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## **EFFECT OF SURYANAMASKAR PRACTICE ON NASAL MICROBIOME IN HEALTHY INDIVIDUALS – AN EXPLORATORY CLINICAL STUDY**

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### **ABSTRACT**

**Introduction:** Suryanamaskar is a collection of twelve asanas that can be done systematically. Every cell in the body is revitalized and regenerated when Suryanamaskar is practiced. Yoga, in particular, is a better way to modify lifestyle where it can heal our microbiome through stress reduction, gentle exercise and in aiding digestion. As a gentle exercise practice, Suryanamaskar has the potential to support a flourishing and diverse microbiome. **Aim:** To assess the role of Suryanamaskar practice in human nasal microbiome. **Objectives of the study:** To study the effect of Suryanamaskar practice on human nasal Microbiome in apparently healthy individuals. To compare the difference in human microbiome between practitioners and non-practitioners of Suryanamaskar in apparently healthy individuals. **Materials and Methods:** 20 Male healthy individuals in the age group of 20-40 years were randomly divided into two groups of 20 each. Group-A received 2 months practice of Suryanamaskar while Group-B not at all practicing

Suryanamaskar. Results: Practice of Suryanamaskar produced an increase in the nasal microbiome diversity in the Group-A as compared to Group-B. Discussion: The overall effect on health assessment criteria shows good results in the Group-A. nasal microbiome richness and diversity increased in Group-A as compare to Group-B. Conclusion: The present study shows practice of Suryanamaskar has positive benefits as evidenced by improvement of nasal microbiomes in healthy individuals.

**Keyword: Suryanamaskar, Healthy individual, Yoga, Nasal, Bacteria, Microbiome**

## INTRODUCTION:

Suryanamaskar (SN) is a fundamental component of current yoga practice [1]. According to the Vedas, Suryanamaskar has to be performed on a regular basis, as a salutation to the rising sun. Suryanamaskar, consists of twelve asanas and is provide multiple health advantages for various bodily systems [2]. Suryanamaskar, often known as the 'sun salutation' is a series of dynamic postures that is neither an Asana nor a component of traditional Yoga. The Ramayana's "*Aditya Hrudayam*" teaches the sun salute with chants that are comparable to the modern *Suryanamaskar*. *Suryanamaskar* has been a popular type of physical exercise both in India and the West in recent years and its health advantages have been thoroughly documented through various researches conducted on it [3]. *Suryanamaskar* is a type of yoga that helps the body's musculo-skeletal system, as well as its internal organs, to function normally and effectively. *Suryanamaskar* also increases intestinal

peristalsis movement, blood flow in the body, stimulates and tones the kidneys, allows wastes to be easily eliminated from the body with ease and helps the body eliminate toxins through increased sweating. *Suryanamaskara* increases exchange of gases in the alveoli, which speeds up breathing. The defends the body from illness chemicals by manufacturing antibodies and other activities. *Suryanamaskara* boosts the efficacy of the immune system [4].

The human microbiome is a complex population of micro-organisms that coexist in human micro-habitats in a symbiotic relationship. Microbial diversity and function differ depending on the human body site, such as the gastrointestinal system, skin, and airways, due to microbial niche specialization [5, 6]. The Upper Respiratory Tract (URT) is constantly drenched in airflow from the external environment since a healthy adult breaths more than 7000 litre of air and 104 – 106 bacterial cells/cubic meter of air are

inhaled along with the air of every day. Aside from biological particles, the URT is subjected to physical and chemical elements in the environment, such as humidity, oxygen, immunological factors, and nutrition. These factors shape distinct micro-environments in the URT, such as the nasal cavity, sinuses, naso-pharynx, and oropharynx, in addition to anatomy. As a result, various microbial communities exist in different microhabitats in the URT, with varying proportions of resident and temporary micro-organisms. The upper respiratory tract, like other parts of the human body, is invaded by a range of microbial species shortly after birth. The initial colonization appears to be dependent on delivery mode (vaginal delivery or caesarean section), with the most dramatic modifications occurring within the first year of life, most likely due to immune system maturation. This early microbial community evolves into the adult URT microbiome over time, to become less dense and more diversified. The different microbiomes of particular microenvironments become more similar in the elderly. According to many researches, the phyla Actinobacteria, Bacteroidetes, Firmicutes, and Proteobacteria dominate the nasal microbiome of healthy individuals, with representatives of the genera *Bifidobacterium*, *Corynebacterium*,

*Staphylococcus*, *Streptococcus*, *Dolosigranulum*, and *Moraxella* being more.

