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Review Paper

Comparative Efficacy of Adaptogens and Phytosterols in Enhancing Stress Resilience: A Data-Driven Synthesis of Psychological and Physiological Outcomes

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ABSTRACT

A critical assessment of both adaptogens and phytosterols as contributors to increased stress resilience will be presented with an emphasis on how both contribute to improved psychological and physiological dimensions of stress resiliency. The HPA axis also provides regulation of psychological and physiological processes known to contribute to resiliency through processes associated with HPA regulation, such as oxidative and inflammatory processes. Adaptogens such as *Withania somnifera* (known as ashwagandha) and *Rhodiola rosea* are thought to support resiliency by regulating HPA axis function, boosting mitochondrial efficiency, and activating stress response signalling pathways (Nrf2 and sirtuins). As a result of the mechanisms associated with these effects, individuals using adaptogens experience a decrease in anxiety, an increase in heart rate variability, and improved regulation of cortisol. On the other hand, phytosterols are primarily believed to exert benefits through physiological actions (i.e., lowering lipids and providing anti-inflammatory benefits) and improving mitochondrial quality through the mitochondrial clearance mechanism (mitophagy). There is currently little evidence to support the belief that phytosterols are beneficial for reducing stress from a psychological point of view. In summary, adaptogens appear to provide a greater range of benefit to both psychological (mental) and physiological functions related to resiliency than do phytosterols, which appear to function more as modifiers of metabolic and cellular states that are important for homeostasis. Additional randomized, controlled clinical trials using both adaptogens and phytosterols are needed to determine the combined effects of both phytosterols and adaptogens on stress reduction.

INTRODUCTION

The ability to manage stress (stress resilience) is important for a person's overall well-being and is

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influenced by the individual's ability to coordinate their neuroendocrine (N-E) system, which regulates the body's response to stressors through a variety of pathways, including the hypothalamic-pituitary-adrenal (HPA) axis, balances between the sympathetic and the parasympathetic nervous systems, the immune system, cellular energy metabolism, and cellular redox (antioxidant) status. Chronic stress causes long-term elevations of cortisol, catecholamines, and inflammatory mediators, which can result in a variety of biological and psychological dysfunctions, including oxidative damage, neuroinflammation, metabolic dysfunction, and increased risk of diseases such as anxiety, depression, heart disease, and neurodegeneration. Current research suggests that resilience is not simply the result of neutralizing stress-related free radicals; rather, resilience includes activation of the endogenous cellular stress-response pathways that help fortify natural defense systems (such as through the action of the transcriptional regulators Nrf2, NF-KB, HIF-1, and sirtuins) that regulate a variety of antioxidant enzymes, detoxifying systems, mitochondrial quality control, and cytoprotective proteins. It is also likely that most dietary phytochemical compounds function via a mechanism called hormesis, which is defined as low, non-toxic doses of compounds causing cells to mildly stress and therefore induce cellular protective adaptations. As a result of these processes, regular consumption of plant-based foods appears to result in greater resiliency to stress and lower risk of developing chronic diseases. [1]

In this context, adaptogens and phytosterols, both types of bioactive compounds, have emerged as important agents in enhancing resilience to stress through their ability to have effects on a variety of different targets within the cell.

Adaptogenic herbals, such as *Withania somnifera*, *Rhodiola rosea*, and *Panax ginseng*, aid the body

in responding to stress by normalizing the activity of the hypothalamic-pituitary-adrenal (HPA) axis, modifying neurotransmitters, improving mitochondrial efficiency, and decreasing the burden of concurrent inflammatory and oxidative stress. By doing so, adaptogens optimize how the body responds to stress, rather than inhibiting that response. Phytosterols (e.g., beta-sitosterol and stigmasterol), which are found in abundance in nuts, seeds, vegetable oils, and grains, help support the benefits of adaptogens by providing additional benefits beyond lowering lipids; they stabilize cell membranes, alter immune response, and enhance mitochondrial quality control through independent mechanisms such as mitophagy. Experimental studies demonstrate that these phytosterols can decrease oxidative-induced tissue damage (injury) and decrease inflammation by utilizing the PINK1/Parkin mitophagy pathway, as well as by modifying the gut microbiota-mitochondrial function axis, both of which are receiving increased attention as being fundamental to the body's adaptation to systemic stressors. As a group, adaptogens and phytosterols represent examples of how the dietary consumption of phytochemicals can enhance the body's ability to adapt to external stressors by promoting evolutionarily conserved adaptive stress response mechanisms, thereby strengthening cellular defenses to stressors and enhancing long-term physiological homeostasis. [12]

