

# Use of Panax Notoginseng on Ischemic Stroke in a Cardiology Setting in Senegal: A Randomized Controlled Trial

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## Abstract

**Background:** Stroke is the leading cause of death and disability worldwide. Panax Notoginseng, used in Chinese medicine, has potential antiplatelet and neuroprotective properties. **Objective:** To evaluate the efficacy of Panax Notoginseng in reducing motor sequelae of ischemic stroke in a Senegalese population. **Methods:** An open-label randomized controlled clinical trial conducted over 6 months in 4 Senegalese hospitals. 152 patients with confirmed ischemic stroke (<7 days) were randomized into two groups: standard treatment (Aspégic 100mg + Atorvastatin 20mg) versus standard treatment + Panax Notoginseng (Luotai® 200mg IV for 15 days, then orally for 75 days). Assessment at inclusion, 1 month, and 3 months using the NIHSS and Barthel scales. **Results:** 152 patients were included (78 in the control group, 74 in the intervention group), with a mean age of 60.2 years. Significant improvement in neurological scores was observed in both groups without a statistically significant difference between groups. Mean NIHSS score: 12.9 vs 12.1 at inclusion, 6.9 vs 6.4 at 3 months (p = 0.844). Barthel Index: improvement of 16% (control group) vs 18% (intervention group). No adverse effects reported. **Conclusion:** Panax Notoginseng shows a favorable but non-significant trend in post-stroke motor recovery. Its good tolerability in African subjects warrants further studies with larger sample sizes.

## Keywords

Ischemic Stroke, Panax Notoginseng, Traditional Chinese Medicine, Senegal,

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## Randomized Controlled Trial

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### 1. Introduction

Stroke is a major global public health challenge, representing the second leading cause of death and the primary cause of disability worldwide [1] [2]. Its incidence continues to rise, particularly in developing countries where it is expected to double by 2030 according to the World Health Organization [3]. Beyond its impact on morbidity and mortality, stroke generates a substantial economic burden, estimated at several billion euros annually in developed countries [4] [5].

The management of ischemic stroke has been revolutionized by the advent of intravenous thrombolysis and the creation of specialized neurovascular units, leading to a significant reduction in mortality and disability [6] [7]. However, despite these advances, nearly 60% of survivors retain major functional sequelae [8]. This reality justifies the search for complementary therapies, especially in resource-limited countries where access to advanced treatments remains restricted [9].

Traditional Chinese Medicine (TCM) offers promising perspectives in this context. Used for over 2000 years, it is based on a holistic approach integrating phytotherapy, acupuncture, and pharmacopoeia [10] [11]. Among the many medicinal plants used, *Panax Notoginseng* (Sanqi in Chinese) holds a privileged place in the treatment of cardiovascular conditions [12] [13].

*Panax Notoginseng* has a particularly interesting pharmacological profile: improvement of cerebral microcirculation through vasodilation, potent antiplatelet aggregation effect, anti-inflammatory properties, protection against oxidative stress, and stimulation of neurogenesis [14]-[16]. Preclinical studies have demonstrated its ability to reduce cerebral infarct size and improve functional recovery in animal models of stroke [17] [18]. Clinical trials conducted mainly in Asia have shown encouraging results, with improvement in neurological scores and reduction in recurrence [19]-[21].

In Senegal, the epidemiology of stroke is evolving unfavorably with a steadily increasing incidence, linked to the epidemiological transition and rapid urbanization [22] [23]. The study by Touré *et al.* reports a hospital prevalence of 4.8% with a mortality rate of 28% [24]. Faced with this problem and in the absence of systematic fibrinolysis, the evaluation of new, accessible, and low-cost therapeutic approaches is crucial.

This study represents the first rigorous evaluation of *Panax Notoginseng* in Black African subjects, with the primary objective of evaluating its efficacy in reducing motor sequelae of ischemic stroke in a Senegalese population.

### 2. Methods

#### 2.1. Study Design

This was an open-label, randomized, comparative clinical trial with two parallel

groups, conducted over a period of 6 months. The study protocol (SEN18/53) was approved by the national ethics committee for health research of the Senegalese Ministry of Health and Social Action.

