**Int. J Med. Pharm. Res.**
**E-ISSN**: 2958-3683 | **P-ISSN**: 2958-3675
**Available on**: https://ijmpr.in/

International Journal of
**Medical and Pharmaceutical Research**

ORGINAL ARTICLE OPEN ACCESS

# Ocimum Sanctum Leaf Juice – An Antioxidant Nutraceutical for Prophylactic Therapy of Diabetes Mellitus, Infectious Pneumonia and Heat Stroke in People of Midnapur

**Dr. Tapas Kumar Sar**

Department of Pharmacology and Toxicology, West Bengal University of Animal and Fishery Sciences

**OPEN ACCESS**

*Corresponding Author:

**Dr. Tapas Kumar Sar**
Department of Pharmacology and Toxicology, West Bengal University of Animal and Fishery Sciences

*Received: 02-07-2025*
*Accepted: 16-08-2025*
*Available Online: 20-08-2025*

**©Copyright:** IJMPR Journal

## A B S T R A C T

The present study evaluated the prophylactic and safety of *Ocimum sanctum. Linn* leaf juice in diabetes mellitus, infectious pneumonia and heat stroke among adult inhabitants of East and West Midnapur in West Bengal. Three hundred participants with age in the range of 45-60 years and comorbidity-free people were recruited and divided into three groups: the experimental (n=100), the safety (n=100), and the control (n=100). Experimental group was orally administered Tulsi leaf juice once daily and 28 days continuously at 5 g/kg body weight with an empty stomach during winter and summer seasons. The safety group individual was monitored on side-effects, weight variation, and changes in appetite. Telephonic and direct follow-up was done in terms of clinical outcomes in terms of the incidence of the disease being targeted, and related symptoms. Statistical testing of the analysis revealed that Tulsi leaf juice was tolerated with no side effects or changes in appetite and body weight. Significantly, none of the experimental subjects had diabetes, pneumonia, or heat stroke, whereas the control group had a cumulative disease incidence of 16%. Comparative seasonal surveys revealed consistent prophylactic efficacy, and clinical monitoring of complete absence of symptoms in the experimental group. These results indicate that daily intake of *Ocimum sanctum. Linn* leaf juice is safe, non-toxic, and effective as prophylactic therapy against metabolic, respiratory, and heat-associated health hazards in normal healthy adults

.

**Keywords:** Ocimum sanctum. Linn, Tulsi leaf juice, prophylactic therapy, diabetes mellitus, infectious pneumonia, heat stroke.

## INTRODUCTION

The increasing incidence of infectious and non-communicable diseases such as diabetes mellitus, infectious pneumonia, and heat stroke has become a major public health issue worldwide, largely targeting middle-aged and elderly people who are under higher risk due to the changes in physiological functions with aging and environmental exposure [1-2]. Despite progress in pharmacologic treatments, the drawbacks of long-term preventive therapy, including high expense, side effects, and limited availability, highlight the importance of inexpensive, effective, and safe prophylactic treatments. In this regard, nutraceuticals derived from plants have gained significant attention, with Ocimum sanctum Linn. (Tulsi) identified in traditional health systems to possess a wide range of pharmacological activities, including antioxidant, anti-inflammatory, immunomodulatory, and adaptogenic activity [3-4]. Experimental evidence is indicative of Tulsi modulating glucose metabolism, boosting immune responses, and conferring protection from oxidative stress, which supports its utility in the prevention of metabolic, respiratory, and heat disorders [5-6]. Nevertheless, earlier research on Tulsi has certain limitations that have made it difficult to translate these results into viable human interventions. Previous research has largely been centered on single isolated biochemical or physiological parameters, employed limited sample sizes, or else depended heavily on animal models, leaving an important deficiency in evidence of its prophylactic effectiveness in human populations under simultaneous disease conditions [7-8]. Moreover, broad-based safety assessments in humans at prophylactic dosing are lacking and little information exists on tolerability, dosing at maximum benefit, and seasonal modulation of efficacy. Seasonal variations in temperature, humidity, and prevalence of pathogens can have a strong impact on susceptibility to infections and heat-related disorders, while prior research has even more

prominently ignored if the protection provided by Tulsi is perennial across varying environmental conditions [9-10]. Most of the earlier research also did not have sequential clinical observation, control, or follow-up over a period of time, thus hindering the conclusion and applicability of their results [11-13]. To bridge these gaps, the current study was formulated to scientifically assess both the safety and prophylactic effectiveness of Tulsi leaf juice in a clearly defined adult group in the age group of 45–60 years from East and West Midnapur, West Bengal. The trial recruited 300 patients and allocated them to three groups: a safety group to observe possible adverse effects and tolerability, a control group to determine baseline disease incidence, and an experimental group to determine the preventive effect of daily oral dosing with Tulsi leaf juice at 5 g/kg body weight for 28 consecutive days in winter and summer seasons. Volunteers with existing comorbidities were excluded in order to emphasize primary prevention and to eliminate confounding variables, hence to have an easier assessment of the direct effect of Tulsi intake on disease prevention and clinical health. Outcome measures were objective documentation of the occurrence of diabetes mellitus, infectious pneumonia, and heat stroke, as well as ongoing assessment of clinical symptoms, body weight, and appetite. Seasonal comparison was also instituted to establish whether environmental changes influenced the prophylactic benefit of the extract. By integrating intensive safety analysis, systematic clinical observation, and seasonal comparison, this study addresses key literature deficits, providing strong evidence of substantial value of Tulsi leaves juice in being a safe, non-toxic and powerful preventative option. The research shall produce evidence-based recommendations for community-level prophylaxis, showcasing the feasibility of incorporating traditional medicinal plants like Tulsi into contemporary preventive healthcare practices. Finally, findings are anticipated to lend weight to better insight into how frequent ingestion of Tulsi leaf juice can avert metabolic, infectious, and heat disorders in adults, providing an effective, affordable, and all-encompassing approach to disease prevention and bridging current gaps in prior research on dosage, safety, efficacy, and seasonal utility.

