

Utilization of horticultural crops as natural stimulants to enhance sleep quality in healthcare nursing workers engaged in night shifts

Kanimozhi Chakrapani^{1*} and B. Kalpana²

¹Department of Floriculture and Landscape Architecture, SRM College of Agricultural Sciences, SRM Institute of Science and Technology, Baburayanpettai, Chengalpattu District- 603 201, Tamil Nadu, India. ²School of Public Health, SRM Medicine and Health Science, SRM Institute of Science and Technology, Kattankulathur, Chengalpattu District- 603 203, Tamil Nadu, India *E-mail: kanimozc@srmist.edu.in, kalpanab@srmist.edu.in

Abstract

This study was conducted to evaluate the impact of horticultural crops as natural stimulants in overcoming sleep deprivation issues among healthcare professionals. The research approach used for the study is a static group pre-test and post-test design, with 60 nursing professionals grouped into an HT (n=30) and a control group (n=30). The experimental group was exposed to natural stimulants in the form of indoor plants as a visual stimulant, lavender as a smell stimulant, and chamomile as a taste stimulant, and achieved better results in physiological measures (blood pressure and heart rate) and the sleep quality index. The pre-test value for the Pittsburgh Sleep Quality Index indicated a sleep deprivation score of 10.72 ± 1.53 during the pre-test, and it improved the sleep level with a post-test value of 6.66 ± 0.95 . The drop in blood pressure, as measured by systolic and diastolic blood pressure and heart rate, has been a positive sign of the effectiveness of horticultural therapeutic approaches, with a *P*-value of 0.01, indicating significance at the 1% level. The subjective feedback indicates that the combination effect of all three stimulants, followed by the lavender plant as a smell stimulant, has achieved a more satisfactory level. As the results signify the healing effect of the plants on healthcare professionals' sleep issues, it paves the way for exploring more horticultural crops as sensory stimulants in terms of their influencing aromatic properties, texture, fragrance, and appeal. The first-line sleep issues can be addressed sustainably by utilizing horticulture plants as stimulants, which are safer, more accessible, and cost-effective.

Key words: Aromatic oil, chamomile, indoor plants, lavender, natural stimulants, Pittsburgh sleep quality index, shift work disorder.

Introduction

Good sleep is heavenly and brings in positivity and concomitantly keeping us healthy. The Cenozoic era we are living at present have a society which works in shift patterns and the sleep is deprived, these nonstandard schedules (UCLA health hospital, 2024) of work affects the way we eat, sleep, physique and maintain relationships. Having to work in the night shifts the employees were challenged with dissipating circadian wake promoting signal which is associated with fatigue, sleepiness, poor performance, compared to working in regular shifts (Fossum *et al.*, 2014) and the unusual working pattern may impact on our lifestyle even after we retire. The out of rhythm working style makes them de-synchronized with the day work focused environment shared by their co employees and families having a negative consequences (Lancel *et al.*, 2021). In India the time zone difference among companies, changing lifestyle among younger generation, higher pay, higher level of creativity during night are the reasons behind the popularity of the employees working in the night shifts (Harsh Kashyap, 2021).

One of the primary obstacles of shift work is the requirement to slumber against the clock. Is it possible that the health care sector's employees, who are known for their exceptional care and service, are experiencing better health than their patients? In addition to the challenges of working in a complex environment with exposure to chemicals, pathogens, and radiation, the

responsibility of providing patient care during night shifts can also result in stress. According to Joseph and Joseph (2016), health care workers are not significantly better off than the general population in terms of non-communicable diseases, including heart disease and high blood pressure. This is indicative of a lack of practice in spite of their proselytizing. The protection of healthcare workers from these workplace hazards is equivalent to that of any other category of workers, including miners and construction workers. It is crucial that we allocate sufficient time to unwind, not only for ourselves but also for those who operate at various levels of the healthcare sector.