While treatment allocation was open-label due to the necessity of intravenous administration in the intervention group, we attempted to maintain assessor blinding where feasible. Neurological assessments (NIHSS and Barthel Index) at each time point were conducted by trained clinicians who were instructed not to review medication charts before evaluations. However, given the clinical setting and patient interactions, complete assessor blinding could not be guaranteed. Patients were asked not to discuss their treatment with assessors, though compliance with this request could not be verified.

## 2.2. Study Population and Selection Criteria

### **Inclusion criteria:**

- Patients aged 40 to 70 years
- Ischemic stroke confirmed by non-contrast brain CT scan
- Time since symptom onset less than 7 days
- Permanent residence in the study area
- Signed informed consent

### **Exclusion criteria:**

- History of stroke within the previous 3 months
- Refusal to participate in the 90-day follow-up
- Inability to receive oral treatment
- History of recent traumatic brain injury
- Known allergy to ginseng or its derivatives
- Coagulation disorders or anticoagulant therapy
- Severe hepatic or renal insufficiency

## 2.3. Study Sites

Four hospital centers participated in this study, strategically distributed across Senegalese territory to ensure optimal geographical representation:

- Dakar district: CHU Aristide Le Dantec and General Hospital Idrissa Pouye;
- Saint-Louis district: Regional Hospital of Saint Louis;
- Diourbel district: Matlaboul Fawzeini Hospital of Touba.

## 2.4. Randomization and Interventions

Randomization was performed using block randomization stratified by center, with a 1:1 allocation generated by computer. Numbered, sealed envelopes were used to guarantee allocation concealment.

### **Control group (n = 78):**

- Aspégic (acetylsalicylic acid) 100mg once daily;
- Atorvastatin 20mg once daily;
- Duration: 90 days.

**Intervention group (n = 74):**

- Control group treatment;
- Plus Panax Notoginseng (Luotai®);
- Initial phase: 200mg daily intravenous infusion for 15 days;
- Maintenance phase: 200mg orally (2 capsules of 100mg) daily for 75 days.

**2.5. Evaluation Criteria****• Primary outcome**

Change in NIHSS (National Institutes of Health Stroke Scale) score between inclusion and the 90th day of follow-up. This internationally validated scale assesses the severity of neurological deficit on a 42-point scale.

**• Secondary outcome**

Change in the Barthel Index, measuring the degree of functional dependence in activities of daily living (score from 0 to 100).

Assessment Time points:

- Inclusion (M0): within 24 - 48 hours of admission
- Intermediate assessment (M1): at 30 days  $\pm$  3 days
- Final assessment (M3): at 90 days  $\pm$  5 days

**2.6. Sample Size Calculation and Statistical Analysis**

The minimum sample size calculation was based on the assumption of a 15% difference between groups in NIHSS score improvement, with an  $\alpha$  risk of 10% and a power of 80% ( $\beta = 20\%$ ). This led to a minimum of 69 patients per group. Accounting for a 10% loss to follow-up rate, the total planned sample size was 152 patients.

We selected an  $\alpha$  risk of 0.10 rather than the conventional 0.05 threshold for several reasons: this is an exploratory Phase II trial in a novel population (first evaluation in Black African subjects), where detecting potential signals of efficacy takes priority over definitive hypothesis testing; resource constraints in the Senegalese healthcare setting made recruiting larger sample sizes prohibitive; and this liberal threshold increases sensitivity to detect trends that would justify future adequately-powered Phase III trials. However, readers should interpret our non-significant findings cautiously—the wider confidence intervals and increased Type I error rate mean that observed trends may reflect chance rather than true treatment effects.

**Statistical analyses**

- Mann-Whitney U test for non-parametric comparisons;
- Student's t-test for normally distributed quantitative variables;
- Chi-square test with Yates' correction for qualitative variables;
- Fisher's exact test for small samples;
- Modified intention-to-treat analysis (MITT);
- Significance threshold set at  $p < 0.05$ .

Modified Intention-To-Treat (MITT) analysis included all randomized patients who received at least one dose of study medication and had at least one post-base-

line assessment. For the primary outcome analysis, we analyzed only patients with complete 90-day data (n = 117, 77.0%), constituting a complete-case analysis. We performed sensitivity analyses using: (1) Last Observation Carried Forward (LOCF) for patients with M1 data but missing M3 assessments (n = 19); and (2) Multiple Imputation by Chained Equations (MICE) assuming data were missing at random, generating 20 imputed datasets. Patients who died during follow-up (n = 16) were assigned the worst possible outcome scores (NIHSS = 42, Barthel = 0) in sensitivity analyses.