### Objectives of the study:

- To study the effect of *Suryanamaskar* practice on human Nasal Microbiome in apparently healthy individuals
- To compare the difference in human Nasal microbiome between practitioners and non-practitioners of *Suryanamaskar* in apparently healthy individuals

### MATERIALS AND METHODS:

The Literary data was collected from classical texts of Yoga, Library, Research articles, Dissertations and Internet sources. The healthy individuals attending the OPD of *Swasthavritta* and Yoga at KLE BMK Ayurveda Hospital, Belagavi Karnataka were recruited in the study. All chemicals required for the study was procured from standard pharmaceutical companies.

### Methodology:

After approval from Institutional Ethical Committee (IEC), The healthy persons, who fulfilled the healthy parameters mentioned in inclusion criteria was selected and randomly divided into two groups ie, Group-A and Group-B with help of "Random Number Generator". Informed written consent was taken from the subjects. Evaluation of subjective & objective parameters was done

before and after the intervention with the help of pre-formed parameters.

**Study design:** An Exploratory Clinical Study

**Study type:** Interventional

**Screening criteria to select Swastha person:**

The healthy male persons, irrespective of religion were selected from Swastha OPD of KLE Ayurveda Hospital & Research Centre, Shahapur Belagavi, who fulfills the “Signs of Health” under ‘*Arogya linga*’ (Parameters to assess health) explained in *Kashyapa Samhita*.

**Inclusion criteria:**

- Healthy male persons of age group 20 to 40 years, showing ‘Signs of Health’

under “*Arogya linga* explained in ‘*Kashyapa Samhita*’ were included.

**Exclusion Criteria:**

- Subjects not fulfilling signs of health, female subjects (because of not able to perform Suryanamaskara practice during menstrual period) and history of active sports training & previous history of yoga training were excluded.
- History of major medical illnesses such as Tuberculosis, Cardiac ailments, hypertension, Diabetes mellitus, history of Bronchial asthma & history of major surgery in the recent past were excluded.

Table.1: Shows groups and interventions

Groups	Intervention	Pattern of Suryanamaskara	Completing time of one round of Suryanamaskara	No.of performance of Suryanamaskara practice	Duration
Group-A n=10	Healthy individuals, practicing Suryanamaskara daily	12 posture pattern	2 minutes	12 rounds in 25 minutes	2 months
Group-B n=10	Only healthy individuals, not at all Practicing Suryanamaskara	-	-	-	2 months

**Assessment criteria:** The assessment was based on the following subjective & objective parameters.

**Subjective parameters:** Based on “*Arogya linga* explained in *Kashyapa samhita* and they are as follow [7-11].

- *Annabhilasha* (Desire for food)
- *Bhuktasya paripaaka* (Easy digestion of food)

- *Srusta vin-mootra-vatatwa* (Excretion of feces urine and flatus)
- *Shareerasya laghavam* (Lightness of body)
- *Suprasnnendriyatwa* (Perspicuity of Indriyas)
- *Sukha-swapna prabodanam* (Comfortable sleep and awakening)
- *Soumanasya* (Happiness)

Table 2: Shows Self-Assessment Grading

Annabhilasha (Desire for food)	Timely manifestation of hunger	Grade 0
	Occasional loss of interest	Grade 1
	Disinterested to food always	Grade 2
Bhuktasya paripaaka (Easy digestion of food)	Easy digestion of food	Grade 0
	Occasional disturb in digestion	Grade 1
	Always feel indigestion	Grade 2
Srurvavin-mootra-vatatwa (Excretion of feces urine and flatus)	Normal	Grade 0
	Occasional disturbance	Grade 1
	Untimely and disturbed	Grade 2
Shareerasya laghavam (Lightness of body)	Feels lightness enthusiastic	Grade 0
	Occasional disturbance	Grade 1
	Feels heaviness and laziness	Grade 2
Suprasnendriyatwa (Perspicuity of indriyas)	Natural function of Indriyas	Grade 0
	Mild Impairment	Grade 1
	Impairment	Grade 2
Sukhaswapna-prabodanam (Comfortable sleep and awakening)	Normal manifestation	Grade 0
	Occasional delay	Grade 1
	Continuous disturbance	Grade 2
Soumanasya (Happiness)	Feels happiness and cheerful	Grade 0
	Occasional fluctuation	Grade 1
	Always depress and disturbed	Grade 2

**Objective Parameters:**

- Nasal mucosal swab sampling for assessing respiratory microbiome.

