Testing Results Booklet

betterair

Allergen study In Vitro Lab

Study conducted by Indoor Biotechnologies

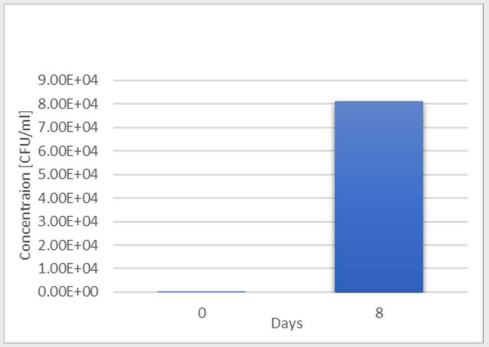


Figure 1: Enviro-Biotics® concentration over time after incubation with Dust mite (Der p2) Allergen

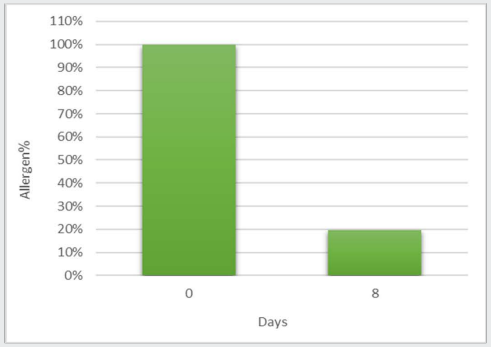


Figure 2: Dust mite (Der p2) Allergen concentration over time after incubation with Enviro-Biotics®

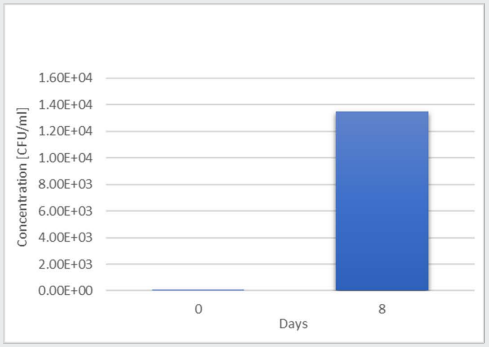


Figure 3: Enviro-Biotics® concentration over time after incubation with Dog (Can f1) Allergen

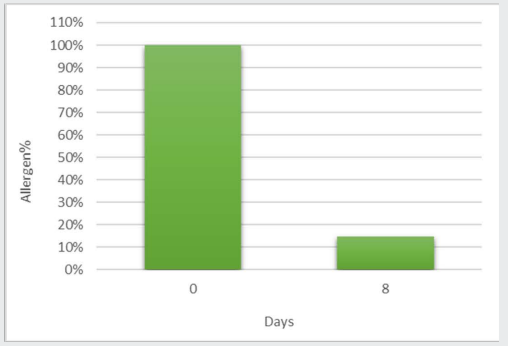


Figure 4: Dog (Can f1) Allergen concentration over time after incubation with Enviro-Biotics®

Study objective

To prove that betterair's Enviro-Biotics® degrade allergens, by using them as a nutrient, samples were taken for bacterial concentration (using a classic microbiology method) and allergen concentration (using the INDOOR MARIA® assay, MARIA SOP-001 ver.1.3).

Conclusion

Our Enviro-Biotics® can grow and prosper by using allergens as a nutrient source, hence dramatically decrease the concentration of allergens and reduce the side effects of ubiquitous indoor allergens on the residents.

University of Oregon study

The BioBE (Biology and Built Environment) center at the University of Oregon, conducted fully controlled trials on the Better Air Enviro-Biotics® technology inside a controlled chamber simulating real life conditions.
The U of O performed the testing that generated the data presented below.

In these trials, BioBE has focused on the microbial viability of Enviro-Biotic™ treatment on surfaces as well as the antagonistic effect against indoor pathogenic microbes.

Oregon 2018

Plates were preloaded with either live or sterilized human-associated microbial communities (HAMC), which was obtained from homogenized and filtered vacuum cleaner dust sourced from three distinct occupied Buildings.

The course of treatment was two weeks using betterair's Biotica 800 device with standard settings in the ESBL Climate Chamber (25.75 m3) with humidity, air temperature, and air exchange rates held constant throughout the duration of the experiment and within the range typical of residential/commercial buildings. Air exchange was held at the minimum acceptable via ASHRAE standards for occupied office buildings. All incoming air was filtered to MERV 15.

Proven efficacy against pathogens

The probiotic treatment exhibited a clear antagonistic effect against three typical indoor microbial pathogens:

Escherichia coli – a pathogenic bacteria causing a wide range of human related infections.