Considering the sleep issues numerous plant based solutions were evident with remedies from complementary therapies through indoor plants and aromatic plants. It was evident from the studies that when 30 college students who had sleep deprivation issues when introduced with indoor plants had PSQI values decreased (Jingqi Yangin *et al.*, 2024) and the efficacy of indoor gardening with 23 dementia patients (Lee and Kim, 2008) on a five week study improved sleep onset and nocturnal sleep efficiency. When *Lavendula* species was studied for its effectiveness on sleep satisfaction among hospice patients it was effective (Eun *et al.*, 2018) and when the lavender steam inhaled it lowered the PSQI value among menopause women (Meryam *et al.*, 2020). The chamomile was used as therapy for sleep improvement in elders (Adib and Mousavi, 2017) and it was effective in improving sleep quality and latency and for the post natal women, a modest effect

was observed (Chang and Chenm 2016). When a combination of virtual drawing task along with fragrance blending was introduced to health individuals it seems to reduce their stress level (Girija *et al*, 2020). Thus, while existing literature has largely examined individual sensory stimulants for improving sleep, this study introduces a multimodal approach combining lavender oil as an olfactory stimulant, chamomile tea as a gustatory stimulant, and a foliage plant as a visual stimulant to enhance sleep among healthcare nursing staff. A recent study at Tehran heart centre though not clinically significant claims that less you sleep the more is the blood pressure. The American College of Cardiology scientist (Hosseini, 2024) found that sleeping less than 7 hours was associated with 7 % increased risk of high blood pressure and sleeping less than 5 hours leads to 11 % increase in blood pressure and more riskier in females. Several Indian states have issued notifications permitting the employment of women in night shifts to promote a more inclusive workplace (Nishith, 2023). However, the associated health aspects still need due consideration. The women employees experience emotional tension and health issues as a result of the irregular working hours and shift changes. Given this, the study was conducted to ascertain the impact of nature-based therapies on the reduction of chronic disorders and the enhancement of nursing women staff sleep, as they are interrelated.

Materials and methods

Methodology: The static pre-test and post-test design with intervention and placebo group was used as the research design (Fig. 1). Considering natural therapy as solution for sleep deprivation problems it was necessary to take a control group to validate the results for real world applicability. The sample size was calculated using G* and with effect size 0.5 and with 95% confident interval it was 44 samples including intervention and control group, however considering the dropouts during the program 60 samples with 30 in control and 30 in intervention group was maintained throughout the study. The duration of the study was 6 weeks and the intervention was carried out in the working place environment at the night time and at the sleeping environment during day time at their sleeping place.

Statistical Analysis: The statistical analysis was done through descriptive and inferential statistics. The frequency and percentage was calculated for the socio demographic variables and the paired sample test with equal variance was done for the physiological and PSQI measure. For subjective feedback pie chart was used to depict the percentage.

Questionnaires: The scales used for the study are the gold standard for measuring stress, well-being, and sleep quality, as

recommended by the expanding corpus of research. The validity, test-retest reliability, and internal consistency of the instruments used have been acknowledged in previous literatures.

Demographic variables: The datas were collected through questionnaires focusing details on their shift working nature; sleeping environment and the socio demographic status were obtained.

Pittsburg Sleep Quality Index: The Pittsburg Sleep Quality Index (PSQI) was created to assess sleep quality in clinical populations (Buysee *et al.*, 1989). The questionnaire's 19 self-reported items fall into seven subcategories: subjective sleep quality, latency, duration, efficiency, disruptions, medication use, and daytime functioning and the scale's psychometric qualities have been studied extensively, and have good validity and reliability.

Subjective feedbacks: The subjective feedbacks through five point likert scale was obtained on the following horticulture intervention. 1. The influence of lavender as smell stimulant for sleep improvement, 2. The influence of chamomile as taste stimulant on sleep improvement, 3. The influence of foliage plants as visual stimulant on sleep improvement, 4. The influence of overall horticulture therapy on sleep improvement.

Indoor plants: The houseplants used in the study were Pothos, Chinese evergreen and Snake plant which are easy to care and were provided to the Horticulture therapy (HT) group in decorated pots.

Lavender oils: The lavender based essential oil was put in small bottle vials constituting around 5 mL and provided with hand painted pots along with potpourri.

Chamomile tea bags: The chamomile tea bags with easy dip in hot water were provided to the HT group.

The data were obtained following ethical standards and contacting the Chief nursing officer and the work was carried out at the horticulture centre and at the sleeping place of the participants.

