MedCrave
Step into the World of Research
Pharmacy & Pharmacology International Journal

Case Series
Open Access
CrossMark

Combination treatment of WHO standard drugs and *Artemisia Afra* for pulmonary tuberculosis - A Pilot study of 25 multi resistant patients

Abstract

Introduction: Tuberculosis is one of the leading infectious causes of death worldwide. The WHO estimates that 1.7 billion people close to one quarter of the humanity are infected with Mycobacterium Tuberculosis the bacteria that causes TB. Last year, 10.6 million fell ill from TB and 1.6 million died.[1]

Moreover, multi resistance to the current anti-tuberculosis drugs is growing thus causing a serious challenge in controlling the spread of the disease worldwide.

Fortunately, as we demonstrated on previous studies that *Artemisia Afra* infusions given with the WHO approved drugs can shorten treatment duration and resistance from 9 months to 52 days maximum[2] and out of the 102 patients 95 were cured in 30 days and 7 in 52 days.

Most recently we also demonstrated that 25 patients of regular tuberculosis completely recovered after 30 days or less by combining *Artemisia Afra* infusions whereby the other 25 patients who took the WHO treatment ALONE either abandoned their treatment and if they continued it, they were still sick on day 30.[3]

The objective of this pilot study is to demonstrate that 25 patients with multi resistant tuberculosis when given *Artemisia Afra* infusions combined with second line anti tb drugs were able to recover in 35 days maximum instead of 90 days or more.

Methods: This case study involved 25 patients who were all multi resistant or recidivist to the tuberculosis and have failed the first line treatment. Moreover, they were confirmed by a GeneXpert test to be resistant to Rifampicin and or Isoniazid. All patients were hospitalized at Ijenda Hospital in Bujumbura rural Province, Burundi between February, and April 2024. They were given the second line treatment at the regular dose + *Artemisia Afra* infusion at 330 ml three times a day.

The patients were also fed with a protein rich meal and nurses made sure that medications were taken regularly according to DOT [Directly Observed Technique].

Results: All the 25 patients recovered in 35 days maximum (see details in the Tables below).

Conclusion: The combination therapy [*Artemisia Afra* infusions+ WHO protocol] has a lot of potential in curing tuberculosis but more studies on a larger cohort [300 patients] will be carried out and there will also be a third leg with multi resistant cases that failed first line treatment with many months of sickness.

Volume 12 Issue 3 - 2024

Pascal Gisenya,[1] Serge Kahatwa,[1] Patrick E Ogwang,[2] Elkan Katotola, Adele Ntezahorigwa, Claudette Ndayininahaze,[3] David Wang, William Wang[4]

[1]Heal Africa Hospital 111 Lyn Lusi, Goma, North Kivu; D.R. Congo
[2]Mbarara University of Sciences and Technology, Mbarara Uganda
[3]Ijenda Hospital, Bujumbura rural, Burundi
[4]Worcester Academy 81 Providence Street Worcester Massachusetts 01604 USA

Correspondence: Pascal Gisenya, Heal Africa Hospital 111 Lyn Lusi, Goma, North Kivu, Democratic Republic of Congo, Tel +1 587 974 7611, Email pbgiseny@gmail.com

Received: May 13, 2024 | **Published:** May 27, 2024

Introduction

Tuberculosis is a disease caused by bacteria that are spread from person to person through the air.

TB usually affects the lungs and cause the following symptoms for the most part: cough, chest pain, fever, weight loss, fatigue, and weakness. Moreover, globally, the estimated number of resistant cases (MDR/RR-TB) were 410.000 in 2022.[1]

This poses a serious healthcare challenge that the international community faces. Fortunately, as we demonstrated in the previous studies it is possible to shorten the treatment duration of this disease by combining the current treatment with *Artemisia Afra* infusions but more studies in a larger cohort are encouraged.[2,3]

The objective of this study is to demonstrate that even the **resistant** and **recidivist** tb cases can be cured by combining the second line treatment with the *Artemisia Afra* infusions given for 35 days maximum.

Materials and methods

Study design

This study was conducted at the Ijenda District Hospital in Bujumbura rural province, Burundi. It was done on 25 patients between the ages of 12 to 70 recidivists or multi resistant who were on the second line of the WHO protocol with the following medications.

The *Artemisia Afra* infusion was prepared at the Ijenda Hospital, and it was given at 330 ml every 8 hours to the patients along with the WHO drugs by using the DOT technique.

Second line treatment common in drug resistant tuberculosis[1]

1. **Bedaquiline**

Dose: Adults: 400 mg once daily for 2 weeks, followed by 200 mg once daily, thrice weekly for 22 weeks.

Side effects: Nausea, arthralgia (joint pain) and headache

2. Prothionamide

Dose: Adults: 15–20 mg/kg/day; upper daily dose is 1 g. Once-daily dosing is advised but clinicians can use 2 divided doses if tolerance is a problem, or until tolerance improves.

Many individuals require gradual ramping up of the dose and treatment due to gastrointestinal upset.

Side effects:

- Nausea
- Vomiting
- Metallic taste
- Anorexia
- Abdominal discomfort
- Diarrhea
- Weight loss.

3. Linezolid

Dose: 600 mg, once daily, upper daily dose is 1.2 g.

Side effects:

- Nausea, vomiting and diarrhea.
- Myelosuppression
- Optic nerve toxicity
- Peripheral neuropathy

4. Moxifloxacin

Dose: 400 mg daily (oral or IV). High dose is 600–800 mg daily, depending on weight band.

Side effects:

- Diarrhea
- Nausea
- Bloating
- Arthralgia

The following extract from WHO guidelines show how complex it is to treat resistant and recidivist tuberculosis cases.