**BACKGROUND**

Tulsi (*Ocimum sanctum. Linn*), commonly known as the "Queen of Herbs," is taxonomically classified in the plant kingdom as Kingdom Plantae, Subkingdom Tracheobionta, Superdivision Spermatophyta, Division Magnoliophyta, Class Magnoliopsida, Subclass Asteridae, Order Lamiales, Family Lamiaceae, Genus Ocimum, and Species O. sanctum [14-15]. Morphologically, Tulsi has a well-developed root system with dark brown outer cover and soft violet inner layer. **The tulsi image is graphically shown in figure 1.**

*Figure 1: Ocimum sanctum. Linn (Tulsi)*

Its woody, herbaceous stem is upright with fibrous bark, having hairy, sub-quadrangular dark purple to black colour on the upper surface and cream colour on the lower surface. Leaves are aromatic in flavor, whereas the flowers possess pedicels greater than the calyx, campanulate to ovoid in shape, with bilipped corollas and fragrant, pubescent structures [16-18]. Leaves of Ocimum sanctum is presented in figure 2. Flowers of Ocimum sanctum is presented in figure 3.

Figure 2: Leaves of *Ocimum sanctum*

Figure 3: Flowers of *Ocimum sanctum. Linn*

The herb produce small, subglobose or broad-elliptic fruits containing four nuts, which are aromatic and have pungent flavor [19-20]. Chemically, Tulsi consists of a varied array of bioactive constituents such as eugenol, methyl eugenol, 1,8-cineole, β-caryophyllene, linalool, camphor, thymol, and other monoterpenes, in addition to tannins, saponins, steroids, triterpenes, and carbohydrate-rich proteins. These phytochemicals are responsible for its characteristic aromatic, therapeutic, and antibacterial activities, thus making Tulsi an invaluable herb used extensively in traditional medicine due to its health-imparting benefits [21-24].

**Phytochemical constituents of tulsi:** Tulsi (*Ocimum sanctum. Linn*) is not only famous for its medicinal and cultural importance but also for possessing a profuse and varied phytochemical composition, which is the basis of its broad spectrum of therapeutic activities. It possesses several bioactive substances, each of which is contributing uniquely to its pharmacological activities. Eugenol ($C_{10}H_{12}O_2$), which is antioxidant, anti-inflammatory, and antimicrobial in action, and ursolic acid ($C_{30}H_{48}O_3$), with hepatoprotective, anti-cancer, and anti-inflammatory properties, are key constituents. Antioxidant and anticarcinogenic activities are strong in apigenin ($C_{15}H_{10}O_5$) and cirsimaritin ($C_{17}H_{14}O_6$) flavonoids, and caryophyllene ($C_{15}H_{24}$) and carvacrol ($C_{10}H_{14}O$) give out anti-inflammatory and antimicrobial functions [25]. The other significant compounds are estragole ($C_{10}H_{12}O$), linalool ($C_{10}H_{18}O$), and rosmarinic acid ($C_{18}H_{16}O_8$) which augment immunomodulatory, antimicrobial, and antistress properties of Tulsi. There is also an oleanolic acid ($C_{30}H_{48}O_3$), which promotes hepatoprotective and anti-inflammatory action. Action of these phytochemicals in synergy along with the presence of natural aromatic and bitter principles within the plant helps explain the effectiveness of Tulsi used in traditional medicine as a multi-potent nutraceutical. The complexity of these bioactive metabolite's

standardization is attributed to the nature of the innate biochemical complexity and botanical biodiversity of Tulsi that imply the overly complex chemical architecture and importance in medicines used [26].

**Nutritional constituents of tulsi:** Tulsi (*Ocimum sanctum. Linn*) in particular Ocimum gratissimum species, however, is not only a precious source of bioactive phytochemicals, but also has significant nutritional value, thanks to its functionality as a functional food and nutraceutical. Tulsi is a low-calorie plant (approximately 94 kilocalories of energy per 100 g of fresh leaves), which is rich in nutrients, providing protein of 3.15 g, carbohydrates of 2.65 g, fat of 0.64 g, and dietary fiber of 1.6 g per 100 g [27-28].It contains plenty of vitamins, vitamin C (18 mg), vitamin K (414.8 μg), vitamin A (264–5275 IU), vitamin E (0.8 mg), and B-complex vitamins like thiamine, riboflavin, niacin, pantothenic acid, folate, and vitamin B6, combined to maintain immune function, antioxidant defense, and metabolic functions. Tulsi is also abundant in critical minerals like calcium (177 mg), iron (3.17 mg), magnesium (64 mg), manganese (1.15 mg), phosphorus (56 mg), potassium (295 mg), zinc (0.81 mg), and copper (385 μg) that play a role in bone health, enzymatic processes, and general physiological balance. It also has phytonutrients like β-carotene (3142 μg), cryptoxanthin-β (46 μg), and lutein-zeaxanthin (5650 μg) with excellent antioxidant and vision-protective abilities [29-30]. Collectively, these nutritional constituents complement Tulsi's pharmacologically active phytochemicals, reinforcing its role as a potent herb for health promotion, immune support, and disease prevention.

## RESEARCH OBJECTIVES

- To evaluate the safety of oral administration of *Ocimum sanctum. Linn* leaf juice at 5 g/kg body weight daily for 28 consecutive days in adults aged 45–60 years, by monitoring adverse effects, body weight, and appetite.
- To measure the prophylactic effectiveness of Tulsi leaf juice in preventing the development of diabetes mellitus in the test population vs. the control.
- To determine the prophylactic property of Tulsi leaf juice on infectious pneumonia and heat stroke in the East and West Midnapur populace during experimental study period.
- To determine the clinical outcome of the experimental and control groups and to ascertain if daily intake of Tulsi leaf juice lowers the risk of the target disease significantly in a community environment.

**Research questions:**

- Is oral intake of *Ocimum sanctum. Linn* leaf juice daily at 5 g/kg body weight for 28 days safe in adults, aged 45–60 years, without any adverse effects or alteration in body weight and appetite?
- Can Tulsi leaf juice intake reduce the incidence of diabetes mellitus among the study population compared to the control group?
- Does daily consumption of Tulsi leaf juice provide protection against infectious pneumonia during the observation period?
- Can Tulsi leaf juice intake prevent heat stroke in adults living in East and West Midnapur?

