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The positive effects of office plants

New University of Technology Sydney (UTS) research made possible by nursery levy voluntary contribution funding has found strong evidence supporting the benefits of office plants for reducing stress and negative mood states in office workers. Plants were found to promote wellbeing, and therefore, potentially performance. Staff who had plants placed in their offices showed reductions in stress levels and negative feelings of a magnitude of 30 to 60%, while those with no plants recorded increases in stress and negativity of 20 to 40%, over the 3-month test period. Importantly, just one office plant was enough to make all the difference. In this Nursery Paper, the researchers involved outline their findings.

**The photos featured in this Nursery Paper are all examples of office plants*

*Photo courtesy of Ambius

The positive effects of office plants

Previous UTS indoor plant research focused on the benefits of pot-plants in reducing urban indoor air pollution[1,2], in particular, types of contaminant almost always found in higher concentrations indoors than outside - volatile organic compounds (VOCs) emitting from plastic/synthetic materials (furnishings, furniture, equipment like computers, copiers etc), and CO_2 (from occupants breathing). It has been shown that cleaner air leads to better cardiovascular health and clearer thinking[3,4]. It is also well known that negative mood states can reduce productivity and performance, and stress can lead to serious illness[5-9].

This study aimed to examine the extent to which the presence of one or more indoor plants could directly be associated with reductions in stress and negative mood states in office staff.

Previous research has found that indoor plants can result in directly measurable health benefits to building occupants, such as reductions in staff sick leave, possibly over 60%, as well as reduced sick leave absences among school children[9]. Productivity gains on computer tasks, and reductions in perceptions of pain and discomfort, have also been recorded when plants are present[10,11].

Furthermore, beneficial impacts of indoor plants in nursing homes for dementia sufferers have also been reported, including better-stimulated senses and more positive emotional feelings[12]. A survey with some 450 respondents found that, on all 10 job-satisfaction criteria tested, scores were higher among staff with plants, and that indoor plants were preferred to window views of planted exteriors[13].

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Study design

Four leafy plant treatments were used: 1 or 3 desk plant specimens (200 mm pots) of *Spathiphyllum* 'Petite', or 1 or 2 floor specimens (300 mm pots) of *Dracaena* 'Janet Craig', plus a no-plant control group. After obtaining UTS Human Research Ethics Committee approval, a baseline measure called the *Lifestyle Appraisal Questionnaire* (LAQ)[14] was administered before the plants were installed. The LAQ confirmed that both the male and female staff participants had physical and mental health scores similar to those of the general community over the same age range and sex. Two other internationally validated psychological questionnaire measures were then used to test the effects of plants on negative mood states and levels of stress in participants. Two rounds of each measure were administered, the first before the plants were installed, and the second after they had been in the offices for about three months (one teaching semester).

Of 55 original participants, 40 individuals completed all the psychological measures. This response rate (72%) is scientifically acceptable, with return rates commonly being in the range 18 to 35%[15,16]. The two selected measures have been used by health professionals for over 30 years to assess mental health status in such states as anxiety, depressive mood, stress, and so on, in a number of clinical and non-clinical situations. The two measures were:

The Profile of Mood States (POMS)[17] comprises 65 items that make up six sub-tests, plus a composite total measure. The six sub-categories include five negative states: tension (anxiety), depressive mood, feelings of anger, levels of fatigue, confusion, and one positive state called vigour, plus the composite total. Participants respond on a five-point Likert scale, 0 to 4, with 0- being 'Not at all like me', to 4- 'Extremely like me', with descriptors such as 'Friendly', 'Hopeless', 'Energetic', 'Sympathetic', etc.

The General Health Questionnaire (GHQ)[18] assesses recent or current feelings of stress, revealed by responses on such matters as ability to concentrate, sleep, or make decisions. The 30-question version of the test was used here. The survey uses a four-point Likert scale: 1- 'Better than usual', 2- 'Same as usual', 3- 'Less than usual', and 4- 'Much less than usual', the last two responses indicating increasing feelings of stress, and summed for final scores.