Results

Socio demographic variables: The socio demographic study was obtained from both the intervention and control group and the data of the total sample is presented in Table 1. The gender included only female nursing staff and the education is all with a nursing degree. The sample population included more number of participants in the age group of 36 to 50 with a value of 65% and the maximum experience category lies in between 1 to 10

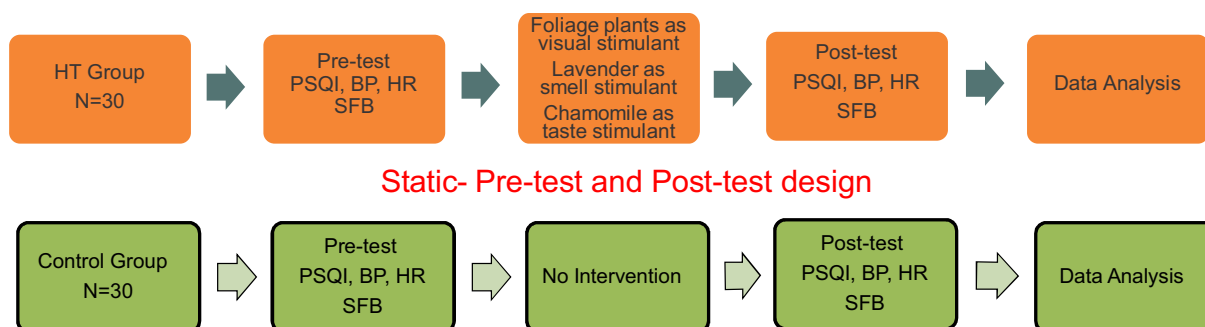


Fig. 1: Graphical representation of the abstract portraying the research approach. Abbreviations: PSQI- Pittsburg sleep quality index, BP- Blood pressure, HR- Heart rate, SFB- Subjective feedback

years with a percentile score of 61.7%. The marital status included more women in married category with 63.3 % and the earnings showed the category earning in between Rs. 16000 to 50000.

Table 1. Socio demographic variables of the health care nursing staff

Variables		Total (n=60)		HT (n=30)		Control (n=30)	
		n	F%	n	F%	n	F%
Gender	Male	00	0.0	00	0.0	00	0.0
	Female	60	100	30	50	30	50
Age	20-35	18	30	16	53.3	02	6.7
	36-50	39	65	13	43.3	26	86.7
	> 51	03	5	01	3.3	02	6.7
Education	SSLC	00	00	00	00	00	00
	HSC	00	00	00	00	00	00
	Degree	60	100	30	100	30	100
Experience	< 1year	15	25.0	13	43.3	02	6.7
	1-10 years	37	61.7	14	46.7	23	76.7
	> 10 years	08	13.3	03	10	05	16.6
Marital status	Married	38	63.3	12	40	26	80
	Unmarried	21	35.	17	56.7	04	20
	Divorced/widower	01	1.7	01	3.3	00	00
Income	< Rs. 15000	13	21.7	05	16.7	08	26.7
	Rs. 16000- 50000	33	55	20	66.7	13	43.3
	> Rs. 50000	14	23.3	05	16.7	09	30

Blood pressure and pulse rate: The systolic pressure value during the pre test was 128.53±12.19 which was reduced to 123.26±12.48 after the intervention and the values were compared to the control group and the resulting t value was 2.52 with with p value 0.01. The diastolic pressure was 86.20±5.35 and reduced to 82.76±6.85 with a mean difference of 3.43 with p value of 2.14 with p value 0.01. The heart rate per minute was 84.23±15.05 before intervention and reduced to 80.76±13.73 after post intervention with a difference of 4.8 and t value is 2.62 with p value of 0.005 (Table 2).

Table 2. The physiological measures of blood pressure and heart rate of the intervention and control group during pre-test and post-test

Measures	Pre-test	Post-test	Diff	t	P
BP Systolic					
Treatment	128.53±12.19	123.26±12.48	5.26	2.12	0.01
Control	129.60±9.80	129.23±9.91	0.36		
Diastolic					
Treatment	86.20±5.35	82.76±6.85	3.43	2.14	0.01
Control	87.76±5.15	87.36± 5.15	0.33		
Heart Rate					
Treatment	84.23±15.05	80.76±13.73	4.8	2.62	0.005
Control	87.06±13.73	87.13±9.65	0.07		

Pittsburgh sleep quality index: The Pittsburgh sleep quality index consisting of seven components presented in Table 3 along with the total PSQI value for both intervention and control group before and after intervention. The values are non-significant for component six on sleep medication with P value 0.24. The total PSQI values have a mean difference of 4.06 between the pre-test value of 10.72±1.53 to post test value of 6.66±0.95 having t value of 2.5 and the P value is 0.01 and they are statistically significant.