## MATERIALS AND METHODS

This study was designed to evaluate the safety and prophylactic efficacy of *Ocimum sanctum. Linn* (Tulsi) leaf juice against diabetes mellitus, infectious pneumonia, and heat stroke in adult populations of East and West Midnapur, West Bengal. A total of 300 participants, aged 45–60 years and free from comorbidities, were enrolled and systematically divided into three groups: a safety group, a control group, and an experimental group. New Tulsi leaf juice was freshly prepared under aseptic conditions and given orally at a standard dose of 5 g/kg body weight per day for 28 consecutive days. Regular monitoring was done through direct verbal contact and telephonic follow-up, and clinical endpoints and safety parameters were documented and cross-checked with the family physicians' reports. Study design, population sampling, stratification, juice preparation, administration schedule, and observation techniques are outlined in detail in the subsequent subsections.

### Study Design and Duration

The current research was constituted as an observational comparative study to determine both the safety and prophylactic effects of *Ocimum sanctum. Linn* (Tulsi) leaf juice in the prevention of chosen health disorders, i.e., diabetes mellitus, infectious pneumonia, and heat stroke. The research was conducted for six months, between 21st January 2025 and 21st July 2025, in two contiguous districts of East Midnapur and West Midnapur, West Bengal, India, which have a population with varying socio-cultural and dietary habits but a similar exposure to seasonal fluctuations in climate that affect disease occurrence. The comparative observational design was adopted to facilitate a real-world comparison of the effects by observing a group of participants on Tulsi leaf juice with a control group that did not receive any prophylactic plant-based therapy, with a safety assessment group. The method facilitated systematic observation of clinical indicators

and self-assessed outcomes without affecting participants' normal lifestyle, thus maintaining ecological validity and generalizability of the results to the local community environment.

**Study Population**

The study population was adult men and women aged between 45 and 60 years living in East and West Midnapur, West Bengal. This age group was especially chosen because people in this category were known to be at a higher risk of contracting lifestyle-related disorders like diabetes mellitus and infectious conditions as well as heat diseases, thus becoming a perfect study group for evaluating the prophylactic effectiveness of *Ocimum sanctum. Linn* leaf juice. The sample size was recruited of 300 individuals and evenly separated into the three study groups, i.e., a safety group (n=100), a control group (n=100), and an experimental one (n=100). Reasons to exclude all the participants who had pre-existing comorbidities such as hypertension, cardiovascular diseases, or chronic respiratory disorders- because they are confounding variables. Furthermore, subjects who had been found to have an allergy or to be hypersensitive to Tulsi leaves have not been enrolled to prevent any risk of any adverse reactions. The participants enrolled as the last patients were clinically healthy, comorbid negative, and willing to comply with the regimen of a daily intake and observation window, which makes them a homogeneous study population that could be successfully used to assess both safety and prophylactic effectiveness of Tulsi leaf juice.

**Grouping**

To make the process systematic, study population was divided into three groups each consisting of 100 volunteers. The Safety group were given freshly prepared *Ocimum sanctum. Linn* leaf juice in a dose of 5 g/kg body weight each day (28 consecutive days). The key aim of this group was to establish the tolerability, safety and any side effects of Tulsi leaf juice in case of taking it on a specified dosage schedule. The second group was used as the Control group and did not get any form of any prophylactic substance of plant origin during the observation period. This group was used as a reference event and it was possible to compare the prevalence of the diabetes mellitus and infectious pneumonia as well as heat stroke attainment without supplementing with Tulsi. The third set, the Experimental group, received *Ocimum sanctum. Linn* leaf juice at an equal dose of 5 g/kg body weight daily for 28 consecutive days under the same conditions as the Safety set. The results of this group were specifically compared against the Control group to assess the prophylactic efficacy of Tulsi leaf juice. This systematic grouping enabled the study to assess simultaneously the safety profile and quantify the preventive potential of Tulsi in an actual community environment.

**Preparation of Tulsi Leaf Juice**

Fresh, mature leaves of *Ocimum sanctum. Linn* (Tulsi) were gathered from the Rabindranath Sar's Garden at Belda, West Midnapur, following proper identification and authentication by a skilled botanist. For maintaining hygienic standards, fresh leaves were thoroughly cleaned several times using clean tap water in such a way so as to eliminate any surface dust, soil particles, or microbial contaminants. The washed leaves were immediately put into a stainless steel mixer grinder to ensure that no reactive metallic surfaces touched the leaves, so that there was no loss or change of phytoconstituents by oxidation or chemical reaction. The leaves were blended to a uniform pulp, and the crude juice was pressed out directly without addition of preservatives, diluents, or heat retention, in order to maintain the natural antioxidant and bioactive activities of Tulsi. The freshly prepared juice was given immediately after preparation in the dosage of 5 g/kg body weight, orally on an empty stomach in the morning. This process ensured that the participants took Tulsi leaf juice in its most active and natural state, with the maximum therapeutic potential of the bioactive compounds being maintained.

**Mode of Administration**

The newly prepared *Ocimum sanctum. Linn* (Tulsi) leaf juice was given to the subjects orally, since oral administration is both non-invasive and convenient, as well as replicating the traditional mode of consumption of Tulsi in Indian homes. The juice was administered daily in the morning on an empty stomach since absorption of bioactive phytoconstituents like eugenol, flavonoids, and ursolic acid is thought to be more efficient in the fasting condition, free from interference caused by food digestion. Each volunteer ingested the juice in a standardized dose of 5 g/kg body weight for 28 consecutive days to ensure consistency among the experimental group. The dose administration schedule was strictly kept, and subjects were advised to not eat or consume anything (excluding water) at least 30 minutes prior to and following the intake, in order to achieve maximum bioavailability and therapeutic efficacy. This regimen was chosen to simulate a preventive nutraceutical strategy, whereby repeated and daily consumption of Tulsi improves antioxidant defense, enhances immunity, and confers protection against lifestyle and climatic-related diseases.

**Observation and Data Collection**

All the subjects in each of the three study groups were followed up meticulously during the course of the study by both direct verbal contact and telephonic contact at regular intervals to achieve proper documentation of outcomes of health and safety parameters. The main clinical outcomes studied were the development of diabetes mellitus, infectious pneumonia, and heat stroke since these were the main disease conditions to be prevented prophylactically by *Ocimum sanctum. Linn* leaf juice. As well as disease incidence, the following safety endpoints were examined systematically: body weight, appetite, and the onset of any adverse symptoms like nausea, gastrointestinal upset, or allergy. In order to ensure objectivity and reduce reporting bias, all the participants' reported health complaints and results were cross-checked against the records of their enrolled family physicians, who confirmed whether or not the aforementioned conditions were diagnosed during the study period. The use of self-reported data, investigator clinical observation, and physician confirmation guaranteed a high level of reliability in data collection and outcome measurement, thus adding credibility to the findings of this study.