Study Results

Reductions in POMS scores with plant presence

Changes in mean total scores in the four plant treatments and the control group are shown in Figure 1. All the plant treatments yielded similar positive results. This means that just one plant can make all the difference in raising mood and reducing stress levels. The no-plant control group in contrast scored a 30% increase in overall negative feelings.

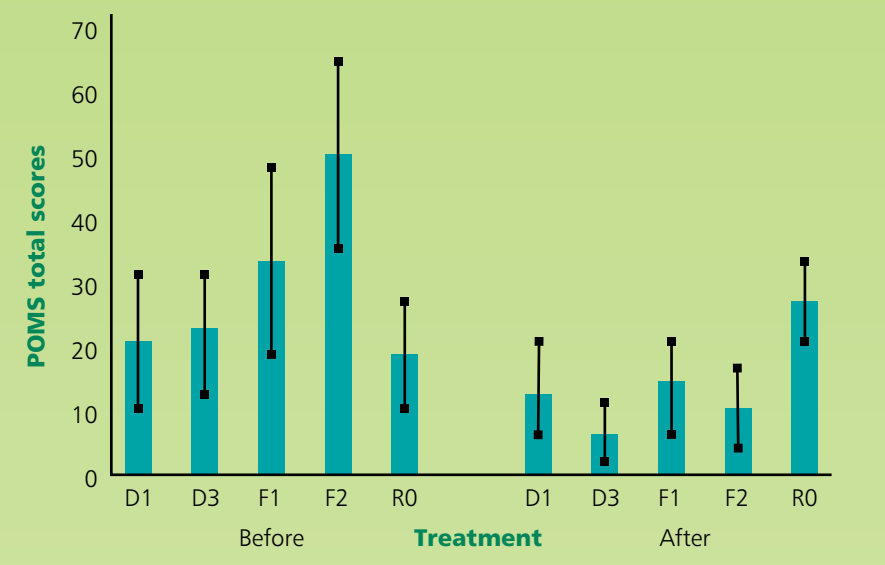

Figure 1. Differences in POMS scores in the five treatment groups before and after plant placement. (Code: D1 and D3: 1 or 3 desk plants; F1 and F2: 1 or 2 floor plants; R0: control – no plants. Means ± SE, N = 7-9).

In the six sub-categories (Table 1), plant presence resulted in very large statistically significant reductions in negative mood feelings, of around 30 to 60%, as well as in overall totals, while feelings of vigour (enthusiasm, energy) remained level over the period. However, in the control group, there was a decrease in vigour of nearly 30%, and an increase of over 40% in overall negative feelings. However, with only a small number of control participants in this treatment, the results for this group were not statistically significant below the 5% probability level.

Table 1. Difference in scores for POMS, sub-categories and totals, for participants before and after plant placements, plus no-plant control group. (N with plants = 31; N with no plants = 9)

Sub-category/ Score differences before and after plant placement	No-plant Control group	With plants
Tension/Anxiety	no change	37% reduction*
Depression/Dejection	32% reduction	58% reduction**
Anger/Hostility	no change	44% reduction**
Fatigue	no change	38% reduction*
Confusion	no change	30% reduction**
Vigour	28% reduction	no change
Changes in overall negativity scores	42% increase	64% reduction**

* Difference statistically significant (p≤0.05);
**Difference highly significant (p≤0.001)
No asterisk – difference not statistically significant.