Subjective feedbacks: The subjective feedbacks were collected in a five-point likert scale and presented in pie diagram for four different parameters on visual, smell, taste stimulants along with overall combination effect over sleep.

The effect of foliage indoor plants on sleep improvement: The

Table 3. The Pittsburgh Sleep Quality Index of Pre-test and post test value of HT and control group

PSQI Index	Pre-test	Post-test	Diff	t	P
Sleep Quality					
Treatment	1.67±0.71	1.03±0.89	0.63	2.08	0.02
Control	1.60±0.81	1.63±0.96	0.03		
Sleep Latency					
Treatment	1.70±0.53	1.17±0.65	0.53	3.96	0.0001
Control	1.67±0.66	1.93±1.08	0.27		
Sleep Duration					
Treatment	1.57±0.57	1.03±0.81	0.53	2.98	0.002
Control	1.57±0.57	1.53±0.63	0.03		
Habitual Sleep efficiency					
Treatment	1.56±0.89	0.73±0.69	0.83	3.47	0.0004
Control	1.83±0.87	1.63±0.81	0.20		
Sleep Distribution					
Treatment	1.97±0.61	1.27±0.64	0.70	3.28	0.0008
Control	2.03±0.81	1.93±0.69	0.10		
Use of sleeping medication					
Treatment	0.17±0.38	0.13±0.35	0.03	0.69	0.24*
Control	0.20±0.41	0.23±0.41	0.03		
Daytime dysfunction					
Treatment	2.07±0.64	1.30±0.65	0.77	2.82	0.003
Control	2.07±0.83	1.80±0.92	0.27		
Total PSQI					
Treatment	10.72±1.53	6.66±0.95	4.06	2.55	0.01
Control	10.98±1.57	9.85±1.41	1.13		

PSQI: Pittsburgh sleep quality index, Diff- difference * Non-significant

feedbacks for the indoor plants have 34% employees reporting in neutral, and 27% expressed dissatisfaction for sleep improvement during their daytime (Fig. 1).

The effect of lavender on sleep improvement: Around 54% employees expressed complete satisfaction for the fragrant oil as smell stimulant and only 3% showed dissatisfaction (Fig. 2).

The effect of chamomile on sleep improvement: The feedbacks for chamomile on sleep improvement had 23 % in completely satisfied and 23% in completely dissatisfied and 23 % in dissatisfied considering its taste (Fig. 3).

The effect of overall horticulture therapy on sleep improvement: The feedback for the overall influence had 40 % in completely satisfied, 27% in satisfied category with 20% employees remained neutral (Fig. 4).

Discussion

The research findings with horticulture therapy encountering the combination of the three stimulants (visual, smell, and taste) on the night working health care nursing staff had a positive result. The blood pressure and the heart rate had improvement compared with the control group. The PSQI values were also found to show a decrease in their level after encountering the interventions. The subjective feedbacks showed more satisfactory level for the combination of therapy followed by lavender oil, chamomile teas and the foliage plants.

As the results showcased the combination of horticultural crops together as stimulants had positive impact, these crops together can be used as an integrative medicine and can act as a healing-oriented medicine concerning the whole body mind and spirit (Shoemaker, 2019). Among the three stimulants the effect of lavender had better feedback comparatively for sleep improvement and would have favoured lowering the PSQI and