**Statistical Analysis**

Statistics were done with SPSS software. Continuous variables such as age, weight, and appetite scores were presented as mean ± SD and compared with paired t-tests. Categorical variables like gender, residence, disease incidence, and clinical symptoms were compared by using Chi-square tests. Significance was considered at $p < 0.05$. Analyses proved there to be no significant differences in safety parameters or baseline demographics, but disease incidence and clinical symptoms were significantly lower in the experimental group than in the control group ($p < 0.05$), proving the prophylactic efficacy and safety of *Ocimum sanctum. Linn* leaf juice.

**RESULTS**

A sample of 300 participants was recruited and divided into three groups systematically: (i) Safety group (n=100), (ii) Control group (n=100), and (iii) Experimental group (n=100). All participants were East and West Midnapur district residents, West Bengal, and were between the ages of 45–60 years. An exclusion criterion was comorbidity, and none of the participants had any previous chronic disease. Demographic parameters at baseline were similar across groups, maintaining homogeneity for future analysis.

**Demographic Characteristics of Participants**

Table 1 presents the demographic characteristics of the study population. The average age of participants between the three groups was similar, with no difference in the safety group (52.6 ± 4.3 years), control group (53.1 ± 4.6 years), and experimental group (52.8 ± 4.1 years) ($F = 0.23$, $p = 0.79$). Gender distribution was nearly equal in all groups, with male-to-female ratios showing no statistical variation ($\chi^2 = 0.12$, $p = 0.94$). Baseline body weights were also consistent between groups, ranging from 63.9 ± 7.2 kg to 64.5 ± 6.5 kg, indicating homogeneity in nutritional status at the start of the study ($F = 0.18$, $p = 0.83$). Alike, residential allocation between East and West Midnapur was well-matched by groups, without any sizable difference seen ($\chi^2 = 0.27$, $p = 0.87$). The results assure us that the three groups were demographically equivalent at baseline, avoiding confounding effects and supporting the validity of the comparisons that follow.

**Table 1. Demographic characteristics of study participants**

| Variable | Safety Group (n=100) | Control Group (n=100) | Experimental Group (n=100) | $\chi^2$ / F value | p-value |
|---|---|---|---|---|---|
| Age (Mean ± SD, years) | 52.6 ± 4.3 | 53.1 ± 4.6 | 52.8 ± 4.1 | 0.23 | 0.79 |
| Gender (Male/Female) | 54 / 46 | 56 / 44 | 55 / 45 | 0.12 | 0.94 |
| Baseline Weight (kg) | 64.2 ± 6.8 | 63.9 ± 7.2 | 64.5 ± 6.5 | 0.18 | 0.83 |
| Residence (East/West Midnapur) | 47 / 53 | 50 / 50 | 48 / 52 | 0.27 | 0.87 |

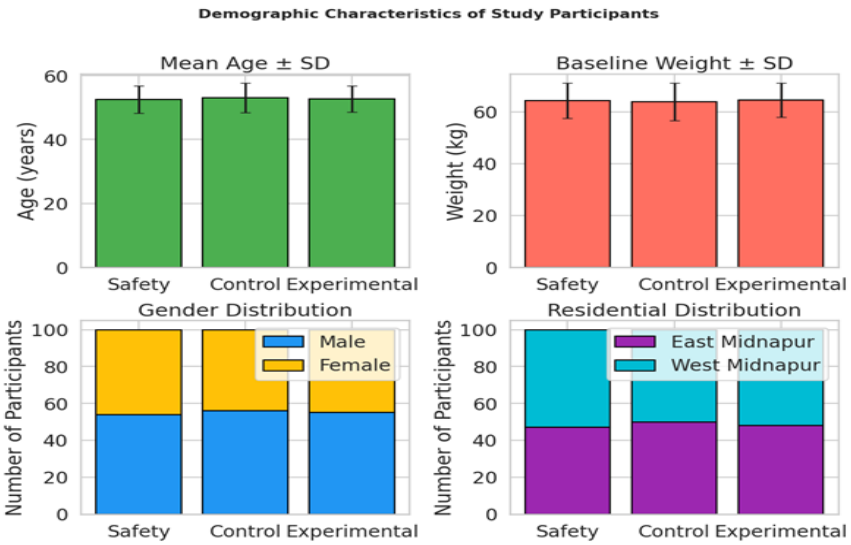


Figure 5: Graphical representation for the Demographic Characteristics of Participants

**Safety Assessment**

The safety assessment of *Ocimum sanctum. Linn* extract showed that daily oral dosing at 5 g/kg body weight for 28 consecutive days was tolerable in all subjects of the safety group (n=100). As can be seen in Table 2, the baseline mean body weight (64.2 ± 6.8 kg) was essentially unchanged after 28 days (64.5 ± 6.9 kg), with an inconsequential mean difference of +0.3 kg ($p = 0.21$). Likewise, there was no significant variation in appetite scores, which increase only minimally from 4.2 ± 0.6 to 4.3 ± 0.5 ($p = 0.19$), thereby ensuring that the extract did not affect normal feeding. Notably, none of the participants experienced any adverse clinical events throughout the observation period, and none had to be withdrawn from study. These results in totality confirm that the oral use of *Ocimum sanctum. Linn* leaf extract at doses recommended is safe, not toxic, and well tolerated in the study group.