Staphylococcus epidermidis - a Gram-positive bacterium that infects patients with compromised immune systems, people with catheters and is a frequent contaminant of specimens sent to the diagnostic laboratory.

University of Oregon study continued

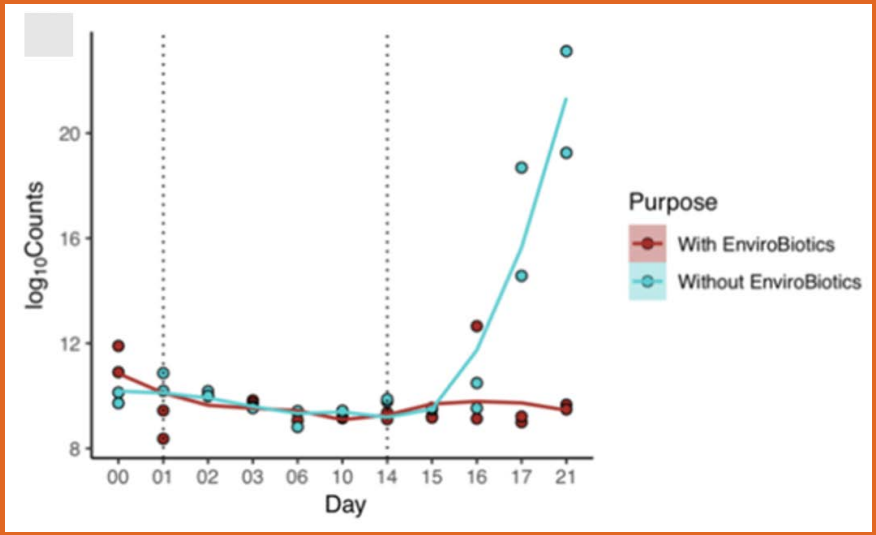


Fig. 1: Counts of live E. coli and S. epidermidis over time. Enviro-Biotics® treated plates received treatment from day 1 to day 14. The treatment period is defined by the dashed vertical lines.

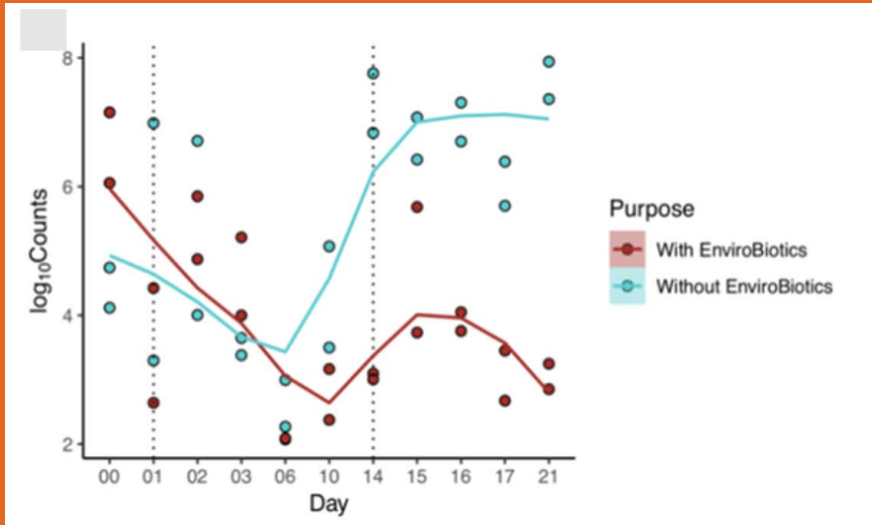


Fig. 2: Counts of live Cladosporium sp. over time. Enviro-Biotics® treated plates received treatment from day 1 to day 14. The treatment period is defined by the dashed vertical lines.

Oregon 2018

Cladosporium sp. - an indoor pathogenic mold. Its airborne spores are significant allergens that severely affect asthmatics.

