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Evaluation of Kutaja (Holerrhena pubescens) Bark and Seed Powders in Brewer's Yeast-Induced Pyrexia in Rats: An Experimental Study

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ABSTRACT:

Background: Kutaja is a medicinal plant used in Ayurvedic practice, including Jwara. Both bark and seed have a history of medicinal use, but direct experimental information on their ability to reduce fever remains limited.

Objectives: This study examined changes in rectal temperature after administration of Kutaja bark and seed powders in rats after subjected to Brewer's yeast-induced fever. Their responses were compared with the vehicle group/Control group and with Standard /paracetamol group.

Materials and methods: The study comprised 24 Wistar albino rats divided into four groups of six each: A. Control group (CMC), B. Standard group (Paracetamol), C. Kutaja seed and D. Kutaja bark. The experimental evaluation gives a dose of 54 mg/rat for each Kutaja preparation. Rectal temperature was measured before treatment and 18 hours after administration of trial drugs at 30, 60, 90, 120, 150 and 180 min. For analysis, each post-treatment value was expressed as the difference from that animal's baseline temperature. One-way ANOVA was carried out separately for each observation time, with Holm adjustment applied to the six overall tests. Welch's t-test was used as an exploratory analysis for comparisons involving the Kutaja groups.

Results: Between-group differences in change from baseline were observed at 30 min ($F=13.340$, Holm-adjusted $p=0.0003$), 90 min ($F=18.828$, $p<0.0001$), 120 min ($F=8.962$, $p=0.0026$), 150 min ($F=5.377$, $p=0.0161$) and 180 min ($F=8.120$, $p=0.0038$), but not at 60 min ($F=2.344$, $p=0.1053$). At 90 min, mean changes from baseline were +1.75°C for seed and +1.83°C for bark compared with +0.30°C for vehicle control. At 180 min, the corresponding changes were −0.07°C and +0.02°C versus −0.72°C in controls. No adjusted comparison between Kutaja seed and bark was statistically significant. The paracetamol group did not show a consistent temperature-lowering advantage over vehicle control.

Conclusion: In the observations available for analysis, neither Kutaja seed nor bark produced a pattern consistent with an antipyretic effect. Significant overall group differences occurred at several time points, but the Kutaja groups generally showed greater increases from baseline rather than the expected fall in temperature. The present findings

therefore do not provide evidence of antipyretic efficacy and should be regarded as exploratory and inconclusive.

1. INTRODUCTION

Fever involves a controlled rise in body temperature resulting from a change in the thermoregulatory set point. In experimental pharmacology, fever models are used to determine whether a treatment can reduce an induced rise in temperature. Brewer's yeast-induced fever in rats has been used for this purpose, and the model described by Loux and colleagues demonstrated that subcutaneous yeast administration could produce a sustained increase in rectal temperature suitable for testing antipyretic agents.

Jwara occupies an important place in Ayurvedic literature and is associated with rise in temperature, and disturbance of normal bodily functions. Kutaja is one of the plants used traditionally in this context. The species recorded in older literature as Holarrhena antidysenterica is currently listed by the Royal Botanic Gardens, Kew as Holarrhena pubescens Wall. ex G.Don, with H. antidysenterica treated as a synonym. The species belongs to Apocynaceae and contains steroidal alkaloids, including conessine and related constituents.[1]

Both bark and seed of Kutaja have been used medicinally, while experimental investigations of H. pubescens have reported antimicrobial and other biological activities. Such findings, however, do not establish an antipyretic action. The present work was therefore restricted to the effect of these two plant materials on rectal temperature in a yeast-induced fever model.

The present paper re-examines the available observations at the individual-animal level. Particular attention was given to the direction of temperature change so that statistical group differences would not be interpreted as antipyresis unless they were accompanied by an appropriate fall in temperature.

2. OBJECTIVES

1. To evaluate the effect of Kutaja bark powder on rectal temperature in Brewer's yeast-induced pyrexia in rats.
2. To evaluate the effect of Kutaja seed powder on rectal temperature of rats.
3. To compare the responses of Kutaja bark and seed with vehicle control and paracetamol.

3. MATERIALS AND METHODS

3.1 Study design and experimental groups

This was a parallel-group animal experiment with four planned groups, each containing six rats. The groups received CMC vehicle, paracetamol, Kutaja seed powder or Kutaja bark powder. Individual animals were used as the units of observation.

Table 1. Treatment groups and planned number of animals.

