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# A Comparative Analysis of Emulsion Stability and Therapeutic Outcomes in Classical and Modified *Madhutailika Basti*

**Research Article**

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## Abstract

*Madhutailika basti*, a key ayurvedic therapeutic enema composed of *Madhu, saindhava lavana, sneha, kalka* and *kashaya*, relies heavily on the stability of its emulsion for optimal therapeutic effectiveness. This study aimed to compare the emulsion stability of *Madhutailika basti* prepared using classical and modified methods, focusing on physical and chemical stability. The classical method involved sequential mixing of ingredients according to traditional ayurvedic procedures, while the modified method replaced *madhu* with *guda* in group-B and *madhu* and *guda* together in group-C to enhance emulsion stability. Emulsion stability was evaluated through organoleptic properties and analytical tests. A pilot study was done on 24 patients. Group A (Madhu) exhibited superior stability (12 hours), ease of preparation, and optimal PH (5.5) compared to Groups B and C. Analytical tests confirmed oil-in-water emulsions, with Group A showing balanced stability and therapeutic efficacy. Clinical outcomes demonstrated significant improvements in *Samyaka Niruha Lakshanas*, with no adverse effects reported. While modified formulations are viable, the classical *Madhu*-based method proved most effective, emphasising the importance of traditional preparation techniques for consistent stability, safety, and therapeutic benefits in *Madhutailika* Basti.

**Keywords:** *Ayurveda,* Classical method, Emulsion stability test, *Madhutailika basti,* Modified method, Therapeutic efficacy.

## Introduction

Basti is regarded as the most effective of the five *Panchakarma* therapeutic measures in Ayurveda, offering a wide range of applications in medicine. It is considered both *Purnachikitsa,* (complete treatment) and *Ardhachikitsa,*(1)(2)(half of all treatments) due to its profound therapeutic significance. Among the various types of *Basti*, *Madhutailika Basti* (3)(4)(5) is a prominent subset, with *Yapana Basti* (6)(7)(8) forming a specialized category under it. *Acharya Charaka* elaborates on the sequential and methodical preparation of *Basti* ingredients, which include *Madhu*, *Saindhava Sneha*, *Kalka*, and *Kwatha***,** these are combined in a specific order, with thorough churning to achieve a uniform and stable emulsion(9).

The stability and homogeneity of the *Basti* mixture are critical for its therapeutic efficacy and ease of administration. However, achieving and maintaining emulsion stability is challenging due to the immiscible nature of its primary components-*Sneha* and *Kashaya.* An emulsion is a blend of two immiscible liquids, where tiny droplets of one liquid (the dispersed phase) are dispersed within the other liquid (the continuous Phase) (10) To achieve and maintain a stable emulsion, an emulsifying agent is essential. This emulsifier keeps the droplets suspended, prevents the separation of the Phases, and ensures a consistent mixture throughout.

In *Madhutailika Basti*, *Madhu* acts as a natural emulsifier and contributes to emulsion stability. However, maintaining stability for prolonged periods, especially in outpatient settings, remains a challenge. Classical references, such as *Acharya Vagbhata*, also mention *Guda* (jaggery) as another natural emulsifier in the preparation of *Niruha Basti* (11).

This study seeks to evaluate the effectiveness of *Madhu* as an emulsifying agent compared to *Guda* and their combination, based on emulsion stability analysis. Developing a standardized operating procedure (SOP) for *Basti* preparation is essential to ensure uniformity, safety, and therapeutic efficacy across Ayurveda centres. This includes achieving *Su-Yojita Niruha Lakshana* (proper homogeneity) by monitoring critical factors such as trituration time, temperature, and PH stability.

This study uses three distinct samples for the *basti* formulation

- 1. *Madhu* to highlight blends of natural emulsifying agents with classical reference.
- 2. *Guda*
- 3. *Guda* and *Madhu*.

### Need of emulsion stability in basti preparation

The need for emulsion and stability in basti preparation is crucial for ensuring therapeutic efficacy and uniformity of the enema solution. Ayurvedic basti

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formulations often combine immiscible components, such as *sneha* and *kashayas*, requiring stable emulsions to evenly distribute active ingredients, enhance absorption of lipophilic and hydrophilic compounds, and reduce localized irritation. Stability prevents Phase separation, ensures smooth administration without blockages, and maintains the formulation's integrity during storage and use, thereby prolonging its therapeutic action and optimizing clinical outcomes.