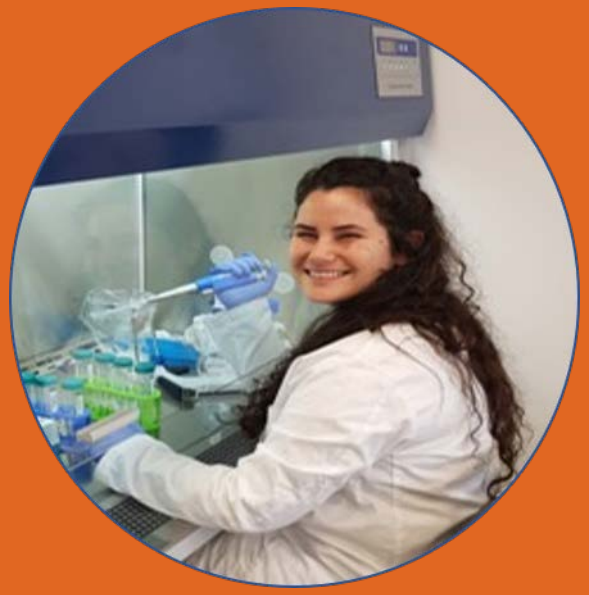
The inhibition effect over E. Coli and S. epidermidis is depicted in Fig. 1. Continuous application for 14 days suppressed the pathogenic bacteria counts in comparison to the control.

Therefore, it can be concluded that from the 8th day onwards, a significant antagonistic effect was demonstrated over the Cladosporium sp. pathogenic fungi.

Following the 14 days treatment regime, the E. coli and S. epidermidis counts in the untreated-control increased dramatically, while their counts in the treated samples were kept low due to the probiotic inhibition effect.

The antagonistic effect against Cladosporium sp. was even more impressive as can be seen in Fig. 2: Cladosporium sp. counts increased significantly more over time in control versus treated samples (Fig. 2; $\chi 2 = 12.3$, $P < 0.001$).

University of Oregon study continued



Conclusion

In conclusion the Enviro-Biotics® treatment exhibited a clear antagonistic effect against three typical indoor microbial pathogens: Escherichia coli, Staphylococcus epidermidis and Cladosporium sp. It is noted that these species typical indoor microbial pathogens with a potential to be pathogenic and harmful to people, able to cause a wide range of human related infections or indoor acquired illnesses.

Field household study to evaluate Enviro-Biotics™ on atopic dogs

Australia 2018

The objective was to evaluate owner's perception of their allergic dog's pruritus (atopic skin condition) and malodour following frequent use of Enviro-Biotics™ over a 21-day period. This study will also evaluate the population pattern of S. pseudintermedius and Enviro-Biotics™ in a subgroup of the study animals.

Dogs with atopic dermatitis have been shown to have less species of bacteria on their skin compared to healthy dogs, therefore contributing to a compromised skin barrier leading to increased itch and skin odour. Atopic dogs are also at a significantly increased risk of developing skin infections (pyoderma).
This pilot study was aimed to evaluate the effects of regular topical application of Enviro-Biotics™, on dogs with atopic dermatitis and their sleeping area.

Furthermore, the assessment of specific bacteriological cultures, pruritus (itch) scores and owner's perception of odour, on skin and bedding before and during the use of the product over a 21 day period was evaluated.
Pruritis assessment:
For the pruritis variable we found a reduction in value of -0.6% per day. The reduction was found to be statistically significant ($F_{1,11.01}=7.05$, $p=0.022$, Figure 1a).

Odour assessment:

For the odour assessment, we found a decrease of 0.57% per day (Figure 1b) .

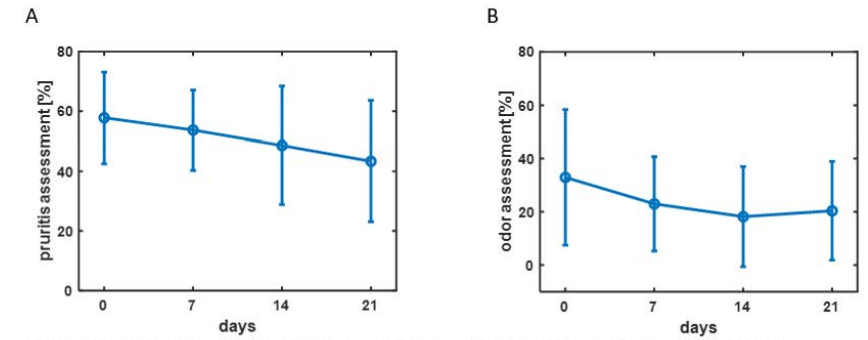


Fig.1: a. Mean pruritis assessment values with error bars representing the standard deviation across four repetitions.
b. Mean odour assessment values with error bars representing the standard deviation across four repetitions.