**Collection of sample:**

- **Nasal -mucosal sample:** Nasal-mucosal sample is collected with the help of sterile nasal swab stick [11].

**Bacterial Count:**

- 1) Bacterial Culture: Pure Culture Gram Staining IMVIC Test Catalase Test
- 2) Colony Counting - Agar Plate Count Method
- 3) DNA Extraction – CTAB Method (12 samples)
- 4) PCR: The 16s RNA gene is completed by PCR method, the number of individuals sample i.e 3-4 samples in each group is taken.

**RESULTS**

**Effect of Suryanamaskara practice on “Annabhilasha” (Desire of food):**

There was increase in *Annabhilasha* (Desire of food) in subjects of Group-A which was significant at 0.0150 with Standard Deviation of 0.5. There was decrease in *Annabhilasha* in subjects of Group-B, which was significant at 0.002 with Standard Deviation of 0.7 (Table 3).

Table 3.1 shows within the Comparison of before and after SN status of Annabhilasha (Desire of food) in Group A and Group B by Wilcoxon matched pairs test:

Within the group, Group A showed significant improvement in *Annabhilasha* (Desire of food) (p=0.0051) with rate of increment 100% whereas Group B showed not significant and decrease in the status of *Annabhilasha* (Desire

of food), ( $p=0.1088$ ) and rate of increment was -50 %.

**Table 4** shows in Between Comparison of Group A and Group B with before and after SN status of *Bhuktasya Paripaaka* (Easy digestion of food) by Mann-Whitney U test:

Group A- There was increase in *Bhuktasya Paripaaka* (Easy digestion of food) of subjects which was significant and where mean was 0.0 with SD of 0.0.

Group B - There was decrease in *Bhuktasya Paripaaka* (Easy digestion of food) of subjects which was significant where mean was 0.7 with SD of 0.8.

**Table 4.1** shows within the Comparison of before and after SN status of *Bhuktasya Paripaaka* (Easy digestion of food) in Group A and Group B by Wilcoxon matched pairs test:

Within the group, Group A showed significant improvement in *Bhuktasya Paripaaka* (Easy digestion of food), ( $p=0.0077$ ) with rate of increment 100% whereas Group B showed not significant and decrease the status of *Bhuktasya Paripaaka* (Easy digestion of food), ( $p=0.3613$ ) and rate of increment was -16.67%.

**Table 5** shows in Between Comparison of Group A and Group B with before and after SN status of *Srusta vin-mootra-vatatwa*

(Excretion of faeces urine and flatus) by Mann-Whitney U test:

Group A- There was increase in *Srusta vin-mootra-vatatwa* (Excretion of faeces urine and flatus) of subjects which was significant and where mean was 0.0 with SD of 0.0.

Group B - There was decrease in *Srusta vin-mootra-vatatwa* (Excretion of faeces urine and flatus) of subjects which was significant where mean was 0.7 with SD of 0.5.

**Table 5.1** shows within the Group of before and after SN status of *Srusta vin-mootra-vatatwa* (Excretion of faeces, urine and flatus) in Group A and Group B by Wilcoxon matched pairs test:

Within the group, Group A showed significant improvement in *Srusta vin-mootra-vatatwa* (Excretion of faeces urine and flatus) ( $p=0.0051$ ) with rate of increment 100% whereas Group B showed also significant and but decrease the status of *Srusta vin-mootra-vatatwa* (Excretion of faeces urine and flatus), ( $p=0.3613$ ) and rate of increment was -75%.

**Table 6** shows in Between Comparison of Group A and Group B with before and after SN status of *Shareerasya laghavam* (Lightness of body) by Mann-Whitney U test:

Group A- There was increase in *Shareerasya laghavam* (Lightness of body) of

subjects which was significant and where mean was 0.2 with SD of 0.4.

