

## To whom it may concern

What we did was to evaluate in real life the activity of Biovitae Lamps in reducing the bacterial load in a sport setting, represented by the locker rooms of the junior Sampdoria FA football team.

We observed that a 24 hours irradiation of the light emitted by Biovitae Lamps reduces, in a substantial manner, bacterial and yeast loads in the environment.

## Background

In the last year, the COVID-19 pandemic has deeply modified our habits. Close contacts are not recommended while air changes, the use of facial masks and personal hygiene are highly recommended, in order to avoid virus spread from an infected subject (or patient) to neighbors. In this context, every method suitable to reduce the virus diffusion is precious, in particular if methods are innovative, green and safe.

Biovitae Lamps have been already described to inhibit the proliferation of SARS-CoV-2 in an in vitro experimental model. The reduction is proportional to the distance of the culture from the lamp and the time of illumination. In a similar context, laboratory strains of common bacteria (*E. coli* and *Staphylococcus aureus*) have also been tested for their proliferative capacities after illumination of the culture. In both cases, a strong inhibition of virus and bacterial growth was observed, thus indicating that Biovitae Lamps may have a significant role in controlling virus (and bacterial) diffusion in specific environments.

However, all these test were carried out in an experimental setting, while real life conditions were never tested. Nevertheless, these conditions should be carefully analyzed being the condition of human living.

To explore a real life situation, the locker rooms of the Junior Sampdoria FA football team were used. In this report, the experimental setting will be described and the results will be shown and discussed.

## Environment

The locker rooms of the junior Sampdoria FA team are in Bogliasco (Genova, Italy), close to one of the three soccer fields of the Sampdoria training site (Figure 1). The locker rooms are located into a reinforced concrete small building, whose windows are new but not perfectly sealed. The windows of the rooms face north. On the north site of the locker rooms there are the three soccer fields, and the closest is a few tens of meters away. Winds in spring are mainly from north and north-east and this fact, together with the non-perfect sealing of the windows, results in a continuous provision of environmental microbes and yeast from the northern fields.

In these rooms, BIOVITAE light were installed and used (Figure 2).

This was carefully measured in the time zero tests performed in the absence of Biovitae lights.

## Experimental setting

The locker rooms were divided in different zones and sampling zones were identified together with the medical staff of the soccer team zones (Figure 3). Samplings were performed in a 24 hours period, starting from Monday 9.00 am to Tuesday 9.00 am, then from Tuesday 9.00 am to Wednesday 9.00 am. Thus, the reference period (lights off) consisted in a 24 hours period where telluric bacterial flora and yeasts were measured. The test period (lights on) consisted in a 24 hours period where inhibition of the proliferation of the telluric flora by Biovitae lights was controlled in the same experimental conditions.

To enumerate the colonies on agar plates (namely, blood agar for gram-positive and gram-negative bacteria and Sabureau agar for yeasts from Biomerieux), agar petri dishes were open and let to lay on the ceiling. After 24 hours, plates were collected, sealed and the incubated at 37° C for 24-48 hours. The number of colonies was counted by two different technicians expert in the field. For yeasts, the colonies were counted after other 48 hours at room temperature. The counts were performed visually.

During the whole period of the test, locker rooms were closed and no one was admitted inside. Thus, test were performed in very basal conditions, avoiding the effects of the presence of athletes. In addition, because locker rooms were closed to athletes for the test, the whole experiment was performed only once in the very short period where workouts were suspended due COVID-19 epidemics.

## Results

| Table n. 1 Effects of Biovitae light on Bacteria |                          |       |       |                 |                 |
|--|--------------------------|-------|-------|-----------------|-----------------|
| Position   | Description              | Day 1 | Day 2 | % of inhibition | Biovitae lights |
| 1  | Massage area             | 17    | 3     | 82,4            | ON              |
| 2  | Locker room (north side) | 22    | 3     | 86,4            | ON              |
| 3  | Locker room (south side) | 32    | 6     | 81,3            | ON              |
| 4  | Showers area             | 216   | 168   | 22,2            | OFF             |
| 5  | Wash basin               | 23    | 3     | 87,0            | INDIRECT        |
| 6  | Toilette                 | 28    | 6     | 78,6            | INDIRECT        |
| 7  | Corridor                 | 30    | 7     | 76,7            | ON              |

| Table n. 2 Effects of Biovitae light on Yeast |                          |       |       |                 |                 |
|---|--------------------------|-------|-------|-----------------|-----------------|
| Position                                      | Description              | Day 1 | Day 2 | % of inhibition | Biovitae lights |
| 1   | Massage area             | 20    | 3     | 85,0            | ON              |
| 2   | Locker room (north side) | 31    | 3     | 90,3            | ON              |
| 3   | Locker room (south side) | 32    | 6     | 81,3            | ON              |
| 4   | Showers area             | 160   | 4     | 97,5            | OFF             |
| 5   | Wash basin               | 32    | 3     | 90,6            | INDIRECT        |
| 6   | Toilette                 | 29    | 6     | 79,3            | INDIRECT        |
| 7   | Corridor                 | 24    | 7     | 70,8            | ON              |