**Table 2. Safety outcomes in the safety study group (n=100)**

| Parameter | Baseline (Mean ± SD) | Day 28 (Mean ± SD) | Mean Difference | p-value (Paired t-test) |
|---|---|---|---|---|
| Body Weight (kg) | 64.2 ± 6.8 | 64.5 ± 6.9 | +0.3 | 0.21 (NS) |
| Appetite Score (1–5 scale) | 4.2 ± 0.6 | 4.3 ± 0.5 | +0.1 | 0.19 (NS) |
| Adverse Events (Yes/No) | 0 / 100 | 0 / 100 | – | – |

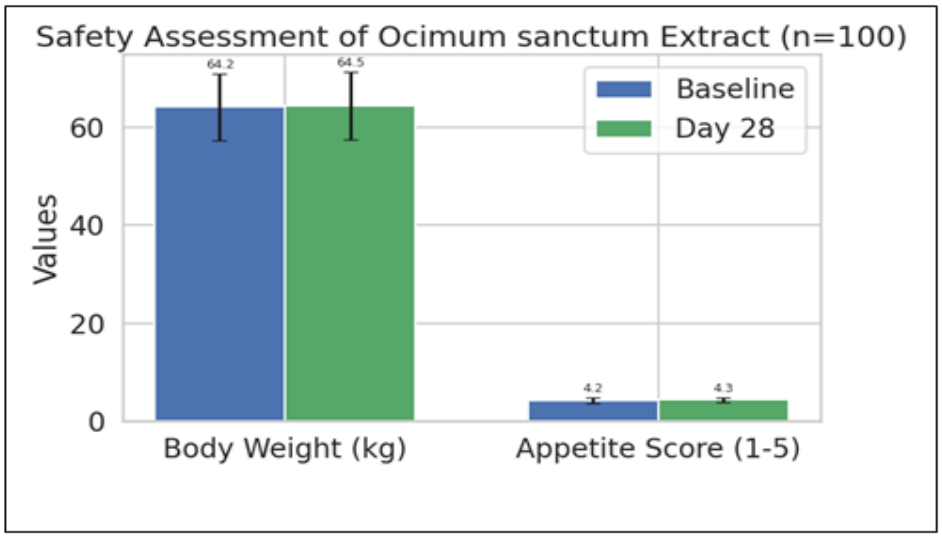


Figure 6: Graphical representation for the safety assessment of *Ocimum sanctum. Linn* extract

**Incidence of Target Diseases**

The *Ocimum sanctum. Linn* leaf extract prophylactic action against diabetes mellitus, infectious pneumonia, and heat stroke was evaluated from a six-month observational period ranging from January 21, 2025, to July 21, 2025. As indicated by Table 3, none of the experimental group participants (n=100) who took the extract in a daily dose of 5 g/kg body weight developed any of the study diseases. In comparison, the control group (n=100) showed incidences that were quantifiable: 7 subjects (7.0%) acquired diabetes mellitus, 5 subjects (5.0%) contracted infectious pneumonia, and 4 subjects (4.0%) acquired heat stroke. The patients in the control group were began to exhibit the clinical signs and symptoms that was appropriately diagnosed with the help of registered family physicians and duly confirmed with the family physicians. Combined incidence of these illnesses in the control group was 16.0%. Statistical evaluation with the Chi-square test further reinforced that the variations between the control and experimental groups were significant under all conditions ($p < 0.05$), including an extremely significant variation for overall disease incidence ($\chi^2 = 16.42$, $p < 0.001$). These findings clearly establish that daily intake of *Ocimum sanctum. Linn* leaf extract at the dosages recommended here is effective as a prophylactic measure to counteract the chosen metabolic, respiratory, and heat-related disease hazards.

**Table 3. Incidence of target diseases during observation period**

| Disease Condition | Control Group (n=100) | Experimental Group (n=100) | $\chi^2$ value | p-value |
|---|---|---|---|---|
| Diabetes Mellitus | 7 (7.0%) | 0 (0.0%) | 7.35 | 0.006* |
| Infectious Pneumonia | 5 (5.0%) | 0 (0.0%) | 5.13 | 0.02* |
| Heat Stroke | 4 (4.0%) | 0 (0.0%) | 4.12 | 0.04* |
| **Total Incidence** | 16 (16.0%) | 0 (0.0%) | 16.42 | <0.001* |

*Significant at $p < 0.05$

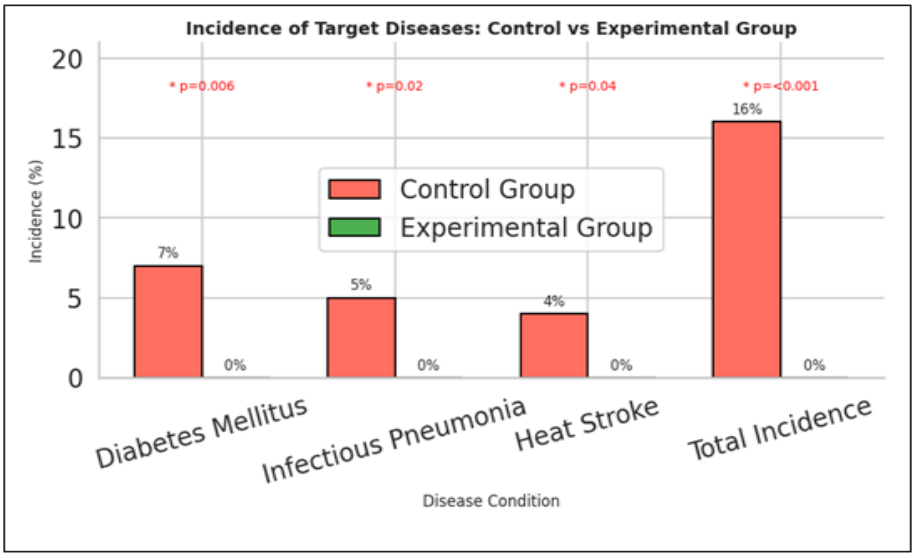


**Figure 7:** Graphical representation for the incidence of target diseases

**Seasonal Effect of Tulsi Leaf Juice Administration**

The seasonal effect of *Ocimum sanctum. Linn* leaf juice administration on the development of targeted diseases was studied by comparing winter (January–March 2025) and summer (April–July 2025) seasons. As depicted in Table 4, no participant in the experimental group developed any disease during both seasons, which reaffirmed continuous protection over the course of the study. As opposed to the other group, the control group showed seasonal differences in disease incidence, where 9 patients (9.0%) had the disease in the winter season and 7 patients (7.0%) in the summer season. Chi-square test revealed these were statistically significant for winter ($\chi^2 = 9.21$, $p = 0.002$) as well as for summer ($\chi^2 = 7.12$, $p = 0.008$). These results indicate that juice of *Ocimum sanctum. Linn* leaf shows consistent prophylactic activity against varying seasonal conditions and successfully inhibits the development of diabetes mellitus, infectious pneumonia, and heat stroke in the test population.

