



# Immediate Effects of Cooling Pranayama on Salivary pH and Intraoral Temperature in Healthy Individuals: A Single-Arm Pilot Interventional Study

Pratheeksha Hasanadka <sup>1</sup>, Meghana Gowda <sup>2</sup>, V. R. Abitone <sup>3</sup> 

<sup>1</sup>Intern, SDM College of Naturopathy and Yogic Sciences, India.

<sup>2</sup>HOD, Department of Pathology, SDM College of Naturopathy and Yogic Sciences, India.

<sup>3</sup>Department of Clinical Research, Sri Ramachandra Institute of Higher Education and Research, Chennai, Tamil Nadu, India.

\*Corresponding Author: V. R. Abitone; [dr.abitone@yahoo.com](mailto:dr.abitone@yahoo.com)

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## Abstract

**Background:** Salivary pH and intraoral temperature are important determinants of oral homeostasis and influence enamel integrity, microbial balance, and oral tissue health. Cooling pranayama techniques such as Sheetalī and Sheetkari are traditionally believed to reduce internal heat and improve physiological balance; however, their immediate effects on oral physiological parameters remain inadequately explored. **Objective:** To evaluate the immediate effects of cooling pranayama on salivary pH and intraoral temperature in healthy individuals. **Methods:** A single-arm, open-label, pilot study was conducted among 30 healthy participants aged 18–50 years. Baseline salivary pH and intraoral temperature were assessed before intervention. Participants then practiced cooling pranayama techniques (Sheetali and Sheetkari) for 20 minutes under supervision. Post-intervention measurements were recorded immediately after the session using pH indicator strips and a calibrated digital oral thermometer. Data were analyzed using a paired t-test. **Results:** Thirty participants completed the study. The mean age of the participants was 25.7 ± 12.5 years. Cooling pranayama produced a statistically significant increase in salivary pH from 7.56 ± 1.22 to 7.90 ± 0.88 (p = 0.02). Intraoral temperature demonstrated a modest but significant reduction from 95.82 ± 1.35°F to 95.55 ± 1.38°F (p = 0.04). **Conclusion:** Cooling breathing methods have produced a significant increase in the saliva's pH and a decrease in the intraoral temperature. Therefore, yogic variations of breath can provide an uncomplicated, safe, and inexpensive form of improving oral health. More extensive research with larger randomized trials will help to confirm these findings.

**Keywords:** Pranayama; Sheetalī pranayama; Sheetkari pranayama; salivary pH; intraoral temperature; yoga therapy.

## Introduction

Saliva is important in the maintenance of homeostasis as it is a lubricant, buffer to acids produced by bacteria, protector of the teeth and gums from bacteria and other micro-organisms, and supporter of the mineralization of the teeth. For saliva, the optimal pH level should be from about 6.2 to 7.5 [1,2]. At a neutral pH, saliva creates an environment that promotes the growth of the oral microbiome, which helps to maintain good oral health and prevent dental caries [2,3]. Conversely, a more acidic environment creates conditions that promote the growth of bacteria and increase the risk of developing gum disease, and also losing tooth enamel [4].

The temperature inside the mouth is also a significant factor in both microbial growth and enzymatic function, as well as oral tissue metabolism. The temperature of the mouth may change in response to temperature changes in the body, and therefore affects a healthy person's mouth [5,6].

Yoga and Pranayama have become popular methods of achieving both physical and psychological health [7,8]. Pranayama is an umbrella term that refers to the various techniques of controlling the breath and regulating the autonomic nervous system that are utilized within different forms of yoga [8,9]. Some of these techniques for cooling down the body are regarded as being effective at helping to cool, relax, and return to a state of homeostasis (balance of emotional, physical, and mental states) [10].

Two types of yogic breathing techniques, Sheetalī and Sheetkari, produce a cooling effect in the body; however, there has been little research on how these techniques affect immediate physiological parameters of the mouth (salivary pH) and mouth temperature (intraoral temperature) [11].

Previous studies have provided evidence that cooling yogic breath practices regulate blood pressure and affect the body through two mechanisms (temperature and mood), and improve cognitive function [12,13].