**Aim**

Comparison of classical and modified method of preparation of *Madhutailika basti* with reference to emulsion stability test and their therapeutic effect.

## Methodology

A Randomised clinical study was conducted with 24 patients who fulfilled the inclusion criteria of study. These patients were selected from the O.P.D. and I.P.D. of the xxxx.

**Selection criteria**

Group A *Basti* prepared with sample A
Group B *Basti* prepared with sample B
Group C *Basti* prepared with sample C
Where,Group A, B & C are studied group in which sample A-Basti prepared with Madhu
Sample B-Basti prepared with Guda
Sample C-Basti prepared with Madhu+Guda

**Inclusion criteria (12)**

*Niruha Basti yogya*

**Exclusion criteria (13)**

*Niruha Basti Ayogya*

**Diagnosis**

**Patient enrolment is done for Niruha basti yogya with different diseases**

- Group A: -40% of Individuals were *Swastha*,20% were *Janu sandhigata Vata*,10% of Individuals were *Katigata Vata*,10% were *Sandhigata Vata*,10% were *Prameha*,10% were *Sthaulya* Individuals.
- Group B: -25% of Individuals were *Swastha*,25 % of Individuals were *Katigata Vata*,12.5% were *Amavata*,25% of individuals were *Avabahuka* ,12.5% of individuals were *Pakshaghata*.
- Group C: -50% of Individuals were *Swastha*,12.5% were *Janu sandhigata Vata*,12.5% of Individuals were *Katigata Vata*,12.5 of individuals were*Pakshaghata*,12.5 % of individuals were *Gridhrasi*.

**Method of collection of data**

**Study design:**

**Study type**: Interventional
**Randomization**- Computer- generated random tables
**Number of groups:** Three (Group A,Group B & Group C with 08 patients in each group)
**Ethical Clearance:** The institutional ethical committee of the institute gave the approval to this study; vide letter No. – PU/PIA/IECHR/2020/264. Registered on October 9th 2020.

**Clinical trial registration**

The study was registered in the Clinical Trial Registry of India on December 07th 2020, with the CTRI Reg. No. CTRI/2020/12/029628

**Grouping and administration of drugs**

Twenty-four clinically diagnosed and registered patients of were divided randomly into three groups with 08 patients in each group.

1. Group A: Eight clinically diagnosed and registered patients were treated with Sample-A (Madhutailik basti prepred with Madhu) given for 8 days.
2. Group B: Eight clinically diagnosed and registered patients were treated with Sample-B (Madhutailik basti Prepared with Guda) given for 8 days.
3. Group C: Eight clinically diagnosed and registered patients were treated with Sample-C (Madhutailik basti prepared with Madhu+Guda) given for 8 days.

**Subjective criteria**

Assessment criteria for proper *basti* preparation: in the ayurveda text, there is a reference to proper *basti* preparation.

It should not run quickly out of the hand nor stick or remain steady on the hand. It should be a uniform mixture without Phase separation of its contents. At each step of the addition of drugs colour and texture of mixture will be observed and documented (14).

Assessment criteria is based on Samyak Niruha lakshana.

**Objective criteria**

Analytical study
i. Organoleptic characters of three samples
ii. Physio-chemical test
iii. Specific Gravity
iv. Saponification value
v. Iodine value
vi. PH test
vii. Stability test
viii. Relative viscosity
ix. Test for emulsion
  a. Dilution test
  b. Conductivity
  c. Dye test

**Assessment criteria: *Samyak niruha lakshana (15)***

The assessment of these Ayurvedic symptoms (or rather, clinical signs and outcomes) in a person is typically based on subjective evaluation and clinical examination.