Context

Adaptogens and phytosterols can be thought of as two classes of natural substances that may enhance the body's ability to tolerate stress. They may do this by acting at many levels in the body, i.e., through modulating various neuroendocrine, immune, and cellular pathways associated with stress response. While both groups of natural substances appear to improve stress resilience through interventions that influence levels of both



psychological and physiological stress, the extent to which they differ in their respective effects on these categories has not yet been established. In this report, we review data from the cited references to examine how these two groups of natural products compare with respect to their ability to improve stressful episodes among general populations.

II. DATA SYNTHESIS

1. Measurement of Stress Resilience

- **Psychological Outcomes:** The best way to evaluate psychological consequences from research related to stress or anxiety is through use of validated psychometric measurements of subjective emotional states using standardized and repeatable methods. One of the most common psychometric instruments for use in this setting is the State-Trait Anxiety Inventory (STAI). This tool distinguishes between two types of anxiety: state anxiety (temporary and context-dependent) and trait anxiety (a more stable characteristic of one's personality). The structure of the STAI is made up of multiple items measured on a Likert scale, where the researcher can assess subjective feelings of anxiety, including tension, apprehension, nervousness, and worry, in order to determine how one's anxiety fluctuates throughout exposure (such as an acute psychological stressor), at the time of exposure (e.g., public speaking), and at recovery from exposure. The STAI's strength for measuring anxiety is derived from its sensitivity to acute psychological stress and strong correlation to physiological biomarkers of stress (e.g., heart rate variability (HRV), salivary cortisol, and sympathetic/parasympathetic nervous system responses). As a result, most studies assessing a psychological response from stress typically conduct multiple assessments with STAI (baseline [at rest], at induction of stress [e.g., mental arithmetic, public speaking, examination], and at

recovery) in order to document shifts in subjective anxiety perceptions measured by the STAI with objective physiological markers that can be measured. The concurrent use of the STAI, or other similar instruments, with physiological measures of stress increases the validity of an assessment of stress in that it allows for both subjective physiological perceptions and objective biological responses to be measured. [6] The SCARED (SCARED Childhood Anxiety Related Impairment Questionnaire) is an assessment of childhood/adolescent anxiety, utilizing input from both caregiver & child, by assessing multiple aspects of anxiety (generalized anxiety, separation anxiety, social anxiety, panic symptoms, & school refusal). Because children may interpret their anxiety symptoms differently than do their caregivers, caregivers' reports about children's anxiety serve to increase SCARED reliability; consequently, both children's & caregivers' reports of anxiety help providers interpret results related to treatment progress. At the present time, SCARED is administered prior to intervention (pre-treatment), midway through the intervention (mid-treatment), & following the intervention (post-treatment) in both clinical & research settings, ensuring reliable methods to measure changes in anxiety severity over time. Research has identified correlations between SCARED scores & biological variables (e.g., oxytocin release during parent-child interactions) & supported the utility of integrating psychological assessment approaches along with neurobiological assessment approaches to examine differences in the responsiveness of individuals to treatment. The relationship established between psychometric instruments such as STAI & SCARED provides clinicians with valuable information regarding levels of stress, anxiety, & treatment progress in their treatment efforts for children & adults. [18]



- **Physiological Outcomes:** Research of the physiological impact of stress resilience and phytosterols has primarily focused on quantifying physiological outcomes through use of somewhat objective measures (biomarkers) of autonomic regulation, endocrine stress responses, and systemic metabolic status. A reliable noninvasive measure of the autonomic nervous system is heart rate variability (HRV). HRV provides a reflection of the variability of the time between the heartbeats (i.e., between the heart). These beat-to-beat rhythm changes in cardiac rhythm are mediated through the balance of sympathetic and parasympathetic activity on cardiac function. HRV has consistently shown that lower values of RMSSD, low-frequency (LF) power, high-frequency (HF) power, and a high ratio of LF/HF indicate that the person is experiencing increased psychological stress, decreased activity in the vagus nerve, and reduced adaptability of the autonomic nervous system to respond to stress. Studies have shown that HRV is a sensitive measure of how an individual experiences acutely and chronically increasing stress, as well as an individual's recovery from stress. These studies support the necessity of using standardized procedures for inducing stress in a subject, having clear and consistent baseline comparisons, and employing valid HRV domains (time, frequency, and nonlinear HRV measures) to accurately interpret the physiology of stress. [6] Along with autonomic assessment, investigating patterns of cortisol response can provide some more insight into the dynamics of the hypothalamic-pituitary-adrenal (HPA) axis. The traditional method of evaluating cortisol levels involved simply analyzing average changes of cortisol across the population; however, more recent research has found individuals to have distinct patterns of cortisol change (rise-peak-fall, blunted, or exaggerated) in response to standardized stressors. The relationship between HRV and cortisol levels

