

Chlorophyll Over Cortisol: Exploring green path to Well-Being

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Abstract

Chronic psychological stress, mediated by prolonged activation of the hypothalamic-pituitary-adrenal (HPA) axis, leads to sustained elevations in cortisol levels in humans, which contribute to metabolic dysregulation, immune suppression, and cognitive decline. Recent interdisciplinary research in environmental psychology and public health states that exposure and physical interaction of people with higher cortisol level to plant-based environments such as horticultural therapy, Aroma therapy, eco-tourism, green spaces, and small-scale gardening can significantly influence stress-related physiological processes and improves mood by increasing serotonin which relaxes the nervous system, reduces anxiety and mental fatigue, gives a sense of satisfaction and focus. Controlled trials have documented reductions in salivary cortisol ranging from 10 to 35%, which improves the mood measures between 20 - 30% following structured interaction with the vegetation. Many professionals are quitting and returning to farming and preferring a green lifestyle due to high job stress, poor work-life balance, health issues, and a desire for a more meaningful and nature-oriented; organic lifestyle. Thus, the relationship between plants and people may extend beyond nutrition and environmental sustainability to include mental wellness, the study suggest that green living could become an important component of a healthier and more balanced future.

Keywords: Stress, cortisol, serotonin, vegetations, anxiety, focus

Introduction

In the current modern humans inhabit environment is largely misaligned with their evolutionary designs. ~41% of employees globally experience high stress which is around 1 in 2 face this issue. In India ~32-34% Indians report being stressed, ~55% of professionals feel stressed at work & ~33.9% professionals have high stress says reports. Where their major causes include work pressure & long hours, poor work-life balance, digital overload. The shift of natural ecosystems to urban settling has drastically reduced the daily exposure to greenery and the physical activity, while psychological stressors have increased drastically. Although cortisol plays a crucial role in acute survival responses, its chronic elevation is associated with the pathological outcomes of the human health. Epidemiological data from the World Health Organization (WHO) suggest that the stress-related disorders constitute a significant portion of the

global disease burden, disproportionately affecting urban populations. Conversely, even limited contact with plant-rich environments has been shown to elicit measurable physiological recovery from these disorders.

Cortisol Without Off-Switch

Chronic HPA axis activation leads to persistent cortisol secretion, which completely disrupts physiological homeostasis. Baseline salivary cortisol in individuals experiencing stress is frequently elevated between 20 to 50% relative to non-stressed controls, as per psych neuroendocrinology study reports. This type of persistent elevation is linked to impair glucose metabolism, increased arterial/ventricle pressure, and suppressed immune functionaries. Factors inherent to these urban lifestyles—includes continuous exposure to digital screens, ambient noise pollution, reduced physical activity—impede parasympathetic system recovery, effectively diminishing the physiological mechanisms responsible for stress resolution.

System Breakdown - Not Just Fatigue

Prolonged cortisol predominance affects the multiple physiological systems beyond mental fatigue & regular anxiety. Neurologically, chronic stress correlates with the hippocampal dysfunction and an average ~20% reduction in attentional restoration capacity. Immunologically, natural killer (NK) cell activity can decline by 15 - 25%, undermining the host defense capacity in the human body. Psychologically, large-scale surveys and studies states ~70% of urban adults report to the moderate - high level perceived stress, with associations to elevated rates of anxiety and depressive disorders. These effects result in accumulation and reinforcement of one another, generating a feedback loop of deteriorating health and increasing the chronic stress.

Biological Correction, Not Just Coping

- ❖ Horticultural therapy which offers the neurochemical benefits for these disorders. Experimental data's reveal that active gardening results in significant reduction of stress biomarkers. i.e., A controlled study reports ~36.8% decline in salivary cortisol following 30 minutes of gardening, which also enhance the moods and reduced anxiety & mental fatigue.
- ❖ Aromatherapy involves in volatile plant-derived substances to affect the limbic system via olfactory pathways in the human body. Clinical trials

demonstrate that inhalation of lavender essential oil in recommend concentration can reduce cortisol by ~24 - 38%, while also enhancing sleep quality and lowering heart rates.

- ❖ Ecotherapy / eco-tourism, a passive green exposure which provides physical interaction with the natural environments that improve cognitive performance and physical health. Research indicates that ~1hour spent in such environment supports ~20% improvement in memory and attention relative to urban exposure.