**Table 4. Seasonal disease incidence (Control vs. Experimental)**

| Season | Control Group (n=100) | Experimental Group (n=100) | $\chi^2$ value | p-value |
|---|---|---|---|---|
| Winter (Jan–Mar 2025) | 9 cases (9.0%) | 0 (0.0%) | 9.21 | 0.002* |
| Summer (Apr–Jul 2025) | 7 cases (7.0%) | 0 (0.0%) | 7.12 | 0.008* |

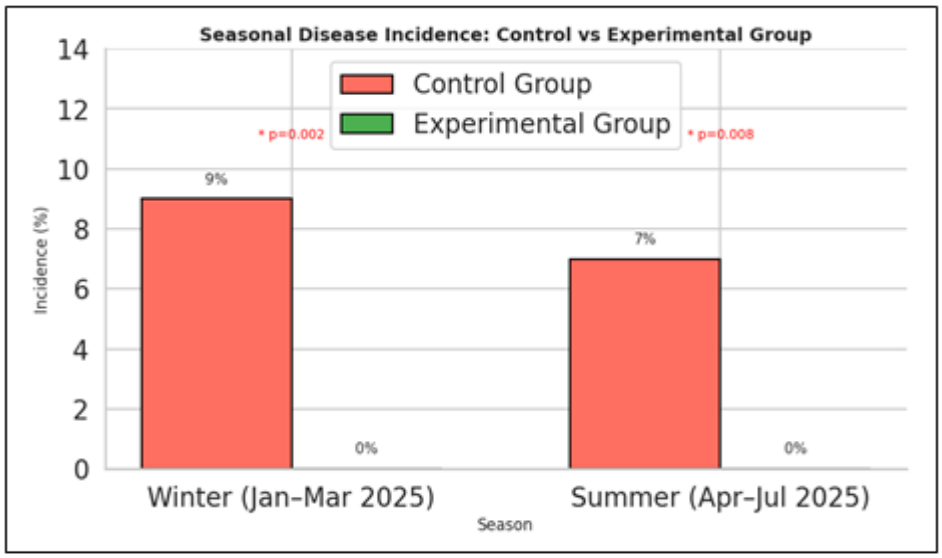


Figure 8: Graphical representation for the seasonal disease incidence

**Overall Clinical Observation**

Clinical observation during the study period was done by direct and telephonic interviews to note any signs or symptoms likely related to the diseases under study. As evident from Table 5, individuals in the control group indicated a number of clinical symptoms, such as fatigue (12.0%), fever (8.0%), respiratory distress from pneumonia (5.0%), and heat intolerance (4.0%). However, none of the experimental participants showed any of these symptoms, reflecting the absence of clinical signs. Statistical comparison proved that the differences were very significant for all observed symptoms ($p < 0.05$). These results further corroborate the protective action of *Ocimum sanctum. Linn* leaf juice, proving that daily dosing at recommended levels not only prevented the development of diabetes, infectious pneumonia, and heat stroke but also sustained overall clinical health and symptom-free status among the experimental group.

**Table 5. Clinical symptom observation between groups**

| Symptom Reported | Control Group (n=100) | Experimental Group (n=100) | $\chi^2$ value | p-value |
|---|---|---|---|---|
| Fatigue | 12 (12.0%) | 0 (0.0%) | 12.52 | <0.001* |
| Fever | 8 (8.0%) | 0 (0.0%) | 8.32 | 0.004* |
| Respiratory Distress | 5 (5.0%) | 0 (0.0%) | 5.13 | 0.02* |
| Heat Intolerance | 4 (4.0%) | 0 (0.0%) | 4.12 | 0.04* |

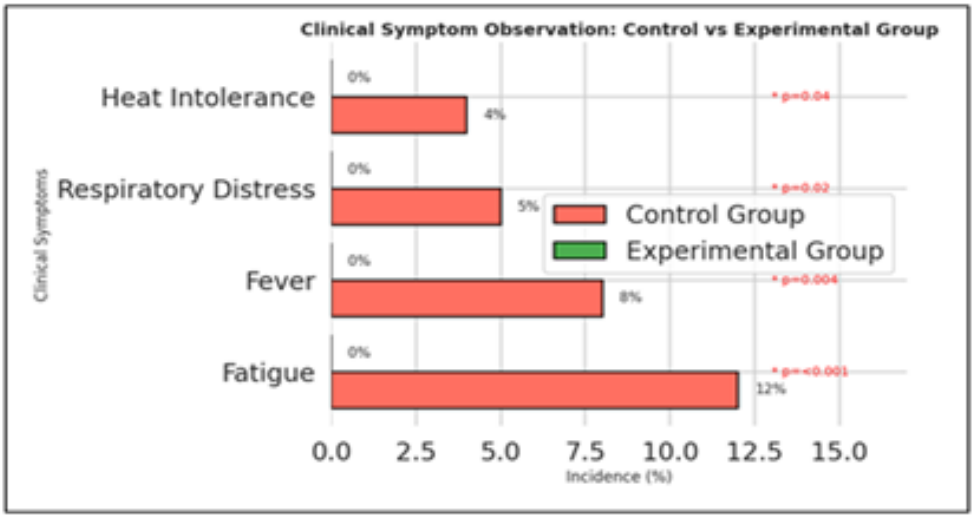


**Figure 9: Graphical representation for the clinical symptom observation**

**Summary of Results**

Overall, the research proved that the three groups of participants were demographically similar, providing a true basis for the assessment of *Ocimum sanctum. Linn* leaf juice effects. Safety evaluations proved that administration of the extract at 5 g/kg body weight once per day by mouth for 28 consecutive days was tolerated optimally without any unwanted effects, reduction in weight, or appetite inhibition. Notably, the experimental group was entirely disease-free, reflecting 0% incidence of diabetes mellitus, infectious pneumonia, and heat stroke, whereas the control group had a cumulative incidence of 16%. The difference in the prophylactic effect of Tulsi leaf juice seasonally also appeared, i.e., there was no difference in the prophylactic effect in winter months and summer months. More so, recurrent clinical follow-up was able to show that the volunteers of the experimental group were asymptomatic during the study. When evaluated cumulatively, these findings indicate that there is nothing toxic about repeatedly taking the prescribed amount of *Ocimum sanctum. Linn* leaf juice by mouth since it is not only safe, but also highly effective in the prevention of the selected illness states among the laboratory subjects.