Field household study to evaluate Enviro-Biotics™ on atopic dogs

continued

Australia 2018

Bacterial culture assessment:

The number of bacteriological cultures positive for S. pseudintermedius declined for these dogs over Day 7-21, while the number of cultures positive for Enviro-Biotics™ remained constant over this period

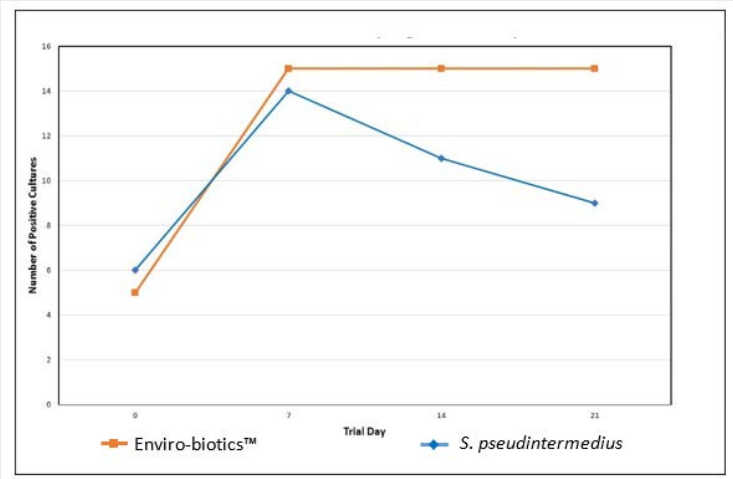


Fig.2: Number of cultures by organism and day

Conclusion

Overall, results are very encouraging considering the pilot data set and the relatively short assessment time frame for a chronic condition.
We can see a statistically significant decrease in Pruritis scoring, together with a clear decrease in odour, furthermore, we can see a decrease in S. pseudintermedius (primarily a pathogen for domestic animals, but has been known to affect humans as well) while Enviro-Biotics™ remained constant.

This study was conducted by Invetus, the largest Australasian veterinary contract research organisation (CRO) with sites throughout Australia and New Zealand and managed by Orivet genetic pet care, Australia.

PROOF OF CONCEPT

Israeli Police Forces, Israel

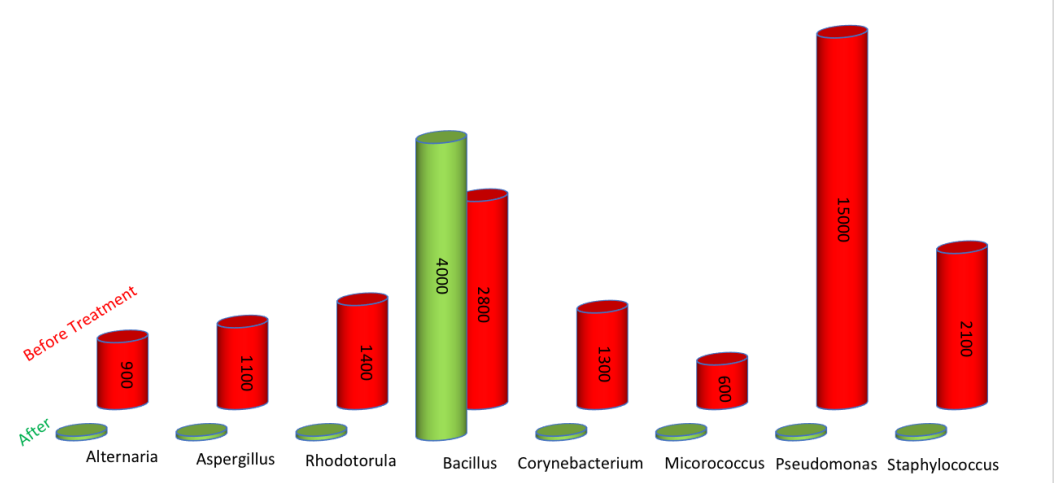
Improved productivity associated with the reduction of airborne irritants.
Reduction of headaches and noticeable improvement in air **and surface** quality, additional **symptoms** associated with SBS.

1 - Before treatment

HMC ID Number: 15005273 - 2		Sample Media: Swab		Volume: 1.00	Limit of detection: 100 cfu / cm2
Sample ID Number: 2		Sample Name: Zion 1			
Organism	Type	Raw Count	cfu / cm2	% of Total	Note
Alternaria	Fungi	9	900	4%	
Aspergillus	Fungi	11	1100	4%	
Rhodotorula	Fungi	14	1400	6%	
Bacillus	Bacteria	28	2800	11%	
Corynebacterium	Bacteria	13	1300	5%	
Micrococcus	Bacteria	6	600	2%	
Pseudomonas sp.	Bacteria	150	15000	60%	

2 - After 12 weeks of treatment

HMC ID Number: 16004813 - 3		Sample Media: Swab		Volume: 1.00	
Sample ID Number: 3		Sample Name: Swab			
Organism	Type	Raw Count	cfu / cm2	% of Total	
No Fungi Detected	Fungi				
Bacillus	Bacteria	40	4000	100%	