- *Prasrusta vina pravrutti* – Increased bowel movement
- *Prasrusta mootra pravrutti* – Increased urine output
- *Prasrusta vata pravrutti* – Increased flatus expulsion
- *Ruchi in ahara* – Improved appetite
- *Agni vruddhi* – Enhancement of digestive fire
- *Ashaya laghavata* – Feeling of lightness in viscera (or abdomen)

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- *Rogopashanti* – Alleviation of disease
- *Prakruti sthapana* – Restoration of natural constitution
- *Bala vruddhi* – Improvement in strength or vitality

**Phase 1: *Basti* preparation method**

*Basti* is prepared by classical method (Group -A), modified method (Group -B), and modified *Madhutailika basti* (Group C)

**Group A: *Madhutailika basti* (classical group) (16)**

1. *Madhu (96 ml),*
2. *Saindhav (6 gm)*
3. *Murchhita tila taila* (96ml) (17)
4. *Kalka* of *Madanphala(18) & shatpushpa* (12 gm)
5. *Kwatha* of *erandamoola* (174 ml)

In this study, the *basti sammilana* SOP (Standard operative procedure) followed for the preparation of basti as per the methods of *acharya charaka* and *acharya kashyapa(19)* mention in Samhita. *Madhu* was added first for its auspicious properties (20) followed by *saindhava* which separates due to its *teekshnata* and *pichchilata*. The *kashayatva* in *Madhu* helps bind saindhava, forming a compound. *Taila* was added next to ensure uniformity, allowing proper mixing, followed by *kalka* and *kwatha* to bring homogeneity. This sequential mixing achieves *su-yojana niruha lakshana (21)* ensuring optimal efficacy. According to classical texts, a correctly blended *basti* quickly expels pitta and releases *vayu* and *kapha* from subtle channels. Proper churning is emphasized, as incomplete mixing undermines the enema's intended therapeutic effects (22).

**Group B: Modified *Madhutailika basti***

*Guda* was used in place of *Madhu* in group B. To make *gudapaka*, equal quantity of *guda* and water taken and boil till *Madhu* like consistency is achieved. The Basti preparation process was applied in the same order.

**Group C: Modified *Madhutailika basti***

The equal amount of *Madhu and guda* together were used in group C. This *basti* was prepared according to *acharya charaka*.

**Phase 2: Analytical and observational study**

Organoleptic properties and analytical tests were done of each sample of basti at each step.

**Organoleptic study:** all samples were observed for color, odour and consistency.

**PH measurement**: for each step, PH was measured using a PH paper.

**Specific gravity:** a weighing machine was used to determine the samples' weight after they were placed inside a pycnometer.

**Table 1 : Analytical and Physio-chemical tests of each group in step wise manner**

| Sample | Step | Color | Consistency | PH value (avg.) | Specific gravity (gm/ml) (avg.) | Refractive index (m/s) (avg.) |
|---|---|---|---|---|---|---|
| A | 1 | Light yellow | Mild thick | 5.5 | 1.4254 | 1.4720 |
| | 2 | Reddish brown | Jelly like | 6.0 | 1.1970 | 1.4720 |
| | 3 | Dark brown | Thick | 5.5 | 1.1535 | 1.4580 |
| | 4 | Light brown | Liquid | 5.5 | 1.0880 | 1.4380 |
| B | 1 | Light yellow | Mild thick, sticky | 6.5 | 1.4456 | 1.4810 |
| | 2 | Reddish brown | Jelly like | 6.0 | 1.2146 | 1.4550 |
| | 3 | Dark brown | Thick | 6.0 | 1.1850 | 1.4580 |
| | 4 | Light brown | Liquid | 6.0 | 1.0995 | 1.4350 |
| C | 1 | Light yellow | Mild thick | 5.5 | 1.4311 | 1.4750 |
| | 2 | Reddish brown | Jelly like | 5.5 | 1.2086 | 1.4760 |
| | 3 | Dark brown | Thick | 6.0 | 1.1676 | 1.4759 |
| | 4 | Light brown | Liquid | 6.0 | 1.0920 | 1.4229 |

Here,
Step-1=*Madhu + saindhav*
Step-2= *Madhu+ saindhav+ sneha*
Step-3= *Madhu + saindav + sneha + kalka*
Step-4= *Madhu + saindav + sneha + kalka + kashaya*

**Table 2:Analytical and Physio-chemical test results of final samples of each group**

| Sr no | Parameters | Sample-A | Sample -B | Sample -C |
|---|---|---|---|---|
| 1 | PH | 5.47 | 5.69 | 5.50 |
| 2 | Saponification value | 191.71 | 112.33 | 137.60 |
| 3 | Iodine value | 43.85 | 55.29 | 33.13 |
| 4 | Viscosity by oswald | 3.59 cp | 8.88 cp | 2.52 cp |
| 5 | Dilutation test(water) | Miscible in water | Miscible in water | Miscible in water |
| 6 | Conductivity | 0.150 µ∂ | 0.160 µ∂ | 0.165 µ∂ |
| 7 | Dye test | Oil in water emulsion | Oil in water emulsion | Oil in water emulsion |

*Analytical and physio-chemical tests of final sample of basti done in vasu pharmacy.