Group B - There was decrease in *Srusta vin-mootra-vatatwa* (Excretion of faeces urine and flatus) of subjects which was significant where mean was 1.4 with SD of 0.8.

**Table 6.1** shows within the Group of before and after SN status of Shareerasya laghavam (Lightness of body) in Group A and Group B by Wilcoxon matched pairs test:

Within the group, Group A showed significant improvement in *Shareerasya laghavam* (Lightness of body) ( $p=0.0051$ ) with rate of increment 90% whereas Group B showed not significant and decrease the status of *Shareerasya laghavam* (Lightness of body), ( $p=0.5930$ ) and rate of increment was 6.67%.

**Table 7** shows in between the Comparison of Group A and Group B with before and after SN status of Suprasnnendriyatwa (Perspicuity of Indriyas) by Mann-Whitney U test:

Group A- There was increase in *Suprasnnendriyatwa* (Perspicuity of Indriyas) of subjects which was significant and where mean was 0.1 with SD of 0.3.

Group B - There was decrease in *Suprasnnendriyatwa* (Perspicuity of Indriyas) of subjects which was significant where mean was 1.3 with SD of 0.8.

**Table 7.1** shows within the Comparison of before and after SN status of Suprasnnendriyatwa (Perspicuity of Indriyas) in Group A and Group B by Wilcoxon matched pairs test:

Within the group, Group A showed significant improvement in *Suprasnnendriyatwa* (Perspicuity of Indriyas) ( $p=0.0077$ ) with rate of increment 92.86% whereas Group B showed not significant and decrease the status of *Suprasnnendriyatwa* (Perspicuity of Indriyas), ( $p=0.5286$ ) and rate of increment was -18.18%.

**Table 8** shows in Between the Comparison of Group A and Group B with before and after SN status of Sukha-swapna-prabodanam (Comfortable sleep and awakening) by Mann-Whitney U test:

Group A- There was increase in *Sukha-swapna-prabodanam* (Comfortable sleep and awakening) of subjects which was significant and where mean was 0.3 with SD of 0.5.

Group B - There was decrease in *Sukha-swapna-prabodanam* (Comfortable sleep and awakening) of subjects which was significant where mean was 1.3 with SD of 0.7.

**Table 8.1** shows within the Comparison of before and after SN status of Sukhaswapna-prabodanam (Comfortable sleep and

awakening) in Group A and Group B by Wilcoxon matched pairs test:

Within the group, Group A showed significant improvement in *Sukhaswapna-prabodanam* (Comfortable sleep and awakening), (p=0.0284) with rate of increment 75% whereas Group B showed not significant and decrease the status of *Shareerasylaghavam* (Lightness of body), (p=0.5002) and rate of increment was -18.18%.

**Table 9** shows in between Comparison of Group A and Group B with before and after SN status of Soumanasya (Happiness) by Mann-Whitney U test.

Group A- There was increase in *Soumanasya* (Happiness) of subjects which was significant and where mean was 0.0 with SD of 0.0.

Group B - There was decrease *Soumanasya* (Happiness) of subjects which was significant where mean was 0.8 with SD of 0.4.

**Table 9.1** shows within the Comparison of before and after SN status of Soumanasya

(Happiness) in Group A and Group B by Wilcoxon matched pairs test

Within the group, Group A showed significant improvement in *Soumanasya* (Happiness) (p=0.0077) with rate of increment 100% whereas Group B showed not significant and decrease the status of *Soumanasya* (Happiness), (p=0.3613) and rate of increment was -33.33%.

**Table 10** shows in Between the Comparison of Group A and Group B with before and after SN status of CFU counts in nasal microbiome by Mann-Whitney U test:

In between the groups, there was significant difference between the groups with p value 0.0343 with mean value of Group A was 6440 with SD 2936.1 while Group B mean value was 5520 with SD 9177.

**Table 10.1** Shows within the Comparison of before and after SN CFU counts in nasal microbiome in Group A and Group B by Wilcoxon matched pairs test:

Within the groups, Group A showed not significant increase in CFU count (p=0.0593) whereas Group B showed increase for the same with no significance (p=0.6465).