Group	Intervention	Number of animals.
I	Vehicle control (CMC vehicle)	6
II	Paracetamol reference	6
III	Kutaja seed powder	6
IV	Kutaja bark powder	6

3.2 Experimental animals

According to the experimental record, 24 healthy Wistar albino rats of either sex were used. Their reported age was about 90–120 days and body weight about 175–200 g. Animals meeting the stated exclusion conditions were not included. Standard Feed and drinking water were provided under the laboratory housing conditions.

3.3 Plant material and authentication

The source record states that Kutaja bark and seeds were collected from the Badami region and identified by the institutional analytical officer. Bark and seed were processed separately to obtain powders. The original work included organoleptic, microscopic, physicochemical and preliminary phytochemical observations.

3.4 Preliminary physicochemical and phytochemical observations

In the source record, moisture was reported as 1% for both bark and seed. Foreign matter was 2.0% in bark and 2.1% in seed, while total ash was 12% and 7%, respectively. Alkaloids were detected preliminarily in aqueous and alcoholic extracts of both materials, and tannins were reported in bark extracts. These values are reproduced as observations from the original record and were not independently reassessed.

3.5 Induction of pyrexia

Fever was produced using the Brewer's yeast procedure described in the source record. The record specifies a 20% suspension prepared in normal saline and administered subcutaneously at 1 mL per 100 g body weight. The interval between yeast administration and subsequent treatment is eighteen hours. Other published yeast induced-fever protocols have used a 20% suspension at approximately 20 mL/kg with confirmation of a sufficient temperature rise before treatment.[2]

3.6 Treatment and dose

The treatment table in the source material records 2 mL CMC for controls, 1.6 mL paracetamol for the reference group, and 54 mg of either Kutaja seed or bark powder for the respective test groups.

3.7 Rectal temperature measurement

Rectal temperature was measured before treatment and at 30, 60, 90, 120, 150 and 180 min thereafter. The source observations record two deaths. One occurred in the control group, after which that animal had no further measurements from 30 min onward; another occurred in the paracetamol group, with measurements unavailable from 150 min onward. Values after death were considered missing.

3.8 Statistical analysis

The main outcome was the change in rectal temperature for each rat, obtained by subtracting the baseline value from the corresponding post-treatment value. Thus, a negative change represents a decrease in temperature. Because the available observations include attrition and do not allow reliable reconstruction of a prespecified repeated-measures analysis, each post-treatment time point was analysed separately with one-way ANOVA. The six-omnibus p-values were adjusted by the Holm method to account for repeated testing. Eta-squared (η^2) was used to describe the magnitude of the overall group effect.

Additional Welch comparisons were made between seed and vehicle, bark and vehicle, and the two Kutaja preparations. These p-values were likewise adjusted by the Holm procedure. Tests were two-sided and an adjusted p value below 0.05 was taken as statistically significant. Calculations were based on the recorded values for individual rats rather than on rounded group summaries.

4. RESULTS

4.1 Animal observations and attrition/deaths.

At the beginning of the experiment, six rats were assigned to each of the four groups. Two animals were later lost because deaths were recorded. The numbers available for analysis were therefore reduced at the later observation points, with 5/6/6/6 animals in the control/paracetamol/seed/bark groups at 150 and 180 min. The corresponding numbers at earlier observations reflect the time at which the control animal became unavailable.

Table 2. Rectal temperature (°C), expressed as mean ± SD from the individual animal records. The number of observations decreases after the reported deaths.

Time	Control	Paracetamol	Seed	Bark
Baseline	38.82 ± 0.13	38.43 ± 0.18	38.33 ± 0.18	38.25 ± 0.16
30 min	38.42 ± 0.36	39.20 ± 0.00	38.65 ± 0.33	38.47 ± 0.29
60 min	39.22 ± 0.38	39.58 ± 0.79	39.25 ± 0.15	38.83 ± 0.35
90 min	39.10 ± 0.47	38.92 ± 0.49	40.08 ± 0.33	40.08 ± 0.33
120 min	38.94 ± 0.55	38.42 ± 0.42	39.25 ± 0.29	39.30 ± 0.24
150 min	38.20 ± 0.16	38.06 ± 0.09	38.33 ± 0.38	38.33 ± 0.38
180 min	38.08 ± 0.08	37.98 ± 0.15	38.27 ± 0.36	38.27 ± 0.31

