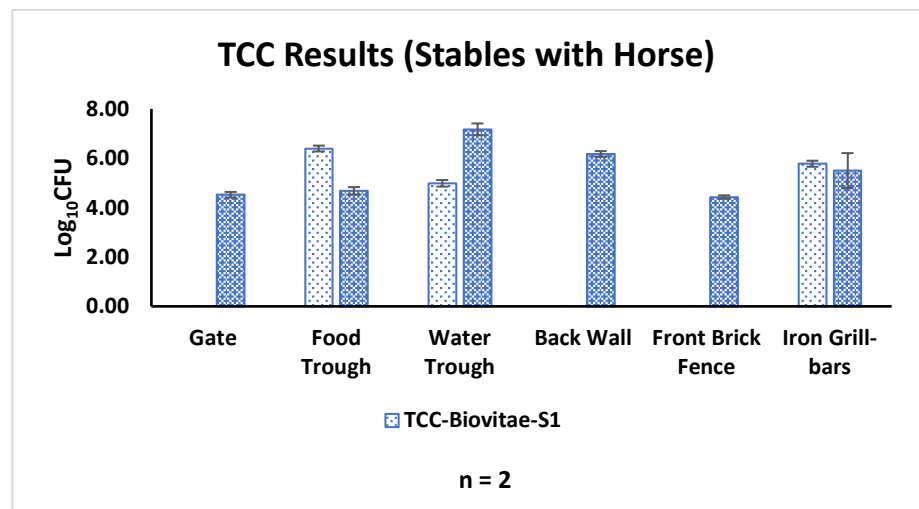
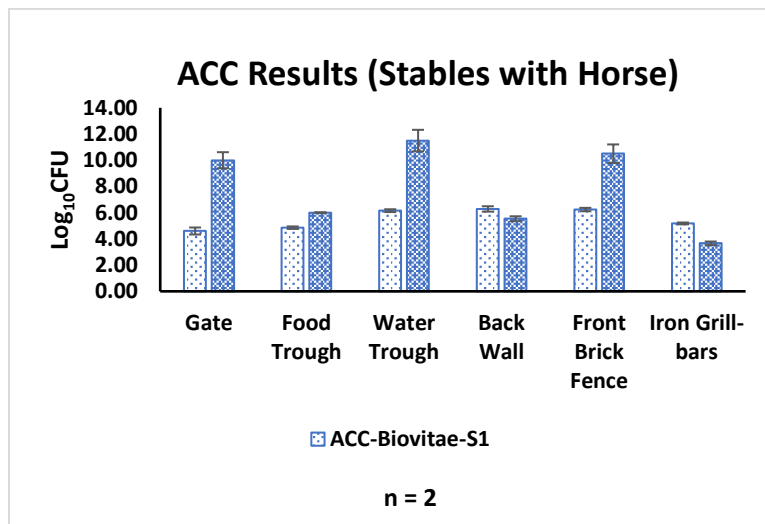
Means were separated using Post Hoc (Least Significant Difference). Across groups, the same alphabetic superscripts mean no significant difference between treatments, while different alphabetical superscripts mean a significant difference between treatments.

| Aerobic colony count |                                       |  |
|----------------------|---------------------------------------|--|
|                      | Stable 1 (Bio-vitae lamp, with horse) | Stable 9 (Fluorescent lamp with horse) |
| Gate                 | 4.60 ± 0.27 <sup>a</sup>              | 10.00 ± 0.61 <sup>b</sup>              |
| Food Trough          | 4.86 ± 0.09 <sup>a</sup>              | 6.01 ± 0.02 <sup>a</sup>               |
| Water Trough         | 6.15 ± 0.11 <sup>a</sup>              | 11.50 ± 0.82 <sup>b</sup>              |
| Back Wall            | 6.28 ± 0.21 <sup>a</sup>              | 5.54 ± 0.19 <sup>a</sup>               |
| Front Brick Fence    | 6.24 ± 0.13 <sup>a</sup>              | 10.50 ± 0.71 <sup>b</sup>              |
| Iron Grill-bars      | 5.18 ± 0.07 <sup>a</sup>              | 3.66 ± 0.14 <sup>a</sup>               |