## Discussion

Data collected in the small but interesting test performed on BIOVITAE lights positioned in the locker rooms of a soccer team indicates that both bacteria and yeast are inhibited. This result is in line with what has already been observed in a more controlled “laboratory” setting by using standard strains of microbes.

Added values of this experimental setting can be identified. Indeed, the results observed were obtained in real life conditions, with real locker rooms, real windows, real microbes and yeast. In addition, BIOVITAE lights were installed as “normal” lights under the ceilings. In one single condition (showers area) due to technical reason, lights were switched off and a worse inhibition was observed.

In the same context, other points should be considered. First, inhibition of the proliferation of bacterial and yeast were not strictly related to the presence of a “direct” irradiation on the surface, but also by diffusion and reflection of the light. This was evident in positions (such as the toilette, where the light was diffused and/or reflected by the corridor lamp). But even more interestingly, despite shower light was off, the diffusion of the corridor light weakly inhibited bacteria (-20%) but strongly (and surprisingly) inhibited yeasts.

Some criticisms related to the experimental setting should be highlighted. First, the assay was performed only once due to the exceptional conditions of the moment. Indeed, locker rooms were used every day by the soccer team and only because of the very short period of the COVID-19 lockdown when workouts were suspended, rooms were available for the tests.

Second, the number of colonies alone – independent from microbe or yeast classification, was measured.

Third, a visual enumeration – mainly related to the very great heterogeneity of colonies, was used.

Finally, a formal statistical evaluation was not carried out. Nevertheless, statistics should be used in the context of a well performed (and repeated) experimental setting. In the present conditions, average 80% inhibition of the number of colonies is probably already suggestive of the activity of the lights.

Despite the above-mentioned warnings, the whole experiment was indicative of the capacity of Biovitae light to inhibit bacterial and yeast proliferation in a real life setting.

This finding may support the use of the Biovitae lights in other environments where the control of microbiological contamination could be indicated.