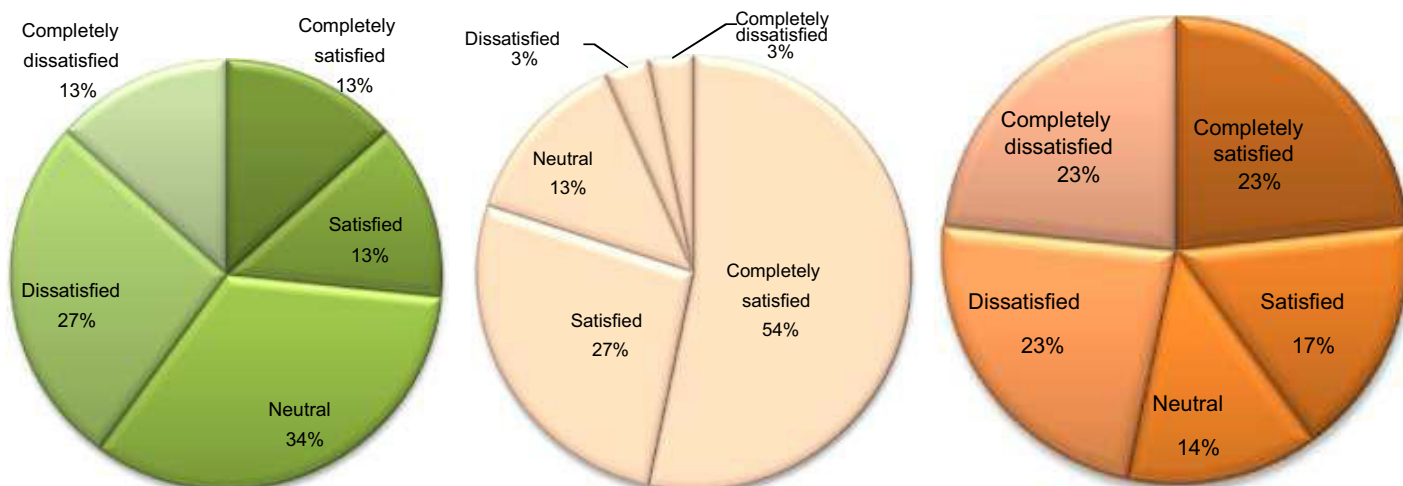


Fig. 1. Impact of indoor plants as visual stimulant. Fig. 2. Impact of lavender oil as smell stimulant. Fig. 3. Impact of chamomile tea as taste stimulant.

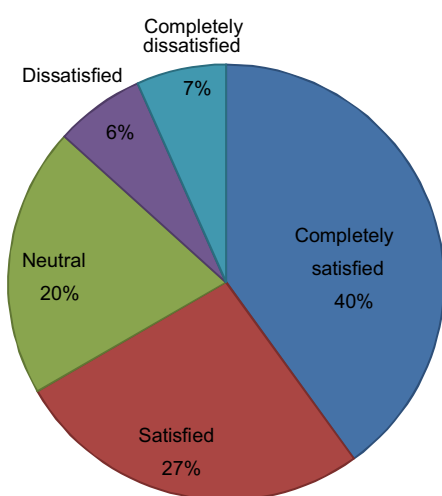


Fig. 4. Overall impact of horticulture interventions as sleep stimulant.

this might be due to the fact that the modern era is looking for natural curative formulations as remedy rather than the synthetic pharmacological agents (Kajjari *et al.*, 2022) and the commonly researched medicinal herb is *Lavandula* species and scientists Goel *et al.* and Lewith *et al.*, 2005 claims the lavender essential oil improve the sleep quality among people suffering insomnia. The purple-blue flowering shrub with Linalyl acetate and Linalool as ingredients (Karadag *et al.*, 2017) offers solutions to various invasive treatments besides their sedative properties. There is a need to explore this herb for its much more therapeutic properties because despite the *Lavandula* genus comprising approximately 47 recognized species only limited species such as *Lavandula angustifolia*, *Lavandula latifolia*, *Lavandula stoechas*, and *Lavandula intermedia* are being frequently utilized (Cavanagh and Wilkinson 2002), consequently there is a necessity to concentrate on collection, conservation and proclaiming its medicinal properties. The aromatic plant lavender used for the therapy helps in lowering stress and brings in a sense of calm and please our senses.