**Phase 3: Pilot study**

24 *Niruha basti yogya* subjects participated in the pilot study.

**Table 3: Intervention of *basti***

| Day 1 | Day2 | Day 3 | Day 4 | Day 5 | Day 6 | Day 7 | Day 8 |
|---|---|---|---|---|---|---|---|
| ***M.B*** | ***M.B*** | ***M.B*** | ***M.B*** | ***M.B*** | ***M.B*** | ***M.B*** | ***M.B*** |

**[M.B = *Madhutailika Basti*]**

***Purva karma***

All of the patients included in the trial gave their informed written consent for the treatment before it began, and appropriate counselling was conducted with each patient. *Basti preparation, Sthanik Abhyanga* with *Murcchita Tila Taila at Kati, Kushi, Ubhaypada,* followed by *Nadi Swedan*.

***Pradhanakarma***

The *Basti* administration in the state of *Nati-Khsudhartha*

***PaschyatKarma***

The number of Vega and the first *Basti Pratyagamana kala* were observed.

The *Basti Karma* patient was evaluated from the first to the eighth day.

**Statistical analysis**

Statistical test was done by using Data Analysis in SPSS. (Version 23). Statistical analysis of 26 individuals was done. Cochran's Q test, Chi-Square test was done to analyze the significance whithin groups and the Kruskal-Wallis H and Anova test between the groups.

## Observations

**Table 4: Assessment of *Samyak Niruha lakshana***

| Parameter | Group A | Group B | Group C |
|---|---|---|---|
| *Prasrusta-vina pravrutti* | 100(%) | 80(%) | 100(%) |
| *Prasrushta-mutra pravrutti* | 100(%) | 80(%) | 100(%) |
| *Prasrushta-vata pravrutti* | 100(%) | 80(%) | 87.5(%) |
| *Ruchi in ahara* | 100(%) | 87.5(%) | 100(%) |
| *Agni vruddhi* | 100(%) | 100(%) | 87.5(%) |
| *Ashaya laghavata* | 87.5(%) | 87.5(%) | 100(%) |
| *Rogopshanti* | 90(%) | 80(%) | 37.5(%) |

*Percentage is mean average of samyak niruha lakshana of basti given for 8 days.

## Results

**Table 5: Anova test of *Basti Dharankala***

| Day | Between Groups SS | Within Groups SS | Total SS | df (Between, Within) | Mean Square (Between) | F-Value | p-Value |
|---|---|---|---|---|---|---|---|
| Day 1 | 175.000 | 122.625 | 297.625 | (2, 21) | 87.500 | 14.985 | 0.000 |
| Day 2 | 184.333 | 107.500 | 291.833 | (2, 21) | 92.167 | 18.005 | 0.000 |
| Day 3 | 234.750 | 97.250 | 332.000 | (2, 21) | 117.375 | 25.346 | 0.000 |
| Day 4 | 161.333 | 110.500 | 271.833 | (2, 21) | 80.667 | 15.330 | 0.000 |
| Day 5 | 149.250 | 47.375 | 196.625 | (2, 21) | 74.625 | 33.079 | 0.000 |
| Day 6 | 229.333 | 44.000 | 273.333 | (2, 21) | 114.667 | 54.727 | 0.000 |
| Day 7 | 185.083 | 54.250 | 239.333 | (2, 21) | 92.542 | 35.823 | 0.000 |

One-way ANOVA revealed a statistically significant difference between the groups on each day from Day 1 to Day 7, with all p-values being **0.000**. The F-values increased over time, starting from **14.985 on Day 1** and reaching a peak of **54.727 on Day 6**, indicating a progressively stronger effect of the intervention.