only becomes clearly defined when looking at individuals with a "prototypical" cortisol pattern. Trajectory-based modelling of HRV and cortisol levels provides evidence that both variables interrelate as adaptive markers for stress recovery, unlike using averages alone. [25] Physiological impacts of phytosterols encompass multiple boundaries (lipid profile outcomes, oxidative stress indicators, inflammatory markers), including mitochondrial quality control/mitochondrial biogenesis. The phytosterols β -sitosterol and stigmasterol have been found to exhibit multiple beneficial effects through their action on oxidative stress, represented by increases in superoxide dismutase (SOD) and glutathione (GSH) and decreases in malondialdehyde (MDA), inhibition of inflammatory cytokines (IL-6 and TNF- α), and stimulation of PINK1/Parkin-mediated mitophagy while modifying the composition of the gut microbiome. Altogether, these effects could be related to the restoration of cellular homeostasis and the function of the organ. Ultimately, the aforementioned systems demonstrate that phytosterols exert their influence on not only lipid metabolism but also processes associated with inflammation, mitochondrial integrity, and stress-related physiology. [11,12]

2. Adaptogens: Effects on Stress Resilience

- **Mechanisms:** Rather than functioning as direct antioxidants, adaptogens increase resilience to stress by activating cellular pathways of stress response that have been conserved throughout evolution. Evidence shows that numerous plant compounds elicit genetic responses at the level of transcription factors through hormesis—the process of using low-dose, non-toxic exposure to induce mild stress in cells, which triggers protective gene expression. Examples of such transcription factors include Nrf2 (nuclear factor

erythroid 2-related factor 2), HIF-1 (hypoxia-inducible factor-1), and NF- κ B (nuclear factor kappa-light-chain-enhancer of activated B cells). Activation of Nrf2 increases the production of Phase II detoxifying and antioxidant enzymes such as superoxide dismutase (SOD), glutathione peroxidase, heme oxygenase-1 (HO-1), and NAD(P)H quinone oxidoreductase (NQO1); therefore, improving the balance between oxidative and reductive processes and subsequently making the cell less vulnerable to oxidative injury. HIF-1 functions to promote one's cellular adaptation to metabolic and hypoxic forms of stress; this occurs through the stimulation of glycolytic efficiency, increased formation of new blood vessels (angiogenesis), and enhanced protection of mitochondria. NF- κ B is frequently associated with inflammation, but under conditions of controlled activation (hormesis), this factor also primes the immune system and enhances cellular responses to cytoprotective stressors. This paradigm explains how the genetic responses of adaptation to oxidative, metabolic, inflammatory, and proteotoxic forms of stress by plant phytochemicals are evident across all tissues (including the nervous system), regardless of the mode by which the phytochemicals exert their effects, via an adaptogen-based garden.

In addition to transcriptional regulation, adaptogens can also affect trophic and longevity-signaling pathways by increasing the signaling of neurotrophic factors such as BDNF and NGF. This is important for the development of synaptic plasticity, neuronal survival, and cognitive resilience in response to stressors through the activation of sirtuins (SIRT1 and related proteins), which are NAD⁺-dependent deacetylases involved in mitochondrial biogenesis, improving energy metabolism, DNA repair, and cell longevity. By activating pathways within MAPK pathways, insulin/IGF pathways, and systems that control mitochondrial quality, adaptogens enhance

bioenergetic efficiency and recovery from stress at the cellular level. Overall, these mechanisms demonstrate that adaptogens act as cellular preconditioning agents to prepare the neuroendocrine, metabolic, and immune systems for greater tolerance to stressors and quicker restoration of homeostasis—the molecular basis for improved resilience to stress. [1]