The taste stimulant Chamomile teas also favored the sleep therapy as they have the sedative hypnotic properties among the folklores and it has been recommended for postpartum women as supplementary to overcome depression and sleep issues (Chang, and Chen, 2016). One of the asteraceae families wonder the *Matricaria chamomilla* L is often regarded as the

‘star of the medicinal species’ pertaining to its multi therapeutic approach values (Bhawana and Muktesh, 2022) and notably for its tranquilizing and sedative effects (Dai *et al.*, 2022). The primary component of chamomile utilized for its therapeutic benefits is its flower. The flower comprises numerous bioactive chemicals, including flavonoids (Hashempur *et al.*, 2017) and terpenoids, which are thought to facilitate its putative sleep-enhancing properties (He *et al.*, 2022). The energetic association of the chamomiles to the sun terming them as ‘solar herb’, in the middle ages the plant is called as plant doctor and its medicinal usage dates back to the antiquity with Hippocrates. The Egyptians valued the plants for curing malaria; The Anglo-Saxons believed the plant to have special powers; the Europeans valued the plant for its relaxing and soothing properties for stomach complaints and women issues (Ronald and Victor 2016). It proves us that the plant kingdom significantly enhanced human health in the absence of manmade medicines and surgical procedures, consequently, it is essential to preserve these plants linked to indigenous knowledge for human advancement and well-being.

The indoor plants have the tendency to act as air purifiers and lifting the mood in the working and sleeping environment and visualizing the plants before sleep would have contributed to decrease in blood pressure and pulse rate and this is in line of previous literature where the indoor plants decreased the systolic and diastolic blood pressure bringing comfort, soothing and natural feel (Lee *et al.*, 2015). The indoor plants act as visual stimulant (Jeong *et al.*, 2021) this can be compared with a study where the green walls replaced the white walls it acted as an visual stimuli and decreased the heart rate (Son *et al.*, 2004). The NASA has recommended indoor plants for combating the sick building syndrome and suggested a list of 15 plants and amongst them is the prominent plants, the Chinese evergreen, snake plant and the money plants. These plants have multiple benefits and these can be recommended according to ones need.

While there is much research which focuses on HT through qualitative data amongst various population there is limited quantitative research and hence this study concentrated on the effect of therapeutic horticulture impacting the women employees on their physiological measures and sleep deprivation issues. The limitation of the study was the study concentrated on women nursing employees alone in the health care sector and needs a

more sample size and more therapist to prove it as a clinically study rather than statistically significant study alone. The program is an interdisciplinary work concerning the public health and hence data shouldn't be ambiguous and a lack of quantitative data will not acknowledge for clinical decision making considering HT for stress relief and improving sleep. The study has taken the major crops lavender and chamomile considering its sedative properties however there are many crops (Lelli *et al.*, 2021) like valerian (*Valeriana officinalis*), jasmine (*Jasminum* spp.), or even lemon balm (*Melissa officinalis*) which have to be studied for their effects on sleep, and could offer valuable additions to the findings. Thus the therapy is suitable for the clinicians to recommend as first line treatment measure until clinically proven through trials. Incorporating the healing power of nature into ICU environments is not just a visionary pursuit; it's an imperative step towards enhancing patient recovery, uplifting family well-being, and nurturing the resilience of our ICU caregivers (Van Iperen *et al.*, 2023).

There is a dearth of research on the hazards encountered by healthcare workers in our country. It is imperative that we broaden the scope of the research to include the combination or multiples of natural elements around as to act as stimuli rather than relying on single-centered therapies. Interventions that are intended for widespread implementation will be spurred by this, alone. A path towards evidence based research in health care in Horticulture therapy will create a standard and will be recommended for further treatments and to be an accepted health care solution. Thus the effect of horticultural crops as sense stimulants has profound effect and can be recommended as first line treatment for the patients as the cost of medication for sleep issues are in billions of dollars annually (Shahly *et al.*, 2012). Towards a sustainable health management practices the horticultural plants plays an important role due to its health benefits and lower cost leading to increased interest in alternative medicines and therapeutic applications compared to synthetic medications. It is imperative to prioritize the occupational health of health workers and guarantee that the personnel is adequately trained and in good health. It is our responsibility as humanitarians to assist the most vulnerable groups; The path forward is no longer "Physician heal thyself," but rather "Physician protect thyself."

Ethical approval: The study was approved by the institutional ethics committee (IEC), School of Public Health, SRM Medical College Hospital and Research Institute, Kattankulathur, Chengalpattu district, with a reference number 0043/IEC/2023, dates 11.12.2023.

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