Hereby, no studies have been done to assess the immediate effect of pranayama on salivary pH and intraoral temperature. This pilot study explores the immediate impact of yogic cooling breathing on individuals' physiology using measures of salivary pH and intraoral temperature.

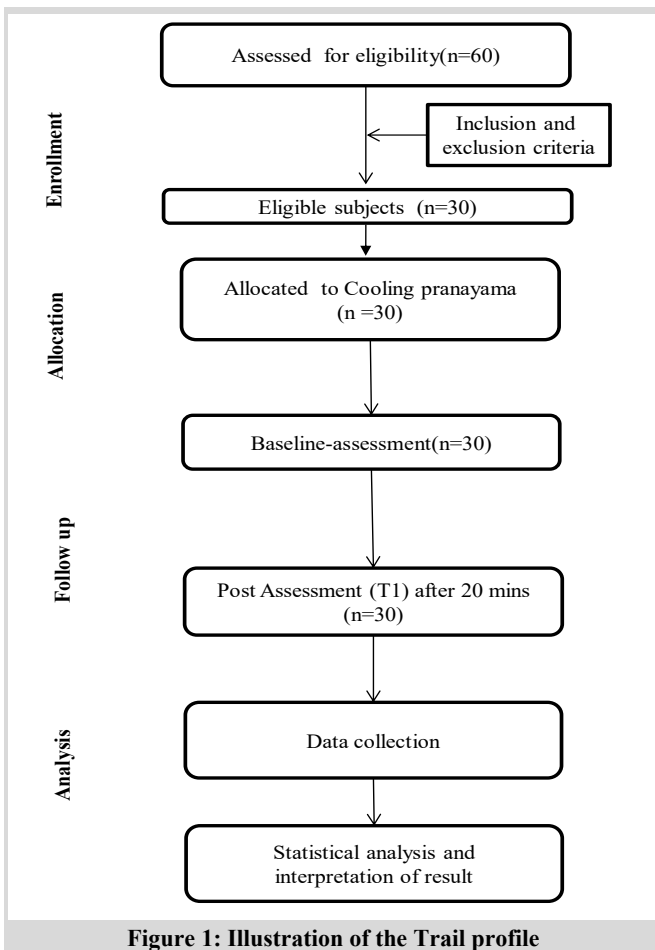
## Materials and Methods

### Study Design

This study was a single-arm pilot interventional study conducted at SDM College of Naturopathy and Yogic Sciences, Ujire, Karnataka, India.

### Participants

A total of 60 individuals were screened, among whom 30 healthy participants fulfilling the eligibility criteria were enrolled and shown in **Figure 1**.



### Inclusion Criteria

- Individuals aged 18–50 years
- Both male and female participants
- Apparently healthy individuals without chronic systemic illnesses
- Participants willing to participate in the study

### Exclusion Criteria

- Presence of systemic illness, oral infections, or recent dental procedures
- History of trauma or surgery affecting oral health
- Individuals undergoing other complementary therapies

### Ethical Considerations

The study protocol was approved by the SDM Institutional Ethics Committee (EC-760). All participants provided written informed consent before participation.

### Sample Size

Sample size was estimated on the basis of a paired design assuming a moderate effect size ( $d = 0.5$ ),  $\alpha = 0.05$ , and 80% power with a minimum requirement of 27 participants. Thirty participants were recruited to allow for attrition.

### Intervention

Participants were instructed to avoid eating, drinking, or performing oral hygiene for at least 1 hour prior. They were advised to practice cooling Pranayama techniques like Sheetalī and Sheetkari for 20 minutes in a well-ventilated room. For Sheetalī Pranayama, the individuals sat in a comfortable meditation posture with the tongue rolled into a tube and protruding out. Inhale slowly and deeply through the curled tongue. Exhale in a controlled fashion through the nostrils. The practice was maintained for some 10 minutes. Then Sheetkari Pranayama was done in a comfortable seated position. In this, participants approximated the teeth gently with the tongue touching the palate. Inhaling was done through the teeth, making a faint hissing sound, then a slow exhale through the nostrils. This pranayama was carried out for about 10 minutes.

### Outcome Measures

#### Salivary pH

Unstimulated whole saliva was assessed using pH indicator strips placed sublingually. Color changes were compared against standardized reference scales.