Results represent Mean ± SD; (n = 2); NG = No Growth Growth

| Total Coliform count |                                       |  |
|----------------------|---------------------------------------|--|
|                      | Stable 1 (Bio-vitae lamp, with horse) | Stable 9 (Fluorescent lamp with horse) |
| Gate                 | NG <sup>a</sup>                       | 4.52 ± 0.11 <sup>b</sup>               |
| Food Trough          | 6.39 ± 0.12 <sup>a</sup>              | 4.68 ± 0.15 <sup>b</sup>               |
| Water Trough         | 4.98 ± 0.13 <sup>a</sup>              | 7.17 ± 0.24 <sup>b</sup>               |
| Back Wall            | NG <sup>a</sup>                       | 6.17 ± 0.12 <sup>b</sup>               |
| Front Brick Fence    | NG <sup>a</sup>                       | 4.43 ± 0.07 <sup>b</sup>               |
| Iron Grill-bars      | 5.78 ± 0.12 <sup>a</sup>              | 5.50 ± 0.71 <sup>a</sup>               |

Results represent Mean ± SD; (n = 2); NG = No

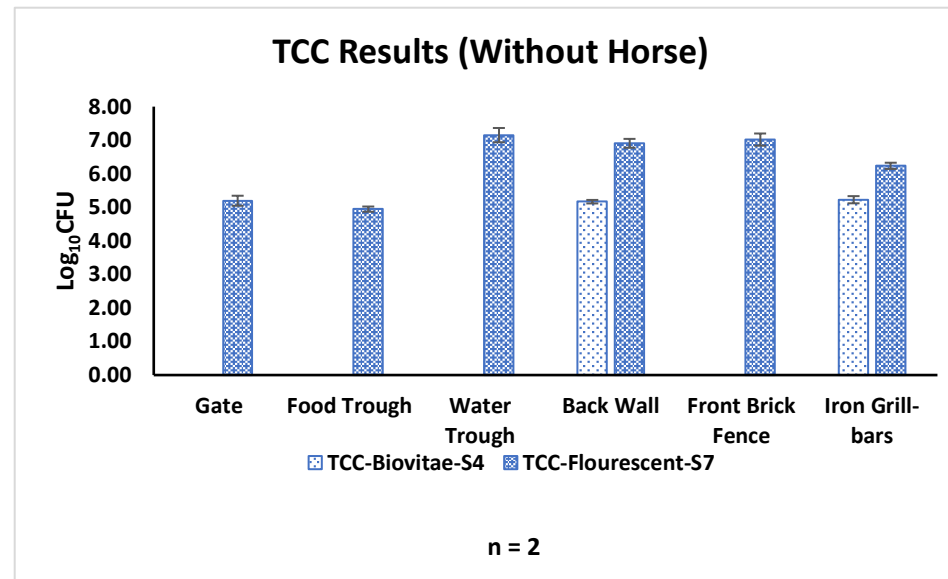
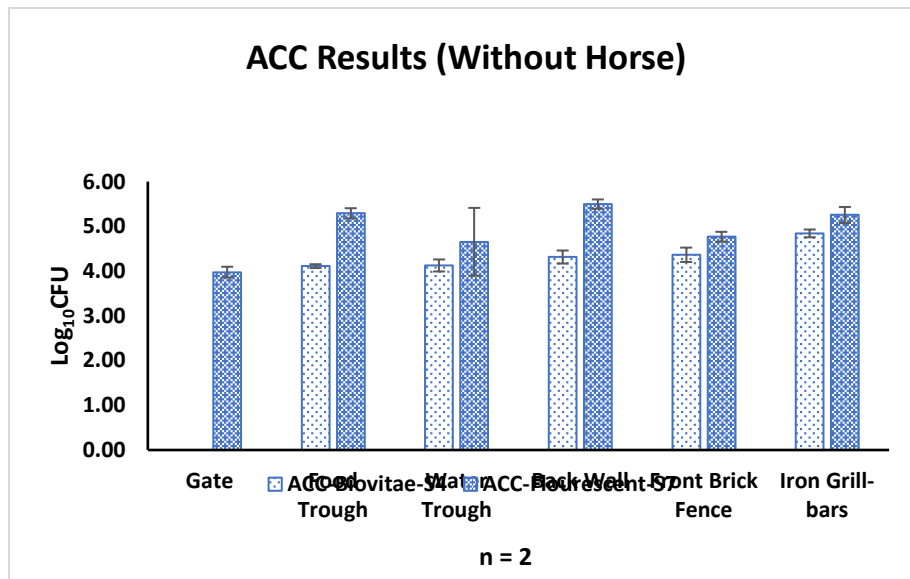