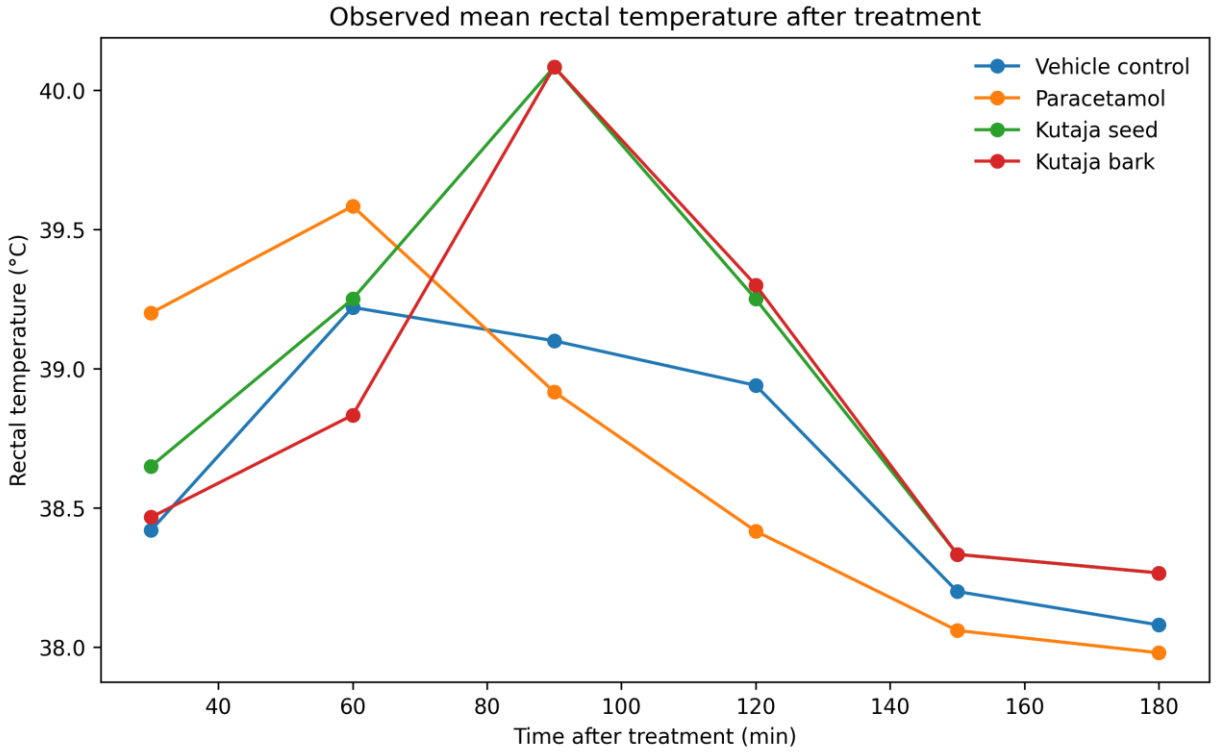

Figure 1. Mean rectal temperature recorded after treatment. The graph is descriptive and should not be interpreted alone as evidence of an antipyretic effect.