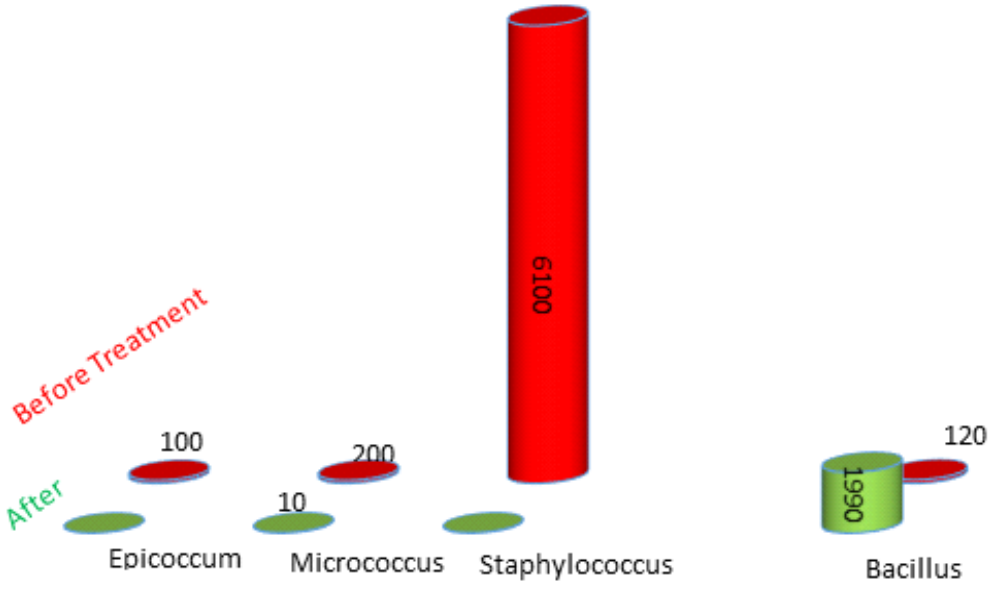


PROOF OF CONCEPT

Caspi Sror Law Offices, Tel Aviv, Israel

Outbreak of rashes and itchy eyes associated with poor indoor air **and surface** quality .

Reduction in **high levels of 3 dangerous strains**, of allergy causing bacteria, and **specific** reduction of Staph, a pathogenic bacteria to non detectable levels. Return to a balanced indoor air **and surface** microbiome. Reduced headaches.



PROOF OF CONCEPT

Altman Offices, Israel

Presence of strains of fungi and bacteria that are associated with health

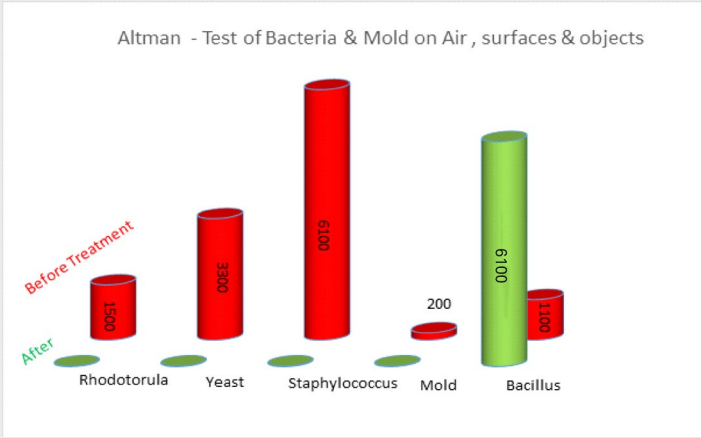
Levels of disease causing bacteria and fungi returned to balanced levels. High levels of **betterair Enviro-biotics™** replaced the allergy causing microbes.

Before treatment

HMC ID Number: 15008044 - 2		Sample Media: Swab		Volume: 1.00	
Sample ID Number: 2		Sample Name: Surface / Table			
Organism	**Type**	**Raw Count**	**cfu / cm2**	**% of Total**	
Rhodotorula	Fungi	15	1500	12%	
Unspecified Mold	Fungi	2	200	2%	
Yeast	Fungi	33	3300	26%	
Bacillus	Bacteria	11	1100	9%	
Staphylococcus sp.	Bacteria	68	6800	53%	

After treatment

HMC ID Number: 15009186 - 3		Sample Media: Swab		Volume: 1.00	
Sample ID Number: 3		Sample Name: Surface / Table			
Organism	**Type**	**Raw Count**	**cfu / cm2**	**% of Total**	
No Fungi Detected	Fungi				
Bacillus	Bacteria	61	6100	100%	



PROOF OF CONCEPT

El Al - Boeing 777, International Flights

Unhygienic in flight conditions on surfaces, in the air and in toilets, with associated high levels of infection causing microbes present.