#### Intraoral Temperature

Intraoral temperature was measured from the sublingual region using a calibrated digital oral thermometer before and immediately after intervention.

#### Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 21.0. Normality was assessed using the Shapiro–Wilk test. Since the data followed a normal distribution, a paired t-test was used to compare pre- and post-intervention values. Statistical significance was considered at  $p < 0.05$ .

## Results

### Participant Characteristics

Thirty healthy participants completed the study. The sample consisted of 10 males and 20 females with a mean age of  $25.7 \pm 12.5$  years, as shown in **Table 1**.

**Table 1: Baseline demographic characteristics of participants**

Variable	Total Sample (N = 30)
Age (years)	25.7 ± 12.5
Gender, n (%)	
Male	10 (33.3%)
Female	20 (66.7%)
Marital Status, n (%)	
Married	12 (40.0%)
Unmarried	13 (43.3%)
Not reported	5 (16.7%)
Occupation, n (%)	
Student	5 (16.7%)
Employed	15 (50.0%)
Unemployed	10 (33.3%)

**Changes in Salivary pH**

Cooling pranayama produced a statistically significant increase in salivary pH. The mean pre-intervention salivary pH was  $7.56 \pm 1.22$ , which increased to  $7.90 \pm 0.88$  following intervention. The mean difference was 0.33 with a p-value of 0.02 and is shown in Table 2.

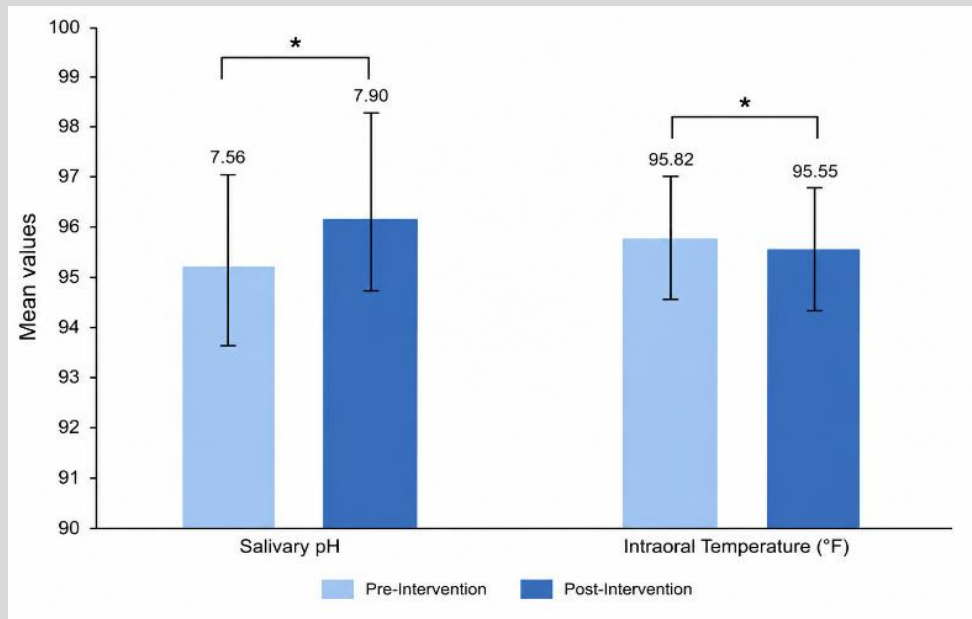
**Changes in Intraoral Temperature**

A modest but statistically significant reduction in intraoral temperature was observed after pranayama practice. Mean intraoral temperature reduced from  $95.82 \pm 1.35^\circ\text{F}$  to  $95.55 \pm 1.38^\circ\text{F}$ . The mean difference was  $-0.27^\circ\text{F}$  with a p-value of 0.04 and is shown in Table 2.