Analyses were performed using SPSS software version 25.0.

## 2.7. Ethical Aspects

All patients or their legal representatives signed informed consent. The study was conducted in accordance with the principles of the Declaration of Helsinki and good clinical practice.

## 3. Results

### 3.1. Population Characteristics

A total of 152 patients were included in the study during the inclusion period. The demographic and clinical characteristics of the two groups at inclusion are detailed in **Table 1**, showing good comparability between the study populations.

**Table 1.** Demographic and clinical characteristics at inclusion.

Characteristics	Control Group (n = 78)	Intervention Group (n = 74)	p-value
Mean age (years) ± SD	61.0 ± 12.5	58.0 ± 11.8	0.023
Male sex, n (%)	31 (39.7)	37 (50.0)	0.213
Mean SBP (mmHg) ± SD	158.1 ± 23.4	159.1 ± 22.8	0.95
Mean DBP (mmHg) ± SD	87.5 ± 14.2	90.1 ± 13.6	0.38
Hypertension, n (%)	65 (83.3)	59 (79.7)	0.572
Diabetes, n (%)	28 (35.9)	31 (41.9)	0.451
Dyslipidemia, n (%)	22 (28.2)	25 (33.8)	0.459
Heart disease, n (%)	18 (23.1)	16 (21.6)	0.834
Smoking, n (%)	12 (15.4)	14 (18.9)	0.565
Recent ischemic lesion on CT scan	73 (93.6)	69 (93.2)	0.931

SD: Standard Deviation; SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure.

The geographical distribution of patients according to recruitment centers is presented in **Table 2**, demonstrating balanced participation from all study sites.

**Table 2.** Distribution of patients by recruitment center.

Centres	Control group n (%)	Intervention Group n (%)	Total n (%)
Dakar (CHU Le Dantec + Idrissa Pouye hospital)	45 (57.7)	42 (56.8)	87 (57.2)

## Continued

	Saint-Louis	18 (23.1)	17 (23.0)	35 (23.0)
Touba (Diourbel)		15 (19.2)	15 (20.3)	30 (19.7)
<b>Total</b>		78 (100)	74 (100)	152 (100)

### 3.2. Evolution of Neurological Scores

The evolution of NIHSS scores during follow-up is reported in **Table 3**, illustrating the progressive improvement of neurological deficits in both treatment groups.

**Table 3.** Evolution of NIHSS score according to groups and time points.

Time Point	Control group (n = 78)	Intervention group (n = 74)	Difference	p-value	IC 95%
<b>M0 (Inclusion)</b>					
Mean ± SD	12.96 ± 4.83	12.11 ± 4.95	0.85	0.43	[-1.23; 2.93]
Median [IQR]	13 [9 - 16]	12 [8 - 15]			
<b>M1 (1 month)</b>					
Mean ± SD	7.85 ± 4.22	7.34 ± 5.03	0.51	0.61	[-1.46; 2.48]
Median [IQR]	7 [5 - 11]	6 [4 - 10]			
<b>M3 (3 months)</b>					
Mean ± SD	6.89 ± 10.38	6.38 ± 12.26	0.51	0.844	[-4.63; 5.65]
Median [IQR]	4 [2 - 8]	3 [1 - 7]			

SD: Standard Deviation; IQR: Interquartile Range; CI: Confidence Interval.

The data regarding the evolution of the Barthel Index are presented in **Table 4**, showing the progressive improvement of functional independence in both groups.

**Table 4.** Evolution of Barthel index according to groups and time Points.

Time Point	Control group (n = 78)	Intervention group (n = 74)	Difference	p-value	IC 95%
<b>M0 (Inclusion)</b>					
Mean ± SD	68.05 ± 17.25	67.75 ± 16.98	0.30	0.921	[-5.38; 5.98]
Median [IQR]	70 [55 - 80]	70 [55 - 80]			
<b>M1 (1 mois)</b>					
Mean ± SD	78.57 ± 16.80	76.84 ± 21.14	1.73	0.631	[-5.38; 8.84]
Median [IQR]	85 [70 - 95]	85 [65 - 95]			
<b>M3 (3 mois)</b>					
Mean ± SD	84.79 ± 16.05	85.54 ± 15.38	-0.75	0.796	[-6.52; 5.02]
Median [IQR]	95 [75 - 100]	95 [80 - 100]			

SD: Standard Deviation; IQR: Interquartile Range; CI: Confidence Interval.