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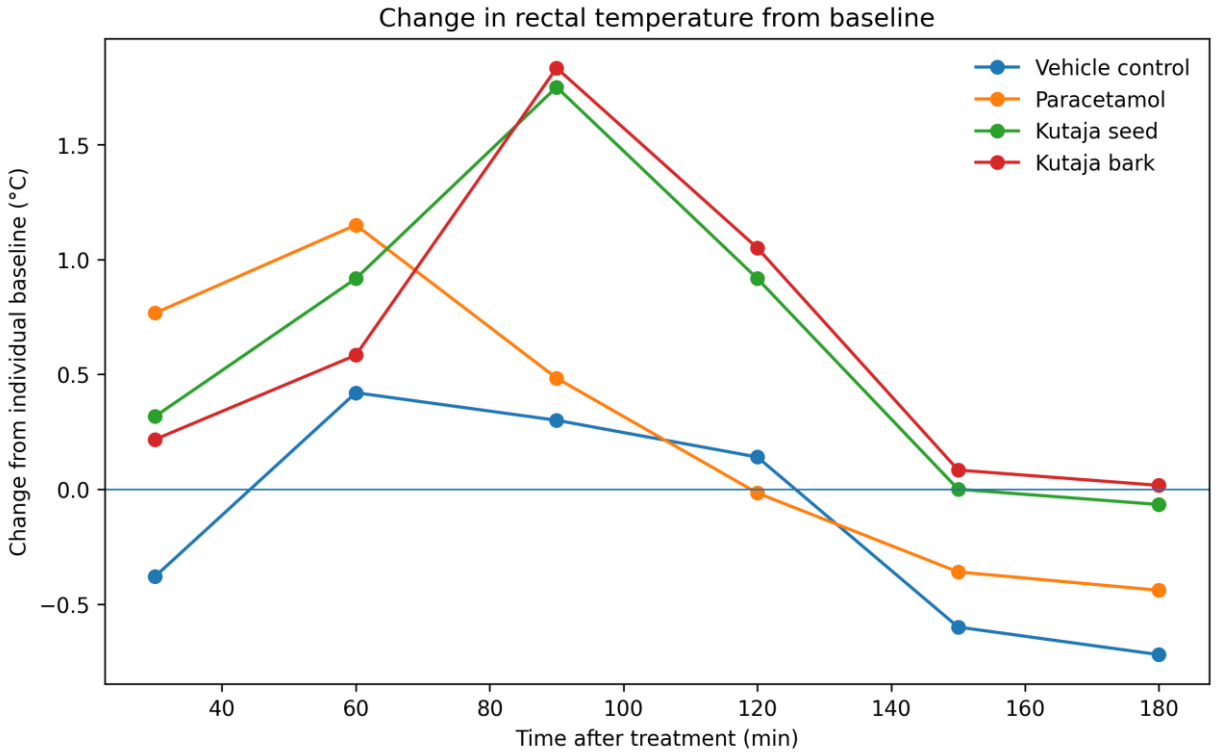

Figure 2. Change in mean rectal temperature relative to individual baseline. Values below zero indicate a reduction from baseline.

4.2 Baseline-adjusted between-group analysis

Table 3. ANOVA results for change from baseline.

Time	n C/P/S/B	Control ΔT	Paracetamol ΔT	Seed ΔT	Bark ΔT	F	Holm p	η^2
30 min	5/6/6/6	-0.38	+0.77	+0.32	+0.22	13.340	0.0003	0.678
60 min	5/6/6/6	+0.42	+1.15	+0.92	+0.58	2.344	0.1053	0.270
90 min	5/6/6/6	+0.30	+0.48	+1.75	+1.83	18.828	<0.0001	0.748
120 min	5/6/6/6	+0.14	-0.02	+0.92	+1.05	8.962	0.0026	0.586
150 min	5/5/6/6	-0.60	-0.36	-0.00	+0.08	5.377	0.0161	0.473
180 min	5/5/6/6	-0.72	-0.44	-0.07	+0.02	8.120	0.0038	0.575

The overall ANOVA was significant at 30, 90, 120, 150 and 180 min, whereas the 60-min comparison was not. At 90 min, temperature had changed by +0.30°C in controls, +0.48°C after paracetamol, +1.75°C after seed powder and +1.83°C after bark powder. At 120 min the respective changes were +0.14°C, −0.02°C, +0.92°C and +1.05°C. By 150 min, the values were −0.60°C, −0.36°C, approximately 0°C and +0.08°C; at 180 min they were −0.72°C, −0.44°C, −0.07°C and +0.02°C.

4.3 Exploratory comparisons of Kutaja groups

Table 4. Exploratory Welch comparisons. None of the adjusted seed-versus-bark comparisons was significant. At 90 min, the significant Kutaja-versus-control differences reflected a larger rise in temperature in the Kutaja groups.

Time	Comparison	Reference	Mean ΔT difference	Welch t	Holm p
30 min	Kutaja seed	vs vehicle	+0.70	3.589	0.0770
30 min	Kutaja bark	vs vehicle	+0.60	3.189	0.1323
30 min	Kutaja seed vs bark	between test groups	+0.10	0.489	1.0000
60 min	Kutaja seed	vs vehicle	+0.50	2.137	0.6043
60 min	Kutaja bark	vs vehicle	+0.16	0.642	1.0000
60 min	Kutaja seed vs bark	between test groups	+0.33	1.811	0.7228
90 min	Kutaja seed	vs vehicle	+1.45	5.289	0.0090
90 min	Kutaja bark	vs vehicle	+1.53	5.750	0.0056
90 min	Kutaja seed vs bark	between test groups	-0.08	-0.314	1.0000
120 min	Kutaja seed	vs vehicle	+0.78	2.445	0.3946
120 min	Kutaja bark	vs vehicle	+0.91	3.026	0.2241
120 min	Kutaja seed vs bark	between test groups	-0.13	-0.596	1.0000
150 min	Kutaja seed	vs vehicle	+0.60	3.013	0.1644
150 min	Kutaja bark	vs vehicle	+0.68	3.673	0.0770
150 min	Kutaja seed vs bark	between test groups	-0.08	-0.396	1.0000
180 min	Kutaja seed	vs vehicle	+0.65	3.740	0.0770
180 min	Kutaja bark	vs vehicle	+0.74	5.003	0.0118
180 min	Kutaja seed vs bark	between test groups	-0.08	-0.456	1.0000