**Table 3: Shows Effect of Suryanamaskara practice on “Annabhilasha” (Desire of food)**

Treatment	Group-A				Group-B				U-value	Z-value	p-value
	Mean	SD	Median	IQR	Mean	SD	Median	IQR			
Before	1.2	0.4	1.0	0.3	0.6	0.5	1.0	1.0	24.0	-2.4390	0.0150*
After	0.0	0.0	0.0	0.0	0.9	0.7	1.0	1.3	15.0	-3.1390	0.0020*

Table 3.1: Shows within the Comparison of before and after SN status of Annabhilasha (Desire of food) in Group A and Group B by Wilcoxon matched pairs test

Groups	Changes from	% of change	Z-value	p-value
Group A	Before to after	100.00	2.8031	0.0051*
Group B	Before to after	-50.00	1.6036	0.1088

Table 4: Shows in Between Comparison of Group A and Group B with before and after SN status of Bhuktasya Paripaaka (Easy digestion of food) by Mann-Whitney U test:

Treatment	Group A				Group B				U-value	Z-value	p-value
	Mean	SD	Median	IQR	Mean	SD	Median	IQR			
Before	1.5	0.7	2.0	1.0	0.6	0.5	1.0	1.0	17.0	-2.6770	0.0070*
After	0.0	0.0	0.0	0.0	0.7	0.8	0.5	1.3	25.0	-2.4920	0.0130*

Table 4.1: Shows within the Comparison of before and after SN status of Bhuktasya Paripaaka (Easy digestion of food) in Group A and Group B by Wilcoxon matched pairs test

Groups	Changes from	% of change	Z-value	p-value
Group A	Before to after	100.00	2.6656	0.0077*
Group B	Before to after	-16.67	0.9129	0.3613

Table 5: Shows in Between Comparison of Group A and Group B with before and after SN status of Srusta vin-mootra-vatatwa (Excretion of faeces urine and flatus) by Mann-Whitney U test

Treatment	Group A				Group B				U-value	Z-value	p-value
	Mean	SD	Median	IQR	Mean	SD	Median	IQR			
Before	0.6	0.7	0.5	1.0	0.4	0.5	0.0	1.0	43.0	-0.6020	0.5470
After	0.0	0.0	0.0	0.0	0.7	0.5	1.0	1.0	15.0	-3.1990	0.0010*

Table 5.1: shows within the Group of before and after SN status of Srusta vin-mootra-vatatwa (Excretion of faeces, urine and flatus) in Group A and Group B by Wilcoxon matched pairs test

Groups	Changes from	%of change	Z-value	p-value
Group A	Before to after	100.00	2.8031	0.0051*
Group B	Before to after	-75.00	2.0304	0.0423*

Table 6: Shows in Between Comparison of Group A and Group B with before and after SN status of Shareerasya laghavam (Lightness of body) by Mann-Whitney U test

Treatment	Group A				Group B				U-value	Z-value	p-value
	Mean	SD	Median	IQR	Mean	SD	Median	IQR			
Before	2.0	0.0	2.0	0.0	1.5	0.7	2.0	1.0	30.0	-2.1690	0.0300*
After	0.2	0.4	0.0	0.3	1.4	0.8	2.0	1.3	14.0	-2.9660	0.0030*

Table 6.1: shows within the Group of before and after SN status of Shareerasya laghavam (Lightness of body) in Group A and Group B by Wilcoxon matched pairs test:

Groups	Changes from	%of change	Z-value	p-value
Group A	Before to after	90.00	2.8031	0.0051*
Group B	Before to after	6.67	0.5345	0.5930

Table 7: Shows in between the Comparison of Group A and Group B with before and after SN status of Suprasnendriyatwa (Perspicuity of Indriyas) by Mann-Whitney U test:

Treatment	Group A				Group B				U-value	Z-value	p-value
	Mean	SD	Median	IQR	Mean	SD	Median	IQR			
Before	1.4	0.7	1.5	1.0	1.1	0.6	1.0	0.3	36.5	-1.1470	0.2510
After	0.1	0.3	0.0	0.0	1.3	0.8	1.5	1.3	12.5	-3.1460	0.0020*