### 3.3. Adjusted Analysis for Baseline Covariates

Given the significant age difference between groups at baseline (61.0 vs 58.0 years,  $p = 0.023$ ), we performed a secondary analysis using analysis of covariance (ANCOVA) to adjust for age and baseline NIHSS score. After adjustment for these covariates, the mean difference in NIHSS reduction at 90 days remained non-sig-

nificant (adjusted mean difference: 0.48 points, 95% CI: -1.52 to 2.48,  $p = 0.63$ ). Similarly, the adjusted Barthel Index improvement showed no significant difference between groups (adjusted mean difference: 1.2 points, 95% CI: -3.8 to 6.2,  $p = 0.64$ ). These adjusted analyses confirm that the observed trends were not substantially confounded by the baseline age imbalance.

### 3.4. Analysis of Functional Recovery

The percentage improvement of the different evaluation criteria at 3 months is summarized in **Table 5**, allowing comparison of the relative efficacy of the two therapeutic strategies.

**Table 5.** Percentage improvement at 3 months according to evaluation criteria.

Evaluation criterion	Overall population (%)	Control group (%)	Intervention group (%)	p-value
NIHSS reduction $\geq 50\%$	58.4	56.6	60.3	0.672
NIHSS reduction $\geq 75\%$	31.1	28.3	34.2	0.451
NIHSS $\leq 4$ (optimal recovery)	47.9	45.3	50.7	0.528
Barthel improvement (%)	17	16	18	0.312
Barthel $\geq 90$ (independence)	67.2	64.2	70.5	0.428

### 3.5. Follow-up and Tolerability

The patient follow-up and tolerability data are summarized in **Table 6**, illustrating the overall acceptability of the therapeutic protocol.

**Table 6.** Follow-up and tolerability data.

Parameters	Control Group (n = 78)	Intervention Group (n = 74)	Total (n = 152)
<b>Complete follow-up at 90 days</b>	58 (74.4%)	59 (79.7%)	117 (77.0%)
<b>Reasons for study discontinuation</b>			
Death	9 (11.5%)	7 (9.5%)	16 (10.5%)
Lost to follow-up	8 (10.3%)	8 (10.8%)	16 (10.5%)
Refusal to continue	1 (1.3%)	0 (0%)	1 (0.7%)
Unusable data	2 (2.6%)	0 (0%)	2 (1.3%)
<b>Therapeutic adherence</b>			
Excellent (>90%)	52 (89.7%)	55 (93.2%)	107 (91.5%)
Good (75 - 90%)	6 (10.3%)	4 (6.8%)	10 (8.5%)
<b>Adverse events</b>			
Minor digestive disorders	2 (2.6%)	1 (1.3%)	3 (100%)
Transient headaches	1 (1.3%)	1 (1.3%)	2 (100%)

### 3.6. Subgroup Analysis

We conducted pre-specified exploratory subgroup analyses to identify potential effect modifiers, examining treatment effects within subgroups defined by age (<60 vs  $\geq 60$  years), sex, baseline stroke severity (NIHSS <8, 8 - 15, >15), and time from symptom onset to treatment (<3 vs 3 - 7 days). These analyses were strictly

exploratory and hypothesis-generating; no adjustment for multiplicity was applied, substantially increasing the risk of false-positive findings.

The subgroup results suggested potentially larger treatment effects in patients aged <60 years (NIHSS reduction 8.2 vs 6.4 points, interaction  $p = 0.18$ ) and those with moderate baseline NIHSS scores of 8 - 15 (improvement 7.8 vs 6.1 points, interaction  $p = 0.24$ ). However, none of these interaction tests achieved statistical significance, and given the small sample sizes within subgroups ( $n = 20 - 40$  per cell) and lack of multiplicity correction, these findings should be interpreted with extreme caution. They may inform stratification or enrichment strategies for future trials but cannot support clinical decision-making.

### 3.7. Sensitivity Analyses for Missing Data

Sensitivity analyses using LOCF and multiple imputation yielded results consistent with the primary complete-case analysis. Using LOCF ( $n = 136$ ), the mean NIHSS difference at M3 was 0.44 points ( $p = 0.68$ ). Multiple imputation analysis showed a mean difference of 0.52 points (95% CI:  $-1.48$  to  $2.52$ ,  $p = 0.61$ ). These analyses suggest our findings are robust to different assumptions about missing data mechanisms.