DISCUSSION

The individual-animal data do not provide convincing evidence that either Kutaja preparation lowered fever in this experiment. The ANOVA results show that the groups were not identical at several observation times, but statistical significance alone does not establish an antipyretic response. At 90 and 120 min, in particular, the seed and bark groups had larger positive changes from baseline than the vehicle group. This is the opposite of the pattern expected from an effective fever-reducing treatment.

The two Kutaja preparations also behaved similarly in the direct statistical comparisons. None of the seed-versus-bark tests remained significant after adjustment. Thus, the available data do not justify describing bark as more effective than seed. The observed numerical differences were insufficient to demonstrate superiority of one plant part.

The paracetamol findings are also important when judging the experiment. The reference treatment did not show a clear and consistent advantage over the vehicle group. A positive control is normally expected to demonstrate that the model can detect a known antipyretic effect; the absence of a clear response therefore weakens confidence in the assay conditions. The original dose and formulation, timing of treatment, success of fever induction, temperature-measurement procedure, environmental conditions and any discrepancies in the source records should be checked before drawing stronger conclusions.

Kutaja continues to be of pharmacological interest because H. pubescens contains steroidal alkaloids and has been investigated for several biological activities, including antimicrobial effects. Those observations provide a rationale for further research, but they cannot be taken as evidence that the powders examined in this study reduce fever. Since the experiment measured temperature alone and did not include inflammatory or molecular markers, no conclusion can be drawn about pathways involving cyclooxygenase, prostaglandins, cytokines or related mediators.

The work has relevance to Ayurvedic pharmacology because Kutaja is part of the traditional materia medica and Jwara is an important Ayurvedic disease concept. At the same time, yeast-induced fever in rats is a biomedical experimental model and should not be equated completely with Jwara as described in Ayurveda. The present experiment can more appropriately be viewed as a test of whether the traditional use of Kutaja is accompanied by a measurable reduction in experimentally raised body temperature.

5. CONCLUSION

Within the limits of the available animal-level observations, neither Kutaja bark nor seed powder showed a convincing antipyretic effect in the Brewer's yeast model. Although overall group differences were detected at several time points, the Kutaja groups did not show the expected fall in temperature relative to controls. The data also provide no statistical basis for claiming that bark is superior to seed. These results should therefore be regarded as exploratory and not as evidence of therapeutic efficacy. Before the findings are used for further claims, the original records should be checked, particularly for animal weights, doses, timing of fever induction and treatment, temperature readings, mortality records and the positive-control procedure.

6. FUNDING

No external financial support was reported for the study.

7. DECLARATION OF COMPETING INTEREST

The authors report no competing interests.

8. AUTHOR CONTRIBUTIONS

Dr. Shiva Prasad Mohanty contributed to study conceptualization, investigation, data curation, and preparation of the original manuscript draft. Dr. Kshirabdhi Tanaya Rautaray contributed through supervision, investigation, Dr Sanjib Kumar Das: Critical review and editing, Dr Pallabi Mahanta: Statistical reanalysis. All four authors reviewed and approved the final version.

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REFERENCES

[1] Royal Botanic Gardens, Kew. Plants of the World Online: Holarrhena pubescens Wall. ex G.Don. Kew Science; 2026. Available from: https://powo.science.kew.org/. Accessed August 29, 2026.

[2] Loux JJ, DePalma PD, Yankell SL. Antipyretic testing of aspirin in rats. Toxicol Appl Pharmacol. 1972;22(4):672–675. doi:10.1016/0041-008X (72)90295-5.

[3] Singh. R., Verghese. S. P., Bansal A. (2026). Silver Nanoparticles For Environmental Sustainability And Their Role In Biological Activities. International Journal of Engineering Sciences & Research Technology, 15(3), 1–8. ttps://doi.org/10.64149/j.ijesrt.15.3-1-8