Table 7.1 shows within the Comparison of before and after SN status of Suprasnendriyatwa (Perspicuity of Indriyas) in Group A and Group B by Wilcoxon matched pairs test

Groups	Changes from	%of change	Z-value	p-value
Group A	Before to after	92.86	2.6656	0.0077*
Group B	Before to after	-18.18	0.6301	0.5286

**Table 8: Shows in Between the Comparison of Group A and Group B with before and after SN status of Sukha-swapna-prabodanam (Comfortable sleep and awakening) by Mann-Whitney U test**

Treatment	Group A				Group B				U-value	Z-value	p-value
	Mean	SD	Median	IQR	Mean	SD	Median	IQR			
Before	1.2	0.6	1.0	1.0	1.1	0.6	1.0	0.3	45.5	-0.4040	0.6870
After	0.3	0.5	0.0	1.0	1.3	0.7	1.0	1.0	14.0	-2.9240	0.0030*

**Table 8.1 shows within the Comparison of before and after SN status of Sukhaswapna-prabodanam (Comfortable sleep and awakening) in Group A and Group B by Wilcoxon matched pairs test**

Groups	Changes from	% of change	Z-value	p-value
Group A	Before to after	75.00	2.1917	0.0284*
Group B	Before to after	-18.18	0.6742	0.5002

**Table 9: Shows in between Comparison of Group A and Group B with before and after SN status of Soumanasya (Happiness) by Mann-Whitney U test**

Treatment	Group A				Group B				U-value	Z-value	p-value
	Mean	SD	Median	IQR	Mean	SD	Median	IQR			
Before	1.0	0.5	1.0	0.0	0.6	0.5	1.0	1.0	32.0	-1.6970	0.0900
After	0.0	0.0	0.0	0.0	0.8	0.4	1.0	0.3	10.0	-3.5590	0.0001*

**Table 9.1: Shows within the Comparison of before and after SN status of Soumanasya (Happiness) in Group A and Group B by Wilcoxon matched pairs test**

Groups	Changes from	%of change	Z-value	p-value
Group A	Before to after	100.00	2.6656	0.0077*
Group B	Before to after	-33.33	0.9129	0.3613

**Table 10: Shows in Between the Comparison of Group A and Group B with before and after SN status of CFU counts in nasal microbiome by Mann-Whitney U test**

Treatment	Group A			Group B			U-value	Z-value	P-value
	Mean	SD	Mean rank	Mean	SD	Mean rank			
Before	4410.0	1845.4	13.0	2700.0	2455.8	8.0	25.0	1.8520	0.0640
After	6440.0	2936.1	13.4	5520.0	9177.0	7.7	21.5	2.1166	0.0343*
Difference	2030.0	2696.5	12.4	2820.0	9951.8	8.6	31.0	1.3985	0.1620

**Table 10.1 Shows within the Comparison of before and after SN CFU counts in nasal microbiome in Group A and Group B by Wilcoxon matched pairs test**

Groups	Changes from	%of change	Z-value	p-value
Group A	Before to after	-46.03	1.8857	0.0593
Group B	Before to after	-104.44	0.4587	0.6465

**DISCUSSION:**

**Discussion on Composition of the Nasal Microbiota:**

The upper respiratory tract (URT) is continuously soaked in air flow from the external environment, and healthy adult breaths more than 7000 liters of air every day. Bacterial cells /cubic meter of air inhaled every day are inhaled along with the air. Aside from biological particles, the URT is

subjected to physical and chemical elements in the environment, such as moisture, oxygen, immune status, and nutrition. These factors shape distinct micro-environments in the URT, such as the nasal cavity, sinuses, nasopharynx, and oropharynx, in addition to anatomy. The upper respiratory tract, like other parts of the human body, is colonized by a range of microbial species shortly after birth.

After consistent practice of Suryanamaskara, the improvements in physiological pathways as well as raised the lung functions will result in an increase in  $VO_2$  max. The phyla make up the majority of the nasal microbiome of healthy people. Bifidobacterium, Corynebacterium, Staphylococcus, Streptococcus, and Moraxella are the most common genera in Actinobacteria, Bacteroidetes, Firmicutes, and Proteobacteria. Even while the URT microbiome is essentially individual, there are also differences in cross bacterial community profiles between winter & summer seasons and individuals. Because Suryanamaskara includes Pranayama and comes into close touch with nasal surfaces, it has a direct impact on the microbiome by supplying oxygen. With humidity, temperature, and oxygenation, pranayama also enhances the airway epithelial cells and boosts the beneficial bacteria colonisation in the nasal microbiome.