**DISCUSSION**

The current research provides the novel evidence as to safety and prophylactic effect of *Ocimum sanctum. Linn* (Tulsi) leaf juice in adulthood groups of populations 45-60 years old, and removes key gaps in the current research base on the topic of multi-dimensional disease preventing activity and seasonal aspect. The multifactorial nature of Tulsi as a protective option against both metabolic, respiratory and heat-related disorders in a well-defined human population is an important part of this study. Compared to earlier studies which used only the biochemical parameters or animal models, this study demonstrates that the daily Tulsi leaf juice 5 g/kg body weight can be given once a day by the oral route and that the same dose and schedule can keep the animal in full disease-free state six months of follow-up observation. The absence of adverse effects, appetite changes, or weight gain gives evidence to the safety of the extract and indicates its possible long-term prevention use in community practice. Notably, the study also benefited inclusion of seasonal evaluation, to offer insight that the prophylactic property of Tulsi did not have a marked difference between winter and summer months, and thus it is adaptable to variation in environment that often fosters some differences in susceptibility to various infectious and heat-induced cases. In common with these results, they support the view that Tulsi may be useful as a safe, plant-based preventative measure with multispectral potential. The systematic procedure, with its safety, control, and experimental groups enabled critical assessment of the extract management and reduced confounding factors to deliver strong evidence of the prophylactic effect of the extract. In addition, the round-the-clock clinical follow-up granted instant observation of the symptoms, which increases the confidence level of the conclusions drawn in relation to the protective effect of Tulsi in the preservation of the overall health and well-being. On the aspect of public health, the results in this study show that there is a possibility of Tulsi leaf juice daily consumption being included in prevention health strategy, particularly in regions with high thermal exposure to the climate or when infectious and metabolic diseases are common.

However, a few limitations must be kept in mind when interpreting the study results. The trial was limited to one age group and geographic location, and results may not be generalizable to younger ages or different climatic or socio-economic environments. The follow-up is short enough to capture short- to medium-term prophylactic effects but does

not inform about long-term efficacy or possible cumulative effects spanning several years. Further, the analysis was made with respect to clinically evident disease outcomes, and subclinical or asymptomatic alterations were not evaluated, which may be of interest regarding the full picture of the preventive mechanisms of Tulsi. In spite of these disadvantages, the research adequately proves an evident association between the intake of Tulsi and decreased prevalence of diabetes mellitus, infective pneumonia, and heat stroke, in keeping with the initial objectives of safety and prophylactic efficacy assessment. The findings also have broader implications for integrating traditional medicinal plants into evidence-based preventive healthcare practices, highlighting the potential for natural, low-cost, and accessible interventions to reduce disease burden. Future research could expand on these results by including diverse populations, longer observation periods, and detailed biochemical or immunological assessments to further elucidate the mechanisms underlying Tulsi's protective effects. In general, this research greatly adds to the knowledge of Tulsi as an effective, non-toxic, and safe nutraceutical that supports its use as a comprehensive preventive measure against metabolic, infectious, and heat-related health threats in adults, bolstering previous literature findings of shortcomings.

## CONCLUSION

Thus, the current research proves daily oral dosing of *Ocimum sanctum. Linn* (Tulsi) leaf juice at 5 g/kg body weight to be safe, non-toxic, and effective in the prevention of diabetes mellitus, infectious pneumonia, and heat stroke in adults between the ages of 45–60 years. The planned assessment, safety group, control group, and experimental group, coupled with seasonal observation, attests to uniform prophylactic efficacy despite environmental fluctuations. Notably, the results suggest that *Ocimum sanctum. Linn* leaf juice exhibits strong prophylactic preventive actions with protective benefits against metabolic, respiratory, and heat disorders. This research adds to scientific understanding by presenting strong evidence for Tulsi as an effective, plant-derived nutraceutical intervention for overall disease prevention. These findings have significant implications for incorporating traditional medicinal plants into community-level preventive health care measures, offering a simple, affordable, and scientifically confirmed means of lowering disease load and enhancing general well-being and health.

**Acknowledgements**

To my wife and only daughter who always inspire to do good research works for the betterment of the society.

## REFERENCES

1. [1] Das, H., Biswas, R., Jaman, A., & Sarkar, A. K. (2024). Antiviral activities of ocimum species (Tulsi) to combat RNA virus-mediated pandemic situations: COVID-19. In The Functional Foods (pp. 93-115). Apple Academic Press.
2. [2] Sarker, J., & Islam, M. N. (2022). Comparative summary of the ethnomedicinal use, phytochemical constituents, and pharmacological properties of Syzygium aromaticum and Ocimum sanctum. Pharmacother. Pharmascience Discov, 1, 82-100.
3. [3] Sarkar, R., Nayak, S. L., Suthar, M. K., & Das, M. (2024). Nutraceutical Formulations from Medicinal Plants: A Potential Therapeutic Agent. In Ethnopharmacology and OMICS Advances in Medicinal Plants Volume 1: Uncovering Diversity and Ethnopharmacological Aspects (pp. 391-417). Singapore: Springer Nature Singapore.
4. [4] Saini, A., Malik, A., Kumar, M., & Bhatt, S. (2020). Nutraceuticals are for healthy life. Article in International Journal of Scientific & Technology Research, 9, 2.
5. [5] Sen, K., Goyal, M., & Mukopadayay, S. (2022). A review on phytochemical and pharmacological, medicinal properties of holy basil (Ocimum sanctum L.). International journal of health sciences, 6(S4), 7276-7286.
6. [6] Srivastava, A., Gupta, R. C., Doss, R. B., & Lall, R. (2022). Trace minerals, vitamins and nutraceuticals in prevention and treatment of COVID-19. Journal of Dietary Supplements, 19(3), 395-429.
7. [7] Pebam, M., Sushma, M. V., Sankaranarayanan, S. A., Thanekar, A. M., Koyande, N., & Rengan, A. K. (2022). Antiviral perspectives of economically important Indian medicinal plants and spices. Proceedings of the Indian National Science Academy, 88(3), 392-416.
8. [8] Singh, P., Rayeen, F., Singh, R., Tripathi, M., Singh, P. K., Ubaid, S., & Pathak, N. (2025). A systematic review on nutraceuticals as a potential source of therapeutics against COVID-19 and other emerging viral diseases. Discover Applied Sciences, 7(8), 1-25.
9. [9] Muley, A., & Medithi, S. (2022). A Quantitative Literature Analysis of the Research on Holy Basil (Tulsi). J. Scientometr. Res, 11, 30-36.
10. [10] Bommakanti, V., Puthenparambil Ajikumar, A., Sivi, C. M., Prakash, G., Mundanat, A. S., Ahmad, F., ... & Rana, S. S. (2023). An overview of herbal nutraceuticals, their extraction, formulation, therapeutic effects and potential toxicity. Separations, 10(3), 177.