Levels of disease causing bacteria and fungi returned to acceptable levels. High levels of **betterair Enviro-biotics™** replaced the allergy causing microbes.

2017 Hayes Microbial, Testing US

1 - Before treatment

HMC ID Number: 17007210 - 1		Sample Media: Swab		Volume: 1.00
Sample ID Number: 1		Sample Name: Lavatory		
Organism	**Type**	**Raw Count**	**cfu / cm2**	**% of Total**
Yeast	Fungi	4	400	2%
Gram Negative Fermenter	Bacteria	145	14500	78%
Gram Negative non-Fermenter	Bacteria	30	3000	16%
Staphylococcus sp.	Bacteria	8	800	4%

HMC ID Number: 17007210 - 2		Sample Media: Swab		Volume: 1.00
Sample ID Number: 2		Sample Name: Comp Fuselage		
Organism	**Type**	**Raw Count**	**cfu / cm2**	**% of Total**
Aureobasidium	Fungi	3	300	2%
Rhodotorula	Fungi	14	1400	7%
Gram Negative Fermenter	Bacteria	50	5000	27%
Gram Negative non-Fermenter	Bacteria	120	12000	64%

HMC ID Number: 17007210 - 3		Sample Media: Air		Volume: 300.00
Sample ID Number: 3		Sample Name: Comp Fuselage Bac		
Organism	**Type**	**Raw Count**	**cfu / M3**	**% of Total**
Bacillus	Bacteria	10	33	26%
Micrococcus	Bacteria	12	40	32%
Staphylococcus sp.	Bacteria	16	53	42%

HMC ID Number: 17007210 - 4		Sample Media: Air		Volume: 300.00
Sample ID Number: 4		Sample Name: Comp Fuselage Mold		
Organism	**Type**	**Raw Count**	**cfu / M3**	**% of Total**
Cladosporium	Fungi	28	93	100%

2 - After treatment

HMC ID Number: 17010911 - 1		Sample Media: Swab		Volume: 1.00
Sample ID Number: 1		Sample Name: Lavatory		
Organism	**Type**	**Raw Count**	**cfu / in2**	**% of Total**
Bacillus	Bacteria	240	24000	100%
No Fungi Detected				

HMC ID Number: 17010911 - 2		Sample Media: Swab		Volume: 1.00
Sample ID Number: 2		Sample Name: Composite Fuselage Swab		
Organism	**Type**	**Raw Count**	**cfu / in2**	**% of Total**
Bacillus	Bacteria	255	25500	100%
No Fungi Detected				

HMC ID Number: 17010911 - 3		Sample Media: Air		Volume: 500.00
Sample ID Number: 3		Sample Name: Composite Fuselage Air Ba		
Organism	**Type**	**Raw Count**	**cfu / M3**	**% of Total**
Bacillus	Bacteria	190	380	100%

HMC ID Number: 17010911 - 4		Sample Media: Air		Volume: 500.00
Sample ID Number: 4		Sample Name: Composite Fuselage Air Mold		
Organism	**Type**	**Raw Count**	**cfu / M3**	**% of Total**
Cladosporium	Fungi	4	8	100%

PROOF OF CONCEPT

Beit Gadi Medical Center

High levels of bacteria and fungi found in recovery rooms and patient rooms - leading to high probability of hospital acquired infections.

Post treatment result showed non detectable level of associated microbes.

1 - Before treatment

Job Number:	241114	Job Name:	Beit Gady Medical Center	Date Collected:	11/24/2014
Collected by:	Yuli Horesh			Date Received:	12/03/2014
Email:	yuli@betterair.co.il			Date Reported:	12/08/2014

HMC ID Number: 14020662 - 1	Sample Media: Air				Limit of detection: 10 cfu / M3
Sample ID Number: 1	Sample Name: Rm 302-BAC				
Organism	Type	Raw Count	cfu / M3	% of Total	Note
Staphylococcus sp	Bacteria	1	10	5%	
Pseudomonas sp	Bacteria	20	200	96%	

Pseudomonas in the Air

HMC ID Number: 14020662 - 2	Sample Media: Air				Limit of detection: 10 cfu / M3
Sample ID Number: 2	Name: Rm 302 Mold				
Organism	Type	Raw Count	cfu / plate	% of Total	Note
Cladosporium	Fungi	17	6	46%	
Rhizopus .	Fungi	7	7	54%	

