



Sudarshan Kriya Yoga and Brain Function



Brain Waves : The language of brain function

Neurons communicate with each other using electrical signals and generate Brain Waves measured by EEG

Different Brain Waves correlate with different states of brain function



Common during rest, relaxed and unfocused state of mind

Alpha Waves



Common during cognitive decision making & focus

Beta Waves



Experienced during deep sleep, restorative healing

Delta Waves



Experienced during intense focus, love, altruism, higher states

Gamma Waves



Experienced during creativity, intuition, bliss, imagination

Theta Waves





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Study 1: Brain Function of Long Term practitioners

Brain Function was measured during Long SKY at multiple time points for 5 Long term practitioners

Brain function was measured via EEG

Results

- β activity in frontal-central region
- α activity in posterior region
- θ activity in central midline region
- coherence in brain regions

Interpretation

- Suggests efficient brain processing**
- Suggests relaxation**
- Suggests greater awareness, bliss**
- Suggests faster information processing between different brain regions**

SKY puts the practitioners in a state of relaxed awareness and creates faster information processing in the brain



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Study 2 : Brain Function before and after SKY

Brain Function was measured before and after SKY for 43 (10 long term and 33 recent) practitioners

Brain function was measured via EEG

Results

After Sudarshan Kriya the population experienced a change in brain wave pattern

97% people
↑ β

84% people
↑ α

100% people
↑ θ

88.4% people
↑ δ

Long term practitioners had a 2-3 fold more increase compared to recent practitioners

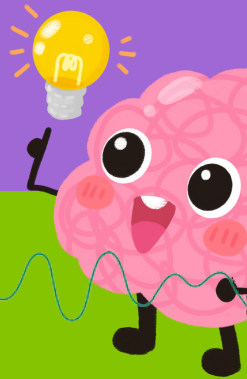
Practitioners experienced more energy and alertness after SKY

SKY creates a state of high awareness, deep relaxation, bliss and creativity, with the effect proportional to practice





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Study 3 : Global Brain Rythm with SKY

Brain Function was measured before and after a single Long SKY for 40 practitioners with >1 year practice

Brain function was measured via EEG

Results

- ↑ overall brain activation
- ↑ activity of all 5 brainwaves 
- ↑ Interhemispheric synchronisation
- ↑ New practioners saw a shift in $\theta \gamma$ which is quite unusual

Interpretation

Increased connectivity, complexities, & symmetry between the right and left cerebral hemispheres

Increased

CALM POSITIVITY BLISS
 ALERTNESS MOTIVATION
 COGNITION CORTICAL ACTIVATION ATTENTION
 VISUAL PERCEPTION
 LONG-RANGE
 NEURONAL COMMUNICATIONS

LOW THOUGHT MENTAL STATES

SKY creates a profound global brain activity denoting more energy and communication among different parts of the brain





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Study 4 : Brain Function in Depressed Population

Brain Function was measured using P300 amplitude before and after SKY for 24 patients with dysthymia (persistent depression) and 15 healthy controls

P300 is a specific wave produced during decision making. P300 ERP is lower in depression compared to healthy adults.

Results

After Sudarshan Kriya the population with depression experienced a change in P300 ERP brain wave pattern

At Baseline

Abnormal and lower brain wave patterns: P300 ERP amplitude

After 90 days

Brain wave patterns P300 ERP amplitude became similar to healthy individuals

EEG brain waves that are disturbed during depression sets back to normal rhythm with daily SKY practice, enabling a healthier mental well-being

SKY practice enables the brainwaves disturbed during depression to come back to normal





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Study 5 : Assesment of Resting Brain Function

Resting Brain Function was measured in 19 SKY practioners
and 16 Non-SKY practioners

Brain function were measured via EEG at resting state

Results

The non-SKY controls were doctors & scientists

A significant increase in
 β beta activity was
observed in various
regions of the brain in the
SKY practitioners, as
compared to the controls.

Interpretation.

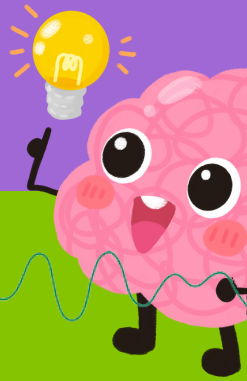
Enhanced Beta activity
denotes improved mental
focus and heightened
awareness

SKY practitioners displayed significantly greater mental alertness (beta activity) than the control group of physicians and medical researchers, whose profession requires development and daily use of these very skills.

SKY creates enhanced beta activity even at rest among
practioners denoting greater mental focus



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Study 6 : SKY and Working Memory

Working Memory

short term memory to store small amounts of information in the brain, for a brief period, so that we can perform tasks and function

Working Memory
for brain

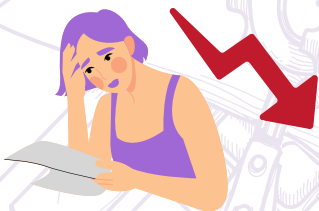


RAM for a computer



Working Memory is IMPORTANT! for everyday reasoning & decision making

Chronic Stress reduces Working Memory



Working memory was tested using computer-based test containing 15 trials, each consisting of remembering & retrieving letters and solving mathematical problems

Working Memory is critical for mental functioning



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Study 6 : SKY and Working Memory

Working memory (WM) and brain signals (EEG) were measured during WM task for 25 people (15 SKY and 10 control) before and after 90 days of SKY