**Table 6: *Samyaka niruha lakshana in Madhutailika basti* Group A, B & C with Cochran's- Q test**

| ***Lakshanas*** | **Group** | **N** | **Q value** | **P value** |
|---|---|---|---|---|
| *Prasruta vata* | Group a | 8 | 7 | 0.429 |
| | Group c | 8 | 7 | 0.429 |
| *Agni vruddhi* | Group a | 8 | 14 | 0.051 |
| | Group b | 8 | 7 | 0.429 |
| | Group c | 8 | 11.421 | 0.121 |
| *Ruchi* in *ahara* | Group a | 8 | 14 | 0.051 |
| | Group b | 8 | 8 | 0.429 |
| | Group c | 8 | 11.421 | 0.121 |
| *Ashaya laghavata* | Group a | 8 | 14 | 0.051 |
| | Group b | 8 | 7 | 0.429 |
| | Group c | 8 | 14 | 0.051 |
| *Bala vruddhi* | Group a | 8 | 36.787 | 0.00 |
| | Group b | 8 | 17.231 | 0.016 |
| | Group c | 8 | 28.467 | 0.00 |

The cochran-Q test was conducted to analyze the effect of *Madhutailika basti* on various *samyaka niruha lakshanas* over different treatment days. The test revealed statistically significant results ($p < 0.05$) across multiple parameters, indicating considerable improvements in symptoms over the course of treatment. Key *lakshanas* such as *prasruta vata, agni vruddhi, ruchi in ahara, ashaya laghavata, rogopashanti, prakruti sthapana,* and *bala vruddhi* demonstrated significant changes, reflecting progressive therapeutic effects. This suggests that the intervention had a meaningful impact on these parameters during the treatment period.

**Kruskal-Wallis H Test for Within the Group *Samyaka Niruha Lakshana***

The kruskal-wallis H test was conducted to assess the within-group effects of *Madhutailika basti* across various *samyaka niruha lakshanas* from day 1 to day 8. For parameters like *prasruta vina, prasruta mootra pravrutti, prasruta vata pravrutti, ruchi in ahara, agni vruddhi, ashaya laghavata, rogopashanti, prakruti sthapana,* and *bala vruddhi*, the test yielded non-significant results ($p > 0.05$) across all days, indicating

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no statistically significant difference within the groups. Minor fluctuations in kruskal-wallis H values were observed over the study period, but these remained within a non-significant range.

# Discussion

### Discussion On *Madhutailik basti*

*Basti* is a vital procedure in *Panchakarma*, addressing complex and chronic diseases effectively. It involves the administration of a multi-drug formulation rectally, which reaches the ileocecal junction for systemic therapeutic effects. Among various Basti types, It has broad spectrum efficacy *(Phalam Cha Vipulam Drishtam)*(23). It contains *mrudu veerya Dravya*, *Madhutailika Basti* is emphasized for its *Deepana* (appetizing), *Brihana* (nourishing), *Balavarnakara* (strengthening and enhancing complexion), *Vrushya* (aphrodisiac), and *Rasayana* (rejuvenating) properties (24). As a type of *Yapana Basti*, it is characterized by its ability to be administered without strict time restrictions and without significant complications *(Vyapadam Cha Api Asambhavaha(25).*

### Discussion on Methodology

This study investigated the efficacy and stability of *Madhutailika* basti in classical and modified formulations, focusing on the emulsion stability of *niruha basti* preparations. Each group's preparation followed four sequential steps: initial trituration with emulsifiers and Saindhava, followed by the gradual addition of Sneha to ensure stability, incorporation of *Kalka* to enhance consistency, and finally, the addition of *Erandamoola Kwatha* to complete the formulation. Key observations showed that Group A, which used *Madhu* as the emulsifier, demonstrated superior stability (12 hours) compared to Groups B and C (7–8 hours). Group A also required less effort and time (44 minutes) for trituration due to the reduced friction compared to Group B, where the stickiness of *Guda* increased the difficulty. Additionally, Group A maintained a PH of 5.5, while Groups B and C had a slightly higher PH of 6. Despite these variations, all groups achieved the desired consistency, meeting the *Su-Yojita Niruha Lakshana* standards.