**Table 2: Comparison of Pre- and Post-Intervention Parameters**

Variable	Pre-Intervention (Mean $\pm$ SD)	Post-Intervention (Mean $\pm$ SD)	Mean Difference	p-value
Salivary pH	$7.56 \pm 1.22$	$7.90 \pm 0.88$	+0.33	0.02*
Intraoral Temperature ( $^\circ\text{F}$ )	$95.82 \pm 1.35$	$95.55 \pm 1.38$	-0.27	0.04*

*Paired-T-Test; \*p<0.05-Statistically significant*



**Figure 2: Comparison of salivary pH and intraoral temperature before and after the pranayama intervention.**

**Discussion**

In the current study, we explored the effect that cooling pranayama had immediately after a session on salivary pH and also on intraoral temperature in healthy people. The results of this study showed that a single 20-minute session of Sheetalī and Sheetkari pranayama significantly increased salivary pH and decreased intraoral temperature.

Salivary pH plays an important role in the determination of oral microbial ecology and dental health. Acidic environments in the mouth are favourable for the growth of acid-producing (acidogenic) and acid-stable (aciduric) organisms that are known to cause dental caries and periodontal disease [14]. Therefore, a change from acidity towards alkalinity suggests that the mouth may be a more hospitable place for healthy teeth and whole-body wellness (i.e., oral-systemic health) [15,16].

In this study, increased salivary pH is consistent with previous studies documenting the positive effects of yogic breathing exercises on various physiological parameters of the mouth and markers of oxidative stress [17]. Pranayama may help regulate pH by stimulating the secretion of saliva through increased activation of the parasympathetic nervous system [17,18].

The decrease in intraoral temperature observed in this study could be attributed to the cooling airflow produced by working with the Sheetalī and Sheetkari pranayama techniques. Using the curled tongue or biting on the clenched teeth during inhalation will allow the air to cool through evaporation while it travels through the oral cavity, therefore reducing the temperature of the oral cavity

temporarily[19]. Autonomic modulation, particularly the inhibition of the sympathetic nervous system, may also enhance metabolic regulation of thermoregulatory and cognitive functions [20].

Performing Sheetalī and Sheetkari pranayama is recommended in yogic texts of olden days. These two types of pranayama are said to help body temperature regulation by stimulating the Vagus nerve and triggering vasodilation, allowing the body to release excess heat [21,22]. That also induces parasympathetic activity via the baroreceptor reflex and leads to sympathetic inhibition [21]. This may be the possible mechanism for the sudden reduction in oral temperature and salivary pH improvement [23]. The physiological data of this study provide preliminary evidence for traditional beliefs regarding these two forms of pranayama [24,25]. Moreover, the participants tolerated the intervention well, and no side effects were noted. Pranayama is an inexpensive, simple, and non-invasive adjunctive strategy that can be used for oral health.

However, despite the advantages of the present study, there are some limitations. The study had a very small sample size, no control group, and only assessed the immediate effects of the intervention. There was also a compromise on the measurement of the salivary pH, as the indicator strips were used rather than the digital pH measurement techniques, which could affect the accuracy of the measurement.

Future studies should include larger randomized controlled trials, longer follow-up periods, and more biomarker assessments, including salivary flow rate, antioxidant levels, pro-inflammatory cytokine levels, and microbial analyses of the oral cavity.

## Conclusions

The results of this pilot study indicate that Sheetal and Sheetkari pranayama created immediate favorable results in salivary pH balance and oral temperature reduction immediately after the practice. Additionally, this study suggested that the practice of these yogic breathing techniques may aid in oral homeostasis by promoting an alkaline-based oral environment and lower mouth temperature. It is a virtually no-cost, simple, safe, and effective ancillary method of practicing Oral health promotion. It is warranted that there should be further well-designed studies using random control design to substantiate these findings.

## Author Contributions

All authors contributed to the study conception and design. **PH**-Conceptualization, Methodology, Data Collection, Statistical Analysis, Manuscript Preparation; **MG**-Conceptualization, Supervision, Manuscript Review and Editing; **AVR**-Methodology, Manuscript Review and Editing. All authors read and approved the final manuscript.

## Conflict of Interest

The authors declare no conflict of interest.

## Funding

No external funding was received for this study.

## Ethical Approval

The study was approved by the Institutional Ethics Committee of SDM College of Naturopathy and Yogic Sciences, Ujire.

## Informed Consent

Written informed consent was obtained from all participants before participation in the study.

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