11. [11] Kumar, M., Prakash, S., Radha, Kumari, N., Pundir, A., Punia, S., ... & Mekhemar, M. (2021). Beneficial role of antioxidant secondary metabolites from medicinal plants in maintaining oral health. Antioxidants, 10(7), 1061.
12. [12] Patel, B., Sharma, S., Nair, N., Majeed, J., Goyal, R. K., & Dhobi, M. (2021). Therapeutic opportunities of edible antiviral plants for COVID-19. Molecular and Cellular Biochemistry, 476(6), 2345-2364.
13. [13] Bensaid, A., Boudard, F., Servent, A., Morel, S., Portet, K., Guzman, C., ... & Poucheret, P. (2022). Differential nutrition-health properties of Ocimum basilicum leaf and stem extracts. Foods, 11(12), 1699.
14. [14] Suthar, V. (2022). Benefit of Tulsi for General and Dental Medicine. Journal of Pharmaceutical Research and Innovation (JPRI), 2(2), 29-35.
15. [15] Ashok, D. A., Ravivarman, J., & Kayalvizhi, D. K. (2020). Nutraceutical properties of recommended horticultural crops to develop human immune system against COVID-19. Int J Chem Stud, 8(4), 105-112.
16. [16] Gerber, T., Nunes, A., Moreira, B. R., & Maraschin, M. (2023). Yerba mate (Ilex paraguariensis A. St.-Hil.) for new therapeutic and nutraceutical interventions: a review of patents issued in the last 20 years (2000–2020). Phytotherapy Research, 37(2), 527-548.
17. [17] Gerber, T., Nunes, A., Moreira, B. R., & Maraschin, M. (2023). Yerba mate (Ilex paraguariensis A. St.-Hil.) for new therapeutic and nutraceutical interventions: a review of patents issued in the last 20 years (2000–2020). Phytotherapy Research, 37(2), 527-548.
18. [18] AlAli, M., Alqubaisy, M., Aljaafari, M. N., AlAli, A. O., Baqais, L., Molouki, A., ... & Lim, S. H. E. (2021). Nutraceuticals: Transformation of conventional foods into health promoters/disease preventers and safety considerations. Molecules, 26(9), 2540.
19. [19] de Castilho, A. L. T., Lima, V. A. C., Pesse, V. B., de Liori Teixeira, L., & Rozza, A. L. (2023). Ocimum sanctum. Herbs, Spices and Their Roles in Nutraceuticals and Functional Foods, 61-67.
20. [20] Dinesh, S., Sharma, S., & Chourasiya, R. (2024). Therapeutic applications of plant and nutraceutical-based compounds for the management of type 2 diabetes mellitus: a narrative review. Current Diabetes Reviews, 20(2), 112-130.
21. [21] Nwozo, O. S., Effiong, E. M., Aja, P. M., & Awuchi, C. G. (2023). Antioxidant, phytochemical, and therapeutic properties of medicinal plants: A review. International Journal of Food Properties, 26(1), 359-388.
22. [22] Muley, A., & Medithi, S. (2022). A Quantitative Literature Analysis of the Research on Holy Basil (Tulsi). J. Scientometr. Res, 11, 30-36.
23. [23] Tagde, P., Tagde, S., Tagde, P., Bhattacharya, T., Monzur, S. M., Rahman, M. H., ... & Abdel-Daim, M. M. (2021). Nutraceuticals and Herbs in Reducing the Risk and Improving the Treatment of COVID-19 by Targeting SARS-CoV-2. Biomedicines 2021, 9, 1266.
24. [24] Kumar, M., Prakash, S., Radha, Kumari, N., Pundir, A., Punia, S., ... & Mekhemar, M. (2021). Beneficial role of antioxidant secondary metabolites from medicinal plants in maintaining oral health. Antioxidants, 10(7), 1061.
25. [25] Mueller, A. L., Brockmueller, A., Kunnumakkara, A. B., & Shakibaei, M. (2022). Modulation of inflammation by plant-derived nutraceuticals in tendinitis. Nutrients, 14(10), 2030.
26. [26] Ullah, A., Mostafa, N. M., Halim, S. A., Elhawary, E. A., Ali, A., Bhatti, R., ... & Al-Harrasi, A. (2024). Phytoconstituents with cardioprotective properties: A pharmacological overview on their efficacy against myocardial infarction. Phytotherapy Research, 38(9), 4467-4501.
27. [27] Chandra, S., Palai, S., Ferreira-Matias, E. F., Pita-Neto, I. C., Gomes-Ramalho, C. L., De Andrade, E. M., ... & Melo-Coutinho, H. D. (2023). Indian medicinal plants are effective in the treatment and management of COVID-19. Biocell, 47(4), 677-695.
28. [28] Lodhi, R., Shilpi, S., Kesharwani, R., Dhakad, U., & Khatri, K. (2023). Herbal Formulation and COVID-19. In COVID-19 and Immunomodulation with Special Emphasis on Nutraceutical and Herbal Formulation (pp. 65-106). Apple Academic Press.
29. [29] Govindasamy, J., Moss, S., Parise, R., Nadar, R. M., Pathak, S., Ramesh, S., ... & Dhanasekaran, M. (2022). Traditional, Cultural, and Nutraceutical Aspects of Cannabis in India. In Cannabis/Marijuana for Healthcare (pp. 301-319). Singapore: Springer Nature Singapore.
30. [30] De, S., Gopikrishna, A., Keerthana, V., Girigoswami, A., & Girigoswami, K. (2021). An overview of nanoformulated nutraceuticals and their therapeutic approaches. Current Nutrition & Food Science, 17(4), 392-407.