HMC ID Number: 14020662 - 3	Sample Media: Swab Sample				Limit of detection: 100 cfu / cm2
Sample ID Number: 3	Name: general surface				
Organism	Type	Raw Count	cfu / cm2	% of Total	Note
Cladosporium	Fungi	1	100	1%	
Yeast	Fungi	9	900	5%	
Pseudomonas sp.	Bacteria	168	16800	94%	

Pseudomonas on the surface

2 - After treatment

HMC ID Number: 15001393 - 1	Sample Media: Air			Volume: 100.00	Limit of detection: 10 cfu / M3
Sample ID Number: 1	Sample Name: Rm 302- BAC				
Organism	Type	Raw Count	cfu / M3	% of Total	Note
Bacillus	Bacteria	6	60	100%	

Only Better Air Probiotics found in the Air

HMC ID Number: 15001393 - 2	Sample Media: Air			Volume: 100.00	Limit of detection: 10 cfu / M3
Sample ID Number: 2	Sample Name: Rm 302- Mold				
Organism	Type	Raw Count	cfu / M3	% of Total	Note
No Fungi Detected	Fungi				

HMC ID Number: 15001393 - 3	Sample Media: Surface Swab			Volume: 100.00	Limit of detection: 10 cfu / cm2
Sample ID Number: 3	Sample Name: General surface				
Organism	Type	Raw Count	cfu / M3	% of Total	Note
No Fungi Detected	Fungi				
No Bacteria Detected	Bacteria				

No infection found on surface

Case Studies in US

Care Partners Assisted Living Facility
4 months study

Evaluate effect on a highly utilized living area. With dispersion of betterair probiotics through the HVAC system.

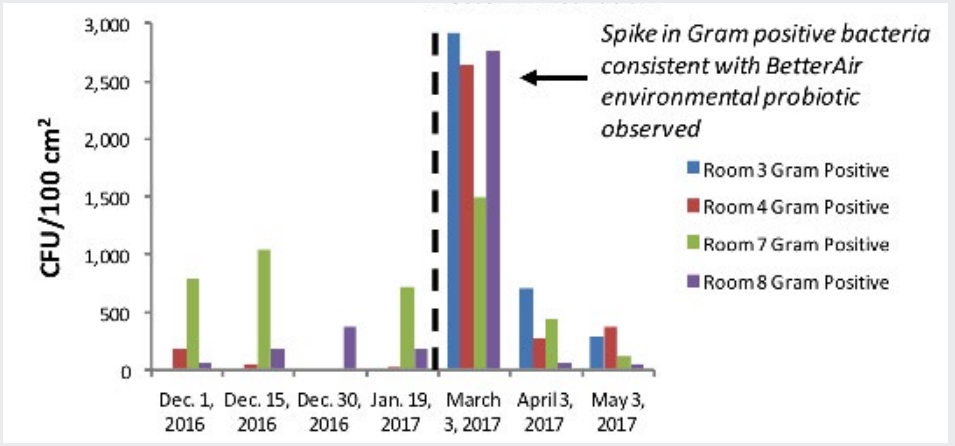


Figure1. Vent interior Gram positive bacteria. Samples were taken from vent duct interior surfaces approximately 50cm distance from vent opening. Approximately 100cm2 surface was swabbed and diluted in 1 ml saline with 0.1 ml subsamples plated on MSA medium. A ten fold dilution factor has been applied to CFU values to account for the dilution.