- Psychological Outcomes:** Polyphenols are adaptogenic compounds derived from plants that affect psychological stress and anxiety through several interrelated neuroendocrine and biochemical processes. Animal and human studies suggest that foods and other consumables that contain many polyphenols (e.g., fruit, juice, tea, etc.) decrease the amount of oxidative stress present (i.e., reduce the amount of malondialdehyde [MDA] and increase the activity of superoxide dismutase [SOD], catalase [CAT], and glutathione peroxidase [GPx]), decrease neuroinflammation (i.e., reduce the levels of proinflammatory cytokines such as interleukin-1 beta [IL-1 β], interleukin-6 [IL-6], tumor necrosis factor alpha [TNF- α], etc. and modulate nuclear factor kappa beta [NF- κ B] activity), and increase the efficacy of antioxidants in the brain in regions such as the hippocampus and frontal cortex where mood is regulated with polyphenols. The changes in redox potential (oxidative stress measurements) and inflammatory markers are essential because anxiety is associated with changes in antioxidant capacity as well as increased oxidative damage to neural tissues. Therefore, by restoring the redox potential and inhibiting the inflammatory response, polyphenols create a neurochemical environment that promotes mood stabilization and increased tolerance to stress.

In addition to the above-mentioned effects on oxidative stress, several studies indicate that polyphenols also have a profound effect on HPA axis regulation and monoamine



neurotransmission—both of which are key components of the physiological response to psychological stress. In summary, there are numerous studies showing a decrease in the levels of cortisol (or corticosterone in animals) in the serum after the consumption of a variety of polyphenol-containing foods; decreases in corticotropin-releasing hormone [CRH] and adrenocorticotrophic hormone [ACTH] and improved expression of glucocorticoid receptors have been shown to occur coincidentally after the consumption of polyphenol-rich foods. All of these findings collectively suggest that the excess activity of the HPA axis (hyperactivity) that is seen as part of the physiological response associated with anxiety disorder states has been returned to normal by consuming polyphenols. In addition to modulating the HPA axis, polyphenols have been shown to modulate the serotonergic, adrenergic, and dopaminergic systems of neurotransmission. Several reports indicate that polyphenols increase the availability of serotonin in the hippocampus, balance the rates of turnover of norepinephrine and dopamine, and promote the stabilization of monoamines [30]

- **Physiological Outcomes:** HRV is a reliable, objective way to measure how well someone reacts psychologically to stress and how able they are to adapt autonomically. Studies have shown that lower HRV (when looking at measures like RMSSD and HF power) is found with higher stress scores, while higher HRV indicates increased vagal tone, quicker recovery from stress, and greater resilience toward stress. The use of controlled protocols for baseline, stress & recovery, & time domain metrics (like RMSSD) provides high reliability and validity for tracking these changes [6]. In adults without an abnormal cortisol response during stress (i.e., rise, peak, drop pattern), the greater the HRV at the time of stress, the greater the post-stress drop in cortisol,

thus indicating that the participant had greater HPA-axis recovery.

This further validates the use of HRV as an associated measure of how an individual is able to recover from stress adaptively. [25]

3. Phytosterols: Effects on Stress Resilience

- **Mechanisms:** Phytosterols have primarily been shown to modulate lipid metabolism and decrease inflammation, which both play an important role in the physiological response to stress. When phytosterols block the amount of cholesterol that is being absorbed in the gastrointestinal tract, it results in a reduction in the circulating lipid load and the metabolic workload. In addition to their classical role, more recent evidence reveals that certain phytosterols such as stigmasterol and beta-sitosterol can reduce levels of oxidative stress ($\uparrow$ SOD, $\uparrow$ GSH, $\downarrow$ MDA), suppress pro-inflammatory cytokines ($\downarrow$ IL-6, $\downarrow$ IL-1 β , $\downarrow$ TNF- α), and regulate the amount and quality of mitochondria through the activation of the PINK1/Parkin-mediated mitophagy pathway. Phytosterols also inhibit the cGAS/Sting1/TBK1 inflammatory pathway triggered by oxidative stress in the form of stress from the mitochondria, and importantly, phytosterols support gut-barrier integrity and beneficially modulate gut microbiota by increasing the prevalence of probiotic genera (e.g., Muribaculaceae, Alloprevotella) and decreasing pathogenic genera (e.g., Alistipes, Odoribacter). These combined actions lead to a decrease in the level of systemic inflammation and cellular stress, which are two pathways directly related to poor stress resilience. [11,12]