| Aerobic colony count |  |   |
|----------------------|--|---|
|                      | Stable 4 (Bio-vitae lamp, without horse) | Stable 7 (Fluorescent lamp without horse) |
| Gate                 | NG <sup>a</sup>                          | 3.98 ± 0.12 <sup>b</sup>                  |
| Food Trough          | 4.11 ± 0.04 <sup>a</sup>                 | 5.29 ± 0.11 <sup>b</sup>                  |
| Water Trough         | 4.13 ± 0.13 <sup>a</sup>                 | 4.66 ± 0.76 <sup>a</sup>                  |
| Back Wall            | 4.31 ± 0.14 <sup>a</sup>                 | 5.50 ± 0.10 <sup>b</sup>                  |
| Front Brick Fence    | 4.36 ± 0.16 <sup>a</sup>                 | 4.77 ± 0.11 <sup>a</sup>                  |
| Iron Grill-bars      | 4.84 ± 0.08 <sup>a</sup>                 | 5.25 ± 0.18 <sup>a</sup>                  |

Results represent Mean ± SD; (n = 2); NG = No Growth Growth

| Total Coliform count |  |   |
|----------------------|--|---|
|                      | Stable 4 (Bio-vitae lamp, without horse) | Stable 7 (Fluorescent lamp without horse) |
| Gate                 | NG <sup>a</sup>                          | 5.20 ± 0.15 <sup>b</sup>                  |
| Food Trough          | NG <sup>a</sup>                          | 4.95 ± 0.08 <sup>b</sup>                  |
| Water Trough         | NG <sup>a</sup>                          | 7.15 ± 0.21 <sup>b</sup>                  |
| Back Wall            | 5.17 ± 0.05 <sup>a</sup>                 | 6.91 ± 0.13 <sup>b</sup>                  |
| Front Brick Fence    | NG <sup>a</sup>                          | 7.02 ± 0.18 <sup>b</sup>                  |
| Iron Grill-bars      | 5.23 ± 0.11 <sup>a</sup>                 | 6.24 ± 0.09 <sup>b</sup>                  |

Results represent Mean ± SD; (n = 2); NG = No Growth



| Tack Room       |                      |                      |
|-----------------|----------------------|----------------------|
|                 | Aerobic colony count | Total Coliform count |
| Desk            | NG                   | NG                   |
| Bench           | NG                   | NG                   |
| Leather Disk    | NG                   | NG                   |
| Kitchen Counter | 4.44 ± 0.08          | NG                   |
| Bridle          | 3.20 ± 0.12          | NG                   |
| Saddle          | 4.53 ± 0.11          | 6.08 ± 0.25          |

Results represent Mean ± SD; (n = 2); NG = No Growth

## 6. Conclusion and Key Findings

Following on for significant research carried out by Nextsense on the eradication of various pathogens with Biovitae Technology, testing was conducted on **Yellow Fever** by Scientific Department of the Celio Military Hospital, Rome, Italy, which is part of the European Biodefence Laboratory Network (EBLN), **Klebsiella Pneumoniae** by the University of Pisa, Department of Translational Research, New Technologies in Medicine and Surgery, and **P. aeruginosa** dried on steel plate was made at Tecniplast Microbiological lab, further testing was performed on **Trichophyton equinum var. autotrophicum** (Common name Ringworm) where in all cases the pathogens was eradicated within 1 hour of exposure to the Biovitae Technology. Further real world testing was planned to see what direct effect the technology would have on the environment of a working stable.

Our study demonstrates that the Biovitae Technology holds significant potential in diminishing bacterial contamination in horse stables, marking a noteworthy advancement over current methods of sustaining cleanliness and health within equine settings. The investigation revealed that the Biovitae Technology effectiveness in reducing microbial loads exhibits variability across different surfaces, with certain areas experiencing a pronounced decrease in bacterial presence.

**Key Findings:**

- **Efficacy of Biovitae Lamp:** The introduction of the Biovitae Lamp into horse stable environments has been shown enhance hygiene and health standards by reducing bacterial contamination.
- **Surface-Specific Results:** The reduction in microbial loads was not uniform across all tested surfaces, indicating that the characteristics of the surface influence the lamp's antimicrobial effect it is exposed to.
- **Prospects for Optimisation:** future enhancements could be achieved by adjusting the lamp's placement, operational duration, or intensity to amplify its antimicrobial properties.

In conclusion, the Biovitae Lamp emerges as a tool for improving the microbiological safety of equine facilities. By optimise its application, there is a tangible opportunity to elevate the standards of hygiene and animal health in the equine industry, potentially setting a new benchmark for environmental sanitation practices.

## Main Collaborator



UNIVERSITY OF  
BIRMINGHAM