## 4. Discussion

### 4.1. Main Results

This first randomized controlled trial of Panax Notoginseng in sub-Saharan Africa provides new insights into the use of this phytotherapy in the management of ischemic stroke in black Africans. Although the primary objective of a significant difference between groups was not achieved, several observations deserve to be highlighted.

The good tolerability of Panax Notoginseng is a major result of this study. No serious adverse events were reported, and the rate of minor side effects (3.4% in the intervention group) is comparable to data from the Asian literature [25] [26]. This safety profile in African subjects was an essential prerequisite before considering larger-scale studies.

The neurological improvement observed in both groups (mean NIHSS score reduction of 46% at 3 months) corresponds to expected data on spontaneous post-stroke recovery [27] [28]. However, the trend towards slightly greater improvement in the Panax Notoginseng group (18% vs 16% for the Barthel Index) suggests a modest but clinically relevant functional benefit.

Our subgroup analyses, while intriguing, must be considered exploratory and hypothesis-generating only. With 8+ subgroup comparisons and no adjustment for multiple testing, the probability of observing at least one spurious association exceeds 40% under the null hypothesis. The apparent benefit in younger patients and those with moderate stroke severity requires prospective validation in an adequately powered trial with pre-specified, limited subgroup analyses.

## 4.2. Comparison with Literature

The results of our study are consistent with several Asian clinical trials. The study by Wang *et al.* Of 320 Chinese patients showed a significant improvement in NIHSS score with Panax Notoginseng (−3.2 points vs −2.1 points,  $p < 0.01$ ) [29]. Similarly, the multicenter trial by Liu *et al.* In 856 patients, a 23% reduction in the risk of severe disability (OR = 0.77, 95% CI: 0.62 - 0.95) [30].

Recent systematic reviews and meta-analyses continue to support the potential benefits of Panax notoginseng in stroke management, though methodological concerns persist. A 2023 meta-analysis by Zhang *et al.*, pooling 18 trials with 2,847 patients found that Panax notoginseng as adjunctive therapy reduced modified Rankin Scale scores at 90 days (OR = 1.68, 95% CI: 1.35 - 2.09), though substantial heterogeneity ( $I^2 = 64\%$ ) and publication bias limited confidence in these estimates [31]. Similarly, Li and colleagues demonstrated in a network meta-analysis that ginsenoside compounds may enhance neurological recovery through anti-inflammatory and antioxidative pathways, but noted that most trials lacked adequate allocation concealment and blinding [32].

However, these studies had significant methodological limitations: lack of double-blinding, heterogeneous inclusion criteria, and, importantly, exclusively Asian populations [33]. Our study, although more modest in size, has the advantage of rigorous randomization and an African population, providing novel data on the intercultural efficacy of this therapy.

The mechanisms of action of Panax Notoginseng explain its potential beneficial effects. Its main active components, ginsenosides Rb1, Rd, and Rg1, exert neuroprotective effects through several pathways: inhibition of neuronal apoptosis, reduction of cerebral inflammation, improvement of angiogenesis, and stimulation of neuroplasticity [34]-[36]. These mechanisms are particularly relevant in the subacute phase of stroke, the period during which our treatment was administered.

Importantly, a 2024 pharmacogenomic study by Chen *et al.*, revealed ethnic differences in ginsenoside metabolism, with African populations showing distinct CYP3A4 and CYP2D6 polymorphism patterns compared to East Asian cohorts [37]. These genetic variations may reduce ginsenoside bioavailability by approximately 20% - 30% in individuals of African ancestry, potentially explaining our more modest effect sizes. This emerging pharmacogenomic evidence underscores the critical importance of conducting trials in diverse populations rather than extrapolating Asian data to African settings, and suggests that higher dosing regimens or alternative formulations may be necessary to achieve comparable efficacy in Black African patients.

## 4.3. Clinical Implications

The relatively young age of our population (60.2 years on average) compared to Western series underscores the specific problem of stroke in sub-Saharan Africa. This earlier onset, already reported by Basse *et al.* [38] and Touré *et al.* [24], re-

flects the impact of the epidemiological transition on the profile of African strokes.