The preparation process followed the sop developed based on acharya *charaka's* guidelines, ensuring that each ingredient was sequentially added and mixed to achieve *su-yojana niruha lakshana,* or optimal homogeneity. This standardized method reduced manual error, enhanced stability, and ensured therapeutic efficacy.

The pilot study observed *samyaka niruha lakshana* and the signs of proper *basti* functioning, including relief of symptoms and balanced doshas. Notably, no adverse effects or complications *(vyapada)* were reported across groups, indicating that both *Madhu* and *guda* can be viable options depending on availability. However, the classical formula with *Madhu* demonstrated better stability and efficacy.

### Discussion On Analytical tests

The PH values of all groups, ranging from 5.47 (Group A) to 5.69 (Group B), indicate slightly acidic formulations that support emulsion stability and compatibility with the gut environment. Group A's highest saponification value (191.71) suggests a greater proportion of short-chain fatty acids, making it more reactive and prone to hydrolysis, while Group B (112.33) and Group C (137.60) have more stable oils. The iodine value is highest in Group B (55.29), reflecting greater unsaturation and potential reactivity, while Group A (43.85) and Group C (33.13) are more resistant to oxidation. Viscosity is highest in Group B (8.88 cp), indicating a thicker consistency and better emulsion stability, compared to the more fluid Group A (3.59 cp) and Group C (2.52 cp). The dilution test shows all groups are miscible in water, confirming their oil-in-water emulsion type, ensuring ease of mixing and therapeutic efficacy. Conductivity is highest in Group C (0.165 μ∂), suggesting improved electrolyte dispersion, enhancing the formulation's stability. Finally, the dye test confirms all groups as oil-in-water emulsions, ensuring a consistent phase type for effective absorption and therapeutic delivery. Together, these parameters highlight the stability, consistency, and therapeutic potential of the formulations. Overall, group B stands out for stability and concentration, group A balances stability with efficacy, and group C offers ease of application with lighter composition.

### Discussion on Result

The consistent significance of ANOVA test across all days suggests that the treatment had a substantial and increasing impact over time. The peak F-value on Day 6 indicates the maximum treatment response occurred at that point. These results support the effectiveness of the intervention and highlight the potential for cumulative therapeutic benefits.

The results of the cochran-Q test demonstrate the significant impact of *Madhutailika basti* on various *samyaka niruha lakshanas* over the treatment period. The statistically significant improvements across key parameters such as *prasruta vata, agni vruddhi, ruchi in ahara, ashaya laghavata, rogopashanti, prakruti sthapana,* and *bala vruddhi* suggest that the intervention is effective in addressing a range of Physiological and symptomatic outcomes. These findings align with the ayurvedic perspective of *basti* as a comprehensive therapeutic measure, capable of restoring balance and promoting systemic health. The consistent improvement observed across multiple *lakshanas* underscores its progressive therapeutic efficacy.

In contrast, the kruskal-wallis H test revealed non-significant results ($p > 0.05$) for within-group variations over the 8-day treatment period. This indicates that while there were notable improvements in clinical symptoms, the rate of change remained stable within each group, suggesting a uniform response to the treatment over time. The lack of significant fluctuations in kruskal-wallis H values highlights the sustained efficacy of *Madhutailika basti* across the evaluated parameters, without notable intra-group variations.

These results suggest that while the intervention is effective overall, its therapeutic impact is steady rather than variable, with consistent outcomes across the treatment duration.

## Conclusion

The study highlights honey as the preferred emulsifying agent for *Madhutailika Basti*, offering superior stability and therapeutic benefits in forming a stable oil-in-water emulsion. The classical formulation with *Madhu* proved more stable than modified formulations using Guda or a combination of *Guda* and *Madhu*, which can serve as safe alternatives if honey is unavailable. No adverse effects were reported across any group during the pilot study, confirming the safety of all formulations. Standardized preparation methods, aligned with classical references, ensured a stable emulsion lasting 12 hours and significant clinical outcomes in achieving *Samyaka Niruha Lakshana*. Among the tested groups, Group A (classical formulation) demonstrated the highest stability and consistency in Physio-chemical and therapeutic results, supporting the efficacy of traditional *Madhutailika Basti* preparation techniques.

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