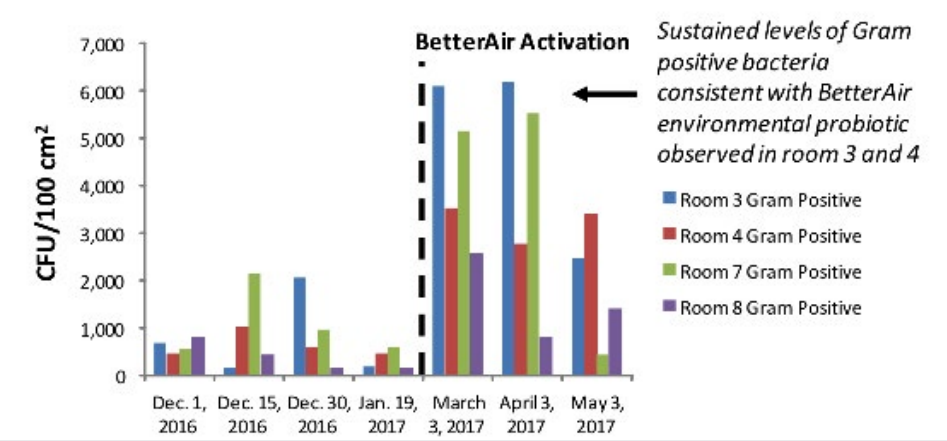


Figure2.Solid Surface Gram positive bacteria. Samples were taken on window stools (lowermost interior horizontal surface) directly above vents and on the upper surface of the door to the room. Approximately 100 cm2 surface was swabbed and diluted in 1 ml saline with 0.1 ml subsamples plated on MSA. A ten fold dilution factor has been applied to CFU values to account for the dilution.

Case Studies in US continued

Care Partners Assisted Living Facility
4 months study

In summary, this data shows that levels of Gram negative bacteria, including fecal indicator bacteria representing potential pathogens, were greatly reduced in numbers on the inner surface of the vent ducts in both the treated and untreated rooms following the application of the **betterair** Enviro-biotics™.

- Replacement of gram negative bacteria was replaced with **betterair** gram positive bacteria.
- Gram negative bacteria associated with fecal matter decreased on the vent surface eventually decreasing to levels of non detection.

SAFETY AND EFFICACY

In Vitro Lab, South Korea

Test efficacy of **betterair** individual strains of bacteria, against 6 forms of pathogenic bacteria and 3 strains of toxin producing mold

1 - Inhalation infection test

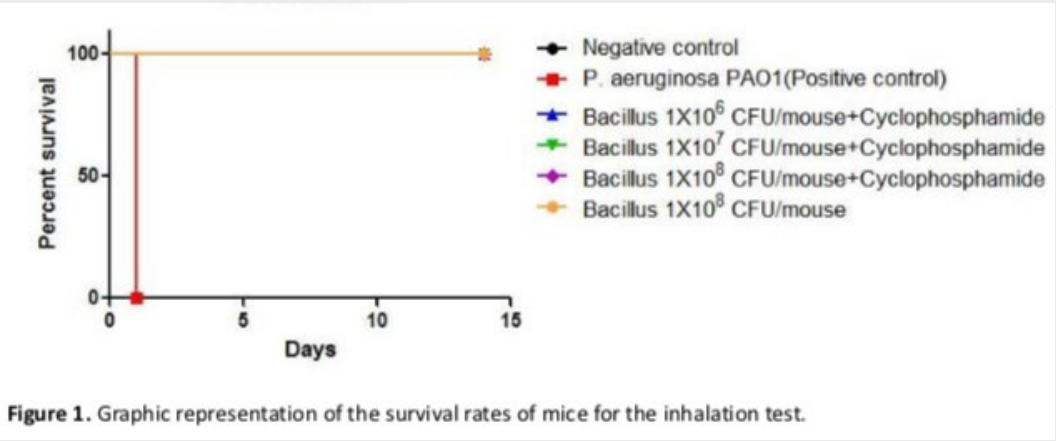
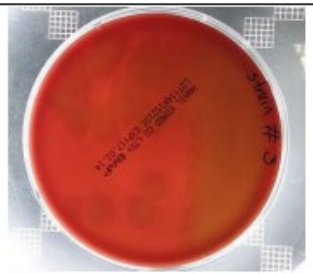


Figure 1. Graphic representation of the survival rates of mice for the inhalation test.

2 - Lecithinase and hemolysis activity

Strain / Test	Lecithinase	Hemolysis
Bacillus subtilis 3		
Result	Negative	Gamma

Safety Studies

- Safety test of our **product** in accordance with EPA protocols as part of a certification processs.
- Effect on inhalation - Lung Challenge test
- Antibiotics susceptibility test to determine resistance to antibiotics.
- Passed the inhalation test and no residual presence of **betterair** bacteria was found in the lungs after testing. DNA sequencing used.
- No breakdown of red blood cells - Lack of Hemolysis.
- Do not produce Lecithinase enzyme which breaks down lecithin, an essential component of body cell membranes.

Summary

In this booklet, we have displayed study cases showing the efficacy of our products together with various conclusive safety tests completed at external laboratories.

We exhibited the ability of our strains in inhibition of various bacteria and mold ubiquitous to indoor environments, both in laboratory experiments and also in "real life" indoor environments, together with various allergens reduction.

We have also exhibited our strains safety by lack of Hemolysis and Lecithinase activity together with antibiotic susceptibility. in addition, our strains passed a stringent lung challenge test.

betterair

Team

betterair

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