The significant age difference between groups (58 vs 61 years,  $p = 0.023$ ), although modest, required statistical adjustment. Our ANCOVA analysis controlling for age and baseline NIHSS confirmed that this imbalance did not substantially affect the primary results. Nevertheless, younger patients generally have better spontaneous recovery potential, and future trials should ensure more balanced randomization or employ stratification by age category ( $<60$  vs  $\geq 60$  years).

The feasibility of this multicenter study demonstrates the possibility of conducting rigorous clinical trials in Senegal, despite logistical constraints. The involvement of cardiology departments, traditionally less involved in stroke management, illustrates the multidisciplinary approach necessary in the African context where specialized neurovascular units remain scarce.

#### 4.4. Therapeutic Perspectives

The integration of traditional medicine into modern healthcare systems is a promising avenue, particularly in Africa where access to advanced therapies remains limited [39] [40]. Panax Notoginseng has the advantage of being affordable (approximately 15,000 FCFA for a full course) compared to innovative treatments like mechanical thrombectomy, which is unavailable in Senegal.

Recent pharmacogenomic studies suggest inter-ethnic variations in response to ginsenosides, related to cytochrome P450 polymorphisms [41] [42]. These differences could explain the more modest results observed in our African population compared to Asian studies.

#### 4.5. Study Limitations

Several limitations must be emphasized. The loss to follow-up rate (19.7%) is higher than international standards ( $<10\%$ ), mainly due to the COVID-19 pandemic which disrupted healthcare systems. This situation may have reduced the study's statistical power and biased the results.

The choice of  $\alpha = 0.10$  for sample size calculations, while appropriate for this exploratory context, means our study had insufficient power to definitively rule out modest treatment effects. The observed 2% difference in Barthel Index improvement (18% vs 16%), though not statistically significant at  $p = 0.312$ , cannot be dismissed as clinically irrelevant without a larger, adequately powered trial using conventional alpha thresholds.

The open-label nature of the study, justified by the need for initial intravenous administration, constitutes a potential bias. The placebo effect, particularly important in neurological studies, may have masked real differences between groups.

The inability to blind outcome assessors represents a significant limitation. Detection bias may have influenced NIHSS and Barthel Index scoring, particularly given that these scales involve subjective clinical judgment. While we instructed assessors to avoid reviewing treatment assignments, the risk of unblinding through clinical interactions or patient disclosure remained substantial. Future

trials should employ independent, properly blinded assessors who do not participate in patient care and should consider video-recorded assessments that can be scored by blinded central reviewers.

The lack of biological assessment of inflammation and oxidative stress markers limits the understanding of *in vivo* mechanisms of action. Similarly, the absence of follow-up imaging (MRI, angiography) does not allow for evaluation of the impact on tissue recovery and revascularization.

Finally, the follow-up duration (90 days) appears insufficient to fully assess the long-term impact, as post-stroke recovery can continue for up to 6-12 months [43].

#### **4.6. Recommendations for Future Studies**

These encouraging preliminary results justify conducting a Phase III clinical trial with a larger sample size ( $\geq 500$  patients per group) to detect a clinically significant difference. A double-blind study, using a placebo for the intravenous phase, would minimize bias.

Extending follow-ups to 6 - 12 months with an assessment of quality of life (EQ-5D scale), recurrence rate, and cost-effectiveness would provide crucial data for public health decision-makers.

Combination with other interventions, such as intensive early rehabilitation or transcranial magnetic stimulation could potentiate the effects of Panax Notoginseng in an integrated therapeutic approach.

### **5. Conclusions**

This first rigorous evaluation of Panax Notoginseng in Sub-Saharan Africa demonstrates its good tolerability in black African subjects and suggests a modest functional benefit on recovery after ischemic stroke. Although the observed differences did not reach the threshold of statistical significance, the favorable trend (18% vs 16% improvement in the Barthel Index) presents potential clinical relevance in a context where therapeutic options remain limited.

These encouraging results, combined with the reassuring safety profile and affordable cost, warrant further investigation through a larger clinical trial. The successful integration of this phytotherapy into a standardized care protocol opens promising perspectives for improving stroke management in sub-Saharan Africa.

Beyond the therapeutic aspect, this study illustrates the feasibility and relevance of African clinical research on traditional medicines, contributing to the emergence of therapeutic approaches adapted to local specificities and the continent's economic constraints.

### **Conflicts of Interest**

The authors declare no conflicts of interest regarding the publication of this paper.

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