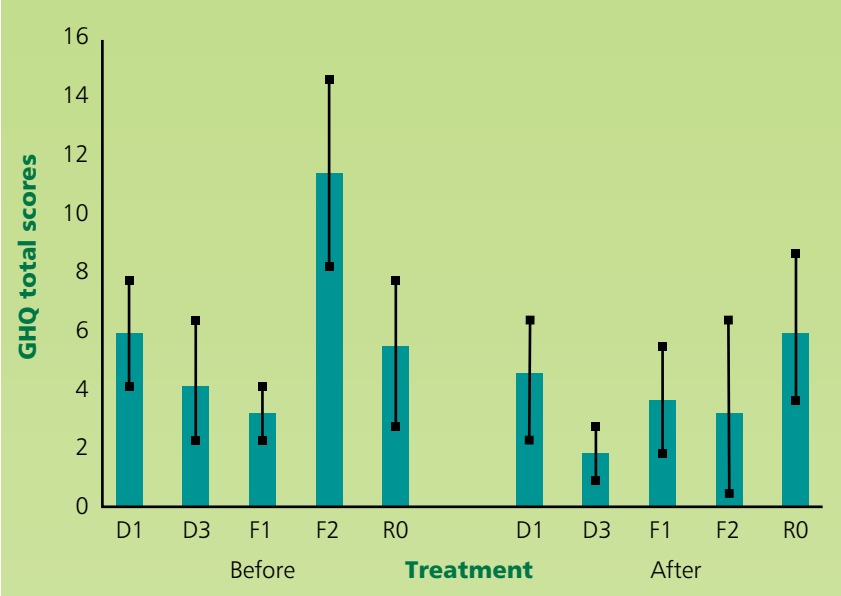

Figure 2. Differences in total GHQ scores in the treatment groups before and after plant placement. (Code: D1 and D3: 1 or 3 desk plants; F1 and F2: 1 or 2 floor plants; R0: reference/control – no plants. Means ± SE, N = 7-9).

Reductions in GHQ scores with plant presence

Changes in mean total scores for the 'more stressed' plus 'very stressed' responses among the four individual plant treatments and the no-plant group, are shown in Figure 2, while the overall results for plant presence/absence are presented in Table 2. The results show similar responses to those found with the POMS questionnaires. Plant presence was again associated with a very significant reduction of 50% in feelings of stress or anxiety. In contrast, the no-plant groups recorded a 20% increase in stress scores over the 3-month period (as would be expected towards the university examination period), but again, because of the small size and variability in the control group, this increase was not statistically significant at p≤0.05).

Table 2. GHQ scores for participants before and after plant placement, plus no-plant control group. (N with plants = 31; N with no plants = 9)

Treatments/Score differences before and after plant placements	Differences
With plants	50% reduction**
No plants	20% increase

**Difference highly significant (p≤0.001).
No asterisk – difference not statistically significant.

Significance of findings

This is the first study designed to investigate directly the effects of plant presence on negative mood states in building occupants, and the first to utilise internationally validated psychological measures for assessing the potential benefits of indoor plants. The results show that plant presence is associated with large reductions in negative mood states and levels of stress among building occupants. Presumably similar benefits can be predicted for indoor plants placed in the home, in health care facilities, or other building situations. Environmental psychologists consider that close-by living greenery is beneficial because it acts as a restorative environment at a subconscious level. Nearby plants relieve 'attention fatigue' and 're-set' a feeling of calm, which reflects our evolutionary history of dependence on plants for shelter and security[19].

On a cautionary note, the number of participants completing all questionnaires was relatively small for psychological testing, and a larger survey is needed to confirm and advance further our understanding of indoor plant/human wellbeing relationships.

Our previous studies[1,2] have demonstrated that a couple of pot-plants per office-space can bring significant reductions in indoor VOC levels, and for CO_2 reductions, the more foliage the better. We are currently profiling CO_2 uptake capacities under various lighting regimes to gain a more detailed understanding of species differences in CO_2 uptake performance, but for now, place plants according to their recommended shade tolerances for optimum results.

This study shows that just one plant per workspace can provide a very large lift to staff spirits, and so promote wellbeing and performance.

*Photo courtesy of Ambius

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Acknowledgements

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