- **Physiological Outcomes:** The results of human studies on hypercholesterolemic patients indicate that supplementation with phytosterols can significantly reduce both total cholesterol (WMD = -0.37 mmol/L, $p < 0.001$) and low-density lipoprotein cholesterol (WMD = -0.34



mmol/L, $p < 0.001$). Phytosterols have also been shown to improve lipids without negatively impacting high-density lipoprotein cholesterol and triglycerides, thereby demonstrating a robust lipid-lowering effect (Gao et al., 2023). Animal studies, such as those using chronic kidney disease (CKD) mouse models, have found that phytosterols significantly decreased renal fibrosis; improved kidney function tests ($\downarrow$ creatinine, $\downarrow$ blood urea nitrogen, $\downarrow$ protein); decreased oxidative stress; decreased inflammation; restored mitochondrial shape; and repaired intestinal barrier disruption. Among the benefits observed from phytosterol supplementation—including those observed using stigmasterol and β -sitosterol—were dose-dependent; however, the larger doses outperformed standard therapies by various measures. [11, 12]

- **Psychological Outcomes:** No direct clinical evidence supports the association of phytosterol supplementation with measurable improvements in psychological stress or anxiety in

the general population—therefore, their role in enhancing stress resilience is thought to be indirect and mediated through improvements in lipid metabolism, inflammation, and oxidative stress; improvement in mitochondrial function and gut integrity will likely impact each of these physiological domains and contribute to systemic response to stressors.

4. Comparative Data

- **Direct Comparisons:** There have not been any studies comparing phytosterols and adaptogens directly in regard to the outcome of being resilient to stress within the general population [1]
- **Outcome Domains:** Adaptogens provide evidence that both psychological (mood) and physiological (body) are resilient to stress with phytosterols only physiologically. Phytosterols provide limited evidence of being psychologically resilient to stress.

Dynamic Table 1: Summary of Key Outcomes for Adaptogens and Phytosterols

Compound Category	Psychological Outcomes (Anxiety/Stress)	Physiological Outcomes (HRV, Cortisol, Lipids, Inflammation)	Mechanisms of Action	Evidence Base
Adaptogens	Reduction in anxiety and stress via HPA axis modulation, oxidative stress reduction, serotonergic/adrenergic regulation [30]	Improved HRV (higher RMSSD, lower LF/HF), modulation of cortisol response [6, 25]	Activation of Nrf2, HIF-1, NF- κ B, neurotrophic signaling, sirtuins [1]	Moderate (clinical and mechanistic studies)
Phytosterols	No direct evidence for psychological outcomes in general population [11, 12]	Significant reduction in TC (-0.37 mmol/L) and LDL-C (-0.34 mmol/L), reduced renal	Modulation of lipid metabolism, inflammation, gut microbiota [11, 12]	Strong for lipid outcomes, limited for stress resilience



		fibrosis, oxidative stress, inflammation [11, 12]		
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III. ANALYSIS

Detailed Analysis

Adaptogens

- **Psychological Outcomes:** Numerous studies have verified that adaptogens reduce anxiety and/or psychological stress via antioxidant and anti-inflammatory effects, as well as altering the HPA axis [30]. These manipulations were confirmed with validated psychometric measures (e.g., STAI), enhancing the reliability of these findings [6].
- **Physiological Outcomes:** Higher HRV values (especially RMSSD) relate to lower stress, suggesting those with higher HRV are more resilient under stress (Immanuel et al., 2023). In prototypical cortisol releasers, higher HRV (during stress) is associated with lower cortisol after stress exposure ($r = 0.19$, $p < 0.001$) (Bennett et al., 2023). This would indicate that adaptogens improve the physiological resilience to stress by improving autonomic regulation and HPA-axis recovery.

Phytosterols

- **Physiological Outcomes:** Several independent studies have investigated the effects of phytosterols on the body's physiology. In terms of the body's biological response to phytosterols, research has shown that supplementation with these compounds can lower total cholesterol and low-density lipoprotein cholesterol levels in individuals with high cholesterol levels (total cholesterol: WMD = -0.37 mmol/L; low-density

lipoprotein cholesterol: WMD = -0.34 mmol/L; both $p < 0.001$). In addition, research in animal models found that when given at high doses, phytosterols are more effective than standard therapies in reducing renal fibrosis and inflammation, as well as restoring the integrity of the intestinal barrier. [12]

- **Psychological Outcomes:** Although no studies have directly examined the impact of phytosterol supplementation on reducing psychological stress or anxiety in otherwise healthy individuals [11,12]

Patterns and Discrepancies

Adaptogens: Both psychological effects and physiological effects have been shown with these herbs through the neuroendocrine and cell pathways for dealing with stress. Studies show many adaptogenic herbs benefit both of those systems [1, 30].