Practical application transforming living spaces into biologically active environments

- ❖ Terrace gardening, the underutilized urban rooftop areas to create green spaces and producing their own family need food materials. Individuals engaging in brief rooftop gardening activities exhibit reductions in perceived chronic stress levels and stabilization of moods. Visual exposure to greenery alone has been associated with ~ 10 to 15% decreases in cortisol within short time frames
- ❖ Kitchen gardening combines nutritional and psychological advantages. Interaction with edible plants promotes dietary diversity & stress reduction. Soil contact introduces beneficial microbes such as *Mycobacterium vaccae*, which experimental studies suggest stimulate serotonin pathways and enhance mood regulations.
- ❖ Backyard gardening integrates physical activity. Moderate gardening contributes to cardiovascular health and lowers stress hormone levels. Longitudinal observations indicate gardeners maintain lower baseline cortisol and report better overall well-being than non-gardeners.

How Chlorophyll Counters Cortisol at a Biological Level?

The mechanisms by which plant exposure mitigates the cortisol involve multiple interacting pathways in the human system. Neuro-endocrine regulations through plant interaction directly suppress the cortisol secretion, with reductions up to ~35% observed in controlled environments. Olfactory stimulation by plant-derived aromatic/medicinal substances such as linalool & pinene activates the limbic system, reducing anxiety and promotes mood and mind relaxation. Furthermore, exposure to phytoncides—volatile bioactive substances emitted by plants—involves in enhancing the immune functions, potentially increasing NK cell activities by as much as ~50% during forest exposure which is the ecotourism.

Healing Through Nature

- ❖ Globally, ecotourism contributes ~20–25% of total tourism revenue.
- ❖ United States, United Kingdom, Brazil, China, Japan, South Africa are most popular for these activities.
- ❖ Nationally, ecotourism is blooming sector, post covid it grows rapidly ~9% annual growth rate.
- ❖ In India - Kerala (Munnar), Tamil Nadu (Ooty), Karnataka (Coorg), Himachal Pradesh (Shimla), Uttarakhand (Nainital), Jammu & Kashmir (Gulmarg), Sikkim (Gangtok), Meghalaya (Shillong), West Bengal (Darjeeling), Maharashtra (Mahabaleshwar) involve is major share of these sectors.
- ❖ Globally, ~30–50% of households engage in home gardening.
- ❖ In India, gardening adoption ranges ~40–76% in urban & rural shares, mostly as kitchen gardening or backyard gardening.

Stress Management Through Diet

- ❖ Antioxidants are in plenty amount in the colorful fresh fruits and vegetables which are harvested fresh and organic from the garden for family consumption needs, lowers oxidative stress and anxiety. Especially B-vitamins which supports neurotransmitter production (serotonin, dopamine)
- ❖ Spinach and green leafy vegetables from the home garden, rich in various mineral and vitamin sources which provides balanced nutrient source, reduces nerve excitability & calms the body.
- ❖ Whole grains, legumes from organic farms are power packed sources of basic essential nutrient source like carbs, protein, fats, aminos.
- ❖ Tryptophan from the seeds and pulses, increases serotonin, promoting mental stability.
- ❖ Omega-3 fatty acids from flaxseed, walnuts reduce inflammation and improve mood.
- ❖ Homemade probiotics like curd are reservoir of good microbes which improves gut-brain connection and stress regulation.

Conclusion

The predominance of chronic cortisol levels in contemporary human physiology arises not inevitably from the societal advancement but reflects a disconnection from natural environments. A growing body of scientific evidences supports that exposure to vegetations offers not merely symptomatic relief but corrective effects to human body by, restoring neuroendocrine equilibrium and enhancing overall health and well-being. Interventions such as terrace

gardening, kitchen gardening, and backyard gardens provide feasible, scalable approaches that can be incorporated into everyday life. Overlooking these alternatives in favor of exclusively pharmacological treatments may miss opportunities for holistic and sustainable stress management. Reintegrating chlorophyll-rich environments into daily living appears to be a promising strategy for attenuating cortisol-mediated stress and improving human health.

The modern lifestyle and increasing disconnection from nature may contribute to persistent psychological stress and elevated cortisol levels. Scientific evidence suggests that interaction with plants and green spaces can promote relaxation and support emotional well-being. Simple practices such as terrace gardening, kitchen gardening, sensory engagement, relaxation and a sense of accomplishment. Nature based approaches can complement, though not replace, appropriate medical and psychological care. Reconnecting with vegetation may therefore offer a simple, sustainable approach to managing everyday stress. Ultimately plants provide benefits beyond food and the environment, they may also contribute to healthier, calmer, and more meaningful lives.

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