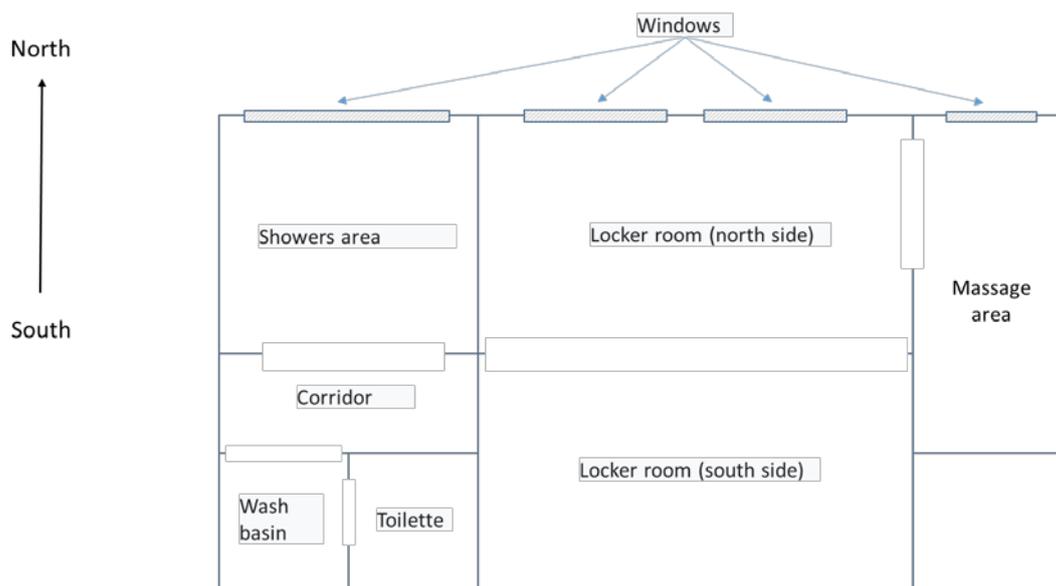


Giovanni Melioli, MD

Alliance Medical Diagnostic srl

Genova, Italy

Figure 1. Locker room planimetry



Basic layout

Figure 2. Position of the lights

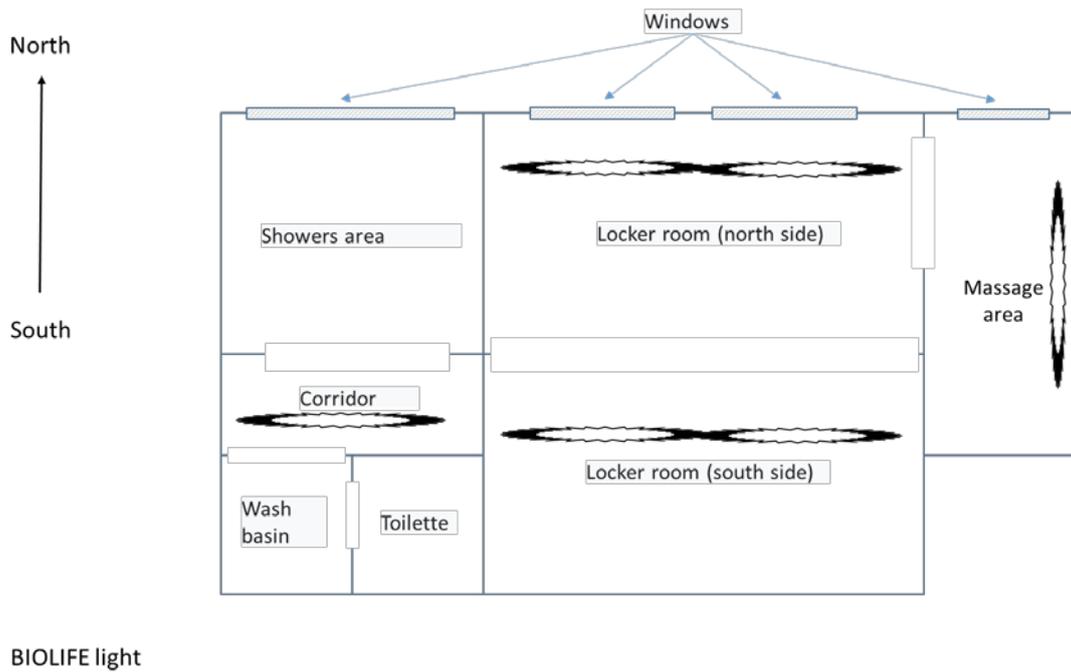
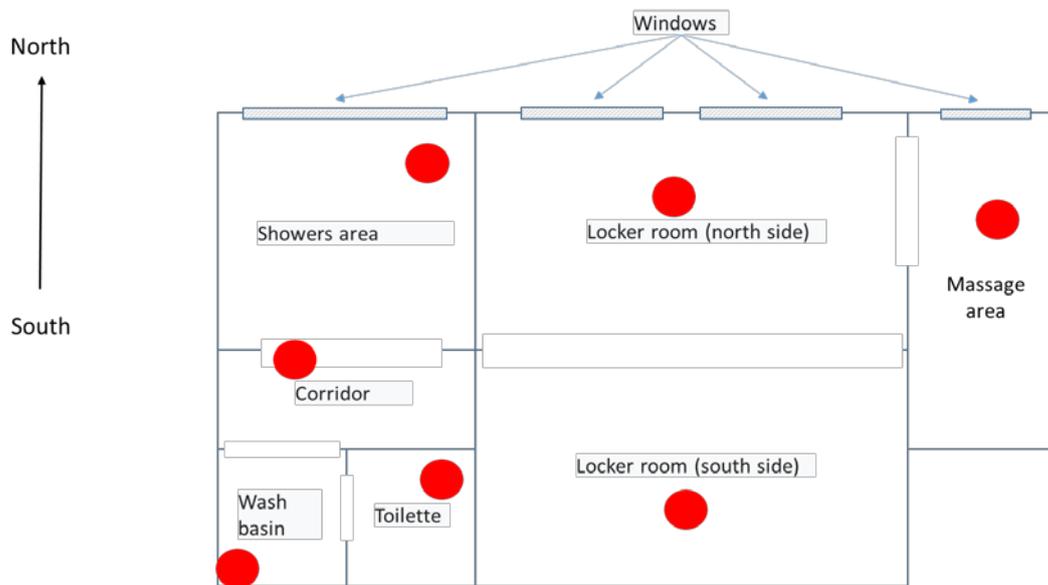


Figure 3. Sampling sites



Sampling places