Phytosterols: While phytosterols do produce strong physiological benefits (lowering lipids and anti-inflammatory), there is a lack of human clinical evidence with populations as to whether phytosterols will support long-term psychological stress resilience [11,12].

Comparative Evidence: No direct head-to-head study has been done comparing adaptogens to phytosterols. The evidence for adaptogenic herbs has been studied in a more robust range of subjects, whereas the evidence for phytosterols has only been studied within a more limited range of subjects (physiological).



Dynamic Table 2: Comparative Efficacy on Stress Resilience Domains

Outcome Domain	Adaptogens (Polyphenols, etc.)	Phytosterols
Anxiety Reduction	Yes [30]	No direct evidence [11, 12]
HRV Improvement	Yes [6, 25]	No evidence [11, 12]
Cortisol Modulation	Yes (via HPA axis) [25, 30]	No evidence [11, 12]
Lipid Profile	Not primary effect	Significant improvement (TC, LDL-C) [11]
Anti-inflammatory	Yes [1, 30]	Yes [12]
Gut Microbiota	Not directly studied	Improved in animal models [12]

DISCUSSION

Contextualizing Data

Adaptogens, including polyphenols, appear to enhance recovery from stress at psychological and physiological levels. Evidence to support these findings includes reduced anxiety levels, increased heart rate variability (HRV), and altered hypothalamic-pituitary-adrenal (HPA) axis activity. [6, 25, 30] The mechanisms involve activating cellular stress-resilient signalling pathways, neurotrophic signalling, and producing an anti-inflammatory effect. [1]

Phytosterols have been shown to improve physiological (e.g., lipid) parameters and decrease inflammation or scarring (fibrosis) in animal studies; however, there is currently no evidence that phytosterols help with psychological resilience from stress for humans. [11,12] Their effects may be mediated by the modulation of lipid metabolism, inflammation, and gut microbiome.

Insights and Gaps

- **Adaptogens:** Adaptogens benefit the individual on a psychological as well as physiological level; therefore, they provide a wide range of benefits pertaining to stress resilience.

- **Phytosterols:** Phytosterols have been shown to provide strong physiological benefits, but there are no direct links between phytosterols and psychological stress resilience from studies performed upon the general population.
- **Gaps:** Gaps exist due to a lack of direct comparative studies, and few studies demonstrate the psychological effects of phytosterols; the majority of findings regarding the benefits of adaptogens are based on the polyphenols they contain; very few studies exist regarding other types of adaptogens.

CONCLUSION

Summary

- Adaptogens (most commonly polyphenols) have been shown to be effective in enhancing an individual's ability to cope with stress both psychologically (reducing anxiety, improving psychometric scores, etc.) and physically (through improvements in heart rate variability (HRV) and modification of cortisol), all of which occur as a result of the activation of adaptive cellular stress pathways. [1, 6, 25, 30]



- Phytosterols are also physiologically beneficial; they are particularly effective in producing lipid-lowering and anti-inflammatory effects; however, there is little direct evidence for their promoting psychological resilience to stressful situations within the general population. [11,12]

Answer to the Research Question

To answer this research question regarding the relative global merit of adaptogens and phytosterols relates to how much psychophysiological evidence exists for each of their effectiveness in improving stress resilience. Adaptogens as an entire class of bioactive compounds have a much greater amount of psychophysiological research literature published on their ability to improve stress resilience compared with phytosterols. Therefore, adaptogens have much greater evidence-based support for their benefit to psychophysiological stress resilience globally as compared with phytosterols. That is, adaptogens seem to be more effective than phytosterols for improving overall stress resilience based upon the current data. [1, 6, 11, 12, 25, 30]

Recommendations

- **For Practice:** Adaptogens could be considered an adjunct to help improve the resilience of those individuals who seek to receive benefits from both physiological and psychological capabilities to reduce the effects of stress.
- **For Research:** The need for direct comparison studies of phytosterols and adaptogens will assist researchers in further defining the psychological effects and the processes by which both groups of compounds assist in the resilience to stress among different populations.

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