- *Annaabhilasha* (Desire of food), *Bhuktasyaparipaaka* (Easy digestion of food) -

Suryanamaskar stretches all of the abdominal organs, increases metabolism and blood circulation, and

promotes in the easy digestion of food, allowing a person to materialize their food in a timely manner.

- *Srusta vin-mootra-vatatwa* (Excretion of feces urine and flatus) - Suryanamaskar practices bring about hormonal equilibrium, which leads to overall well health. Every posture counteracts the one before it, resulting in a balance of flexions and extensions. It stimulates practically all of the endocrine system's glands. The pancreas, adrenals, thyroid, pituitary, and other glands start to secrete their hormones normally as a result of this internal stimulation. It also treats pancreas and liver issues, as well as constipation, wind, indigestion, acidity, and intestinal disorders.
- *Shareerasylaghavam* (Lightness of body) - Suryanamaskar is a deeply spiritual activity that encourages a greater awareness of our bodies' connectivity. In order to prepare, the mind generates a condition of concentration and calmness.
- *Suprasnnendriyatwa* (Perspicuity of Indriyas) - Suryanamaskar, when paired with proper breathing and bija mantras, energizes the overall mind and intellect. The energy is created by the vibration of the bija mantra. Mantras for gaining mental stability and self-control, or for

releasing tensions brought on by modern life. Movements should be coordinated so that they make a single, seamless motion. It gives spiritual power and is effulgent like the sun in removing misery. It also elaborates the intellect and imparts wisdom, as well as resonating in the heart.

- *Sukha-swapna prabodanam* (Comfortable sleep and awakening) – Many kinds of yoga include mindfulness as a component. It can help individuals sleep better at night by increasing melatonin levels. Deep breathing is a sleep-inducing relaxing method.

#### **Discussion on Nasal Microbiome:**

The upper respiratory tract (URT) is continuously soaked in air flow from the external environment, and healthy adult breaths more than 7000 liters of air every day. Bacterial cells / cubic meter of air inhaled every day are inhaled along with the air. Beside from biological particles, the URT is subjected to physical and chemical elements in the environment, such as moisture, oxygen, immune status, and nutrition. These factors shape distinct micro-environments in the URT, such as the nasal cavity, sinuses, nasopharynx, and oropharynx, in addition to anatomy. The upper respiratory tract, like other parts of the human body, is colonized by a range of microbial species shortly after birth.

After consistent practice of Suryanamaskara, the improvements in physiological pathways as well as raised the lung functions will result in an increase in VO<sub>2</sub> max. The phyla make up the majority of the nasal microbiome of healthy people. Bifidobacterium, Corynebacterium, Staphylococcus, Streptococcus, and Moraxella are the most common genera in Actinobacteria, Bacteroidetes, Firmicutes, and Proteobacteria. Even while the URT microbiome is essentially individual, there are also differences in cross bacterial community profiles between winter & summer seasons and individuals. Because Suryanamaskara includes Pranayama and comes into close touch with nasal surfaces, it has a direct impact on the microbiome by supplying oxygen. With humidity, temperature, and oxygenation, pranayama also enhances the airway epithelial cells and boosts the beneficial bacteria colonisation in the nasal microbiome.

#### **CONCLUSION**

Changes in microbial diversity generated by Suryanamaskar can help with tissue metabolism, cardio-respiratory fitness, and insulin resistance. The increased population frequency of *Bacteroides*, *Flavobacterium*, and *Parabacteroides* genera was linked to metabolic alterations induced by

Suryanamaskar. Suryanamaskar practice is performing twelve postures in a row with forward and reverse bending, as well as deep exhale and inhalation, to the utmost extent feasible. Knowledge of microbiological concepts, particularly microbiota, among the general population is likely to influence societal decisions since it can direct decision-makers. As a result, human health has been considered as the result of the microbiome's complicated relationship with its human host.

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