Results

In SKY group after 90 days of practice

- ↑ *Improvement in Working Memory*
- ↓ *Energy losses while performing working memory task*

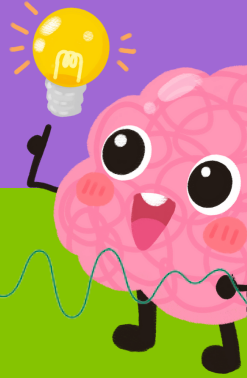
SKY promotes the efficient use of energy of γ θ α bands at the desired locations

Improvements in working memory capacity, as measured by working memory tests , have a role in reducing stress, improving cognition and decision-making abilities

SKY improves working memory and allows more efficient utilization of mental energy during tasks



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Study 7: SKY and Mental Workload Capacity

Mental Workload

Mental workload refers to the quantum of mental resources required to perform multiple tasks at the same time. Constant high mental workload can cause mental fatigue & reduces productivity

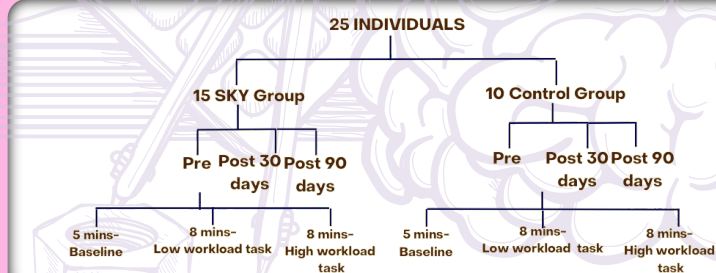
Low Workload Task

A simple task that requires little mental effort

High Workload Task

A complex task requiring large mental effort

Brain function (EEG) were measured during high and low mental workload tasks for 25 people (15 SKY and 10 control) before and after 90 days of SKY



Mental workload capacity is the ability of the brain to process information



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Study 7: SKY and Mental Workload Capacity

Results Post 90 Days of SKY

SKY_Group

- ↓ Subjective experience of workload reduced
- ↑ Task performance improved for both type of tasks
- ↑ $\alpha\beta$ at rest

Controls

- ↔ Subjective experience of workload reduced slightly for simple tasks but increased for complex tasks
- ↓ Task performance decreased for both type of tasks
- ↓ $\alpha\beta$ at rest

SKY improved cognitive flexibility, attentional switching & workload tolerance.

SKY increased α brain activity in rest conditions, increasing focus and reducing distractions while performing the tasks

SKY improves mental workload capacity and creates relaxed awareness even in situations that require high mental workload



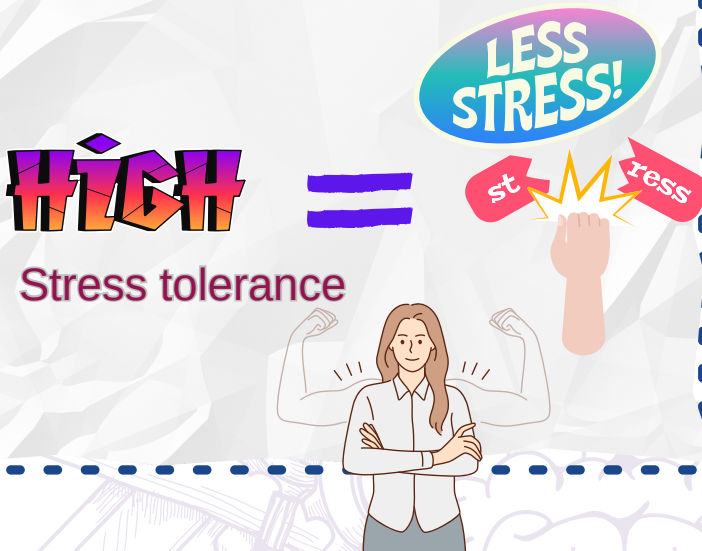
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Study 8 : SKY and Stress Tolerance

Stress Tolerance

Stress tolerance is the ability to be relaxed and composed when faced with difficulties



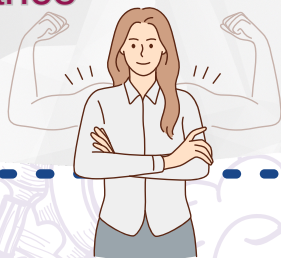
Stress Determination Test (DT)

Computer based test
Assess reactive stress tolerance

Requires continuous, brisk & varied reactions to rapidly changing stimuli

Outcomes measured:

- Average response time
- # total responses
- # delayed responses
- # omitted responses



Stress Determination tests create a mentally stressful situation by using computer based stimulus to discriminate, memorize and respond to different colours and acoustic signals.

High Stress Tolerance is connected to greater resilience and more strength in face of difficult situations



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Study 8 : SKY and Stress Tolerance

Brain function (EEG) were measured pre-post Stress DT for 20 people (10 SKY and 10 control) before and after 30 days of SKY. Brain function was measured via EEG

Results

Post 30 Days of SKY

↑ # of total responses

↓ Average reaction time
↓ # of delayed response

↑ α power post Stress DT test

Control group did not demonstrate any change in scores or EEG band power at day 30 compared to day 0

Interpretation

Increased responses, less errors and reduced response time correlates to improved efficiency to handle the task (stress)

Improved Stress tolerance and calm in SKY group

Greater stress at baseline

↓ ↓
More the reduction, aka more benefit with SKY

SKY improves Stress Tolerance and enhances cognitive performance while being relaxed