Treatment for people diagnosed with rifampicin-resistant TB (RR-TB), isoniazid-resistant TB and multidrug-resistant TB (MDR-TB, defined as resistance to isoniazid and rifampicin) requires regimens that include second-line drugs, such as bedaquiline and fluoroquinolones; these regimens are more expensive (≥US$ 1000 per person) and cause more side-effects than first-line treatments for drug-susceptible TB. Pre-extensively drug-resistant TB (pre-XDR-TB, defined as TB that is resistant to rifampicin and any fluoroquinolone) and XDR-TB (resistance to rifampicin, any fluoroquinolone and at least one of bedaquiline or linezolid) are even harder to treat.

Globally in 2020, 150 359 people were enrolled on treatment for MDR/RR-TB, down 15% from 177 100 in 2019. Most of those enrolled on treatment were adults. There was considerable country variation in treatment enrolment between 2009 and 2020.

The cumulative total number of people reported as enrolled on treatment for MDR/RR-TB from 2018 to 2020 was 482 683, only 32% of the 5-year target (2018-2022) of 1.5 million that was set at the UN high-level meeting on TB in 2018. For children specifically, the cumulative number was 12 219, only 11% of the 5-year target of 115 000.

Substantial improvements in treatment coverage at the global level require an intensification of efforts to diagnose and treat MDR/RR-TB. This requires one or more of the following to be increased:

- The proportion of people with TB who are detected and, of these, the proportion for whom TB is bacteriologically confirmed.
- The proportion of people with bacteriologically confirmed TB who are tested for drug resistance; and
- The proportion of people diagnosed with MDR/RR-TB who are enrolled in treatment.

Globally in 2018 (the latest patient cohort for which data are available), the treatment success rate for people treated for MDR/RR-TB with second-line regimens was 59%; this has improved steadily in recent years, from 50% in 2012.

Among WHO regions, the treatment success rate in 2018 ranged from 56% in the European Region to 69% in the African Region.

By the end of 2020, 109 countries were using bedaquiline as part of treatment for drug-resistant TB (DR-TB), 90 were using all-oral longer regimens for the treatment of MDR/RR-TB and 65 were using shorter regimens for the treatment of MDR/RR-TB. At least some people diagnosed with DR-TB were being monitored for adverse events in most countries. (WHO guidelines)

Resistant patients: 25

Drug-resistant tuberculosis (TB) continues to be a public health problem, taking a heavy toll on patients, communities, and health care systems.

Recent global estimates indicate that there were about half a million new cases of multidrug- or rifampicin-resistant TB (MDR/RR-TB) in 2018, with less than 40% of the estimated burden being notified and 32% reported to have started second-line treatment.[1]

Current treatment regimens for MDR/RR-TB patients are far from satisfactory. Compared with treatments for drug-susceptible TB forms, these regimens require a longer course of treatment, a higher pill burden and the use of medicines with a higher toxicity profile; in addition, patients may develop significant adverse events and have poorer treatment outcomes.

Globally, although treatment success rates have increased, almost 15% of MDR/RR-TB patients die from the disease, and 26% of those deaths are in patients with extensively drug-resistant TB (XDR-TB).[1]

Tuberculosis (TB) strains with drug resistance are more difficult to treat than drug-susceptible ones, and present a major challenge for patients, health care workers and health care services. In addition, the increase of drug-resistant TB threatens global progress towards the targets set by the End TB Strategy7 of the World Health Organization (WHO).

Thus, there is a critical need for the continual development of evidence-based policy recommendations on the treatment and care of patients with drug-resistant TB, based on the most recent and comprehensive evidence available.[1]

We observed 25 patients who were multi resistant to the first line RHZE and we combined their treatment with *Artemisia Afra* infusions

at a dose of 330 ml three times a day for 30 days or until the symptoms were resolved and tested negative to Gen expert.

Their symptoms improved gradually as you can see in the graph below.

Fever, cough, and weight were monitored as outlined below.

The following assessment was made:

Day 0 upon admission

- Temperature was 39.5 degrees Celsius.
- Cough was very severe 100 % for all patients.
- The mean weight was 35 Kgs.

Day 5

- Temperature dropped to 38.6 degrees Celsius.
- Cough was persistent for 87% of the patients.
- The mean weight was 37.4 Kgs.

Day 10

- Temperature remained normal 37.3 degrees Celsius.
- Cough was present for 57% of the patients.
- The weight continued to increase to an average of 38 Kgs.

Day 15

- Temperature remained normal 37.3 degrees Celsius.
- Cough was persistent for 33% of the patients and many of them wanted to go back home to dig in their fields.
- The weight was soaring at 46.6Kgs.

Day 20

- Temperature remained the same 37 Celsius.
- Cough was still in 29% of cases.
- The average weight was 50.3 Kgs.

Day 25

- Temperature was stable, 37 Celsius.
- Cough was 25%.
- The average weight was 54.6 Kgs.

Day 30

- Temperature remained the same, 37 Celsius.
- Cough was almost completely cleared only 4 % (the patients were still coughing).
- The weight was 56.96 Kgs.

Day 35

- Temperature remained the same, 37 Celsius.
- Cough was completely cleared only 4 %.
- The mean weight was 62 Kgs.

For statistics of the people who were in the 3 groups, please look at the trend by comparing those in red [Artemisia plus WHO regular] and those in blue [WHO ALONE] and the artemisia plus WHO resistant in yellow.

Please look at the graphs which highlight the improvement in terms of temperature, cough and weight gain.

Cough in % of Severity

Days	WHO ALONE	WHO +ARTEMISIA	WHO +ARTEMISIA RESISTANT
0	100	100	100
5	88.2	75	87
10	87	50	57
15	82.6	25	33
20	83.4	0	29
25	80	0	25
30	80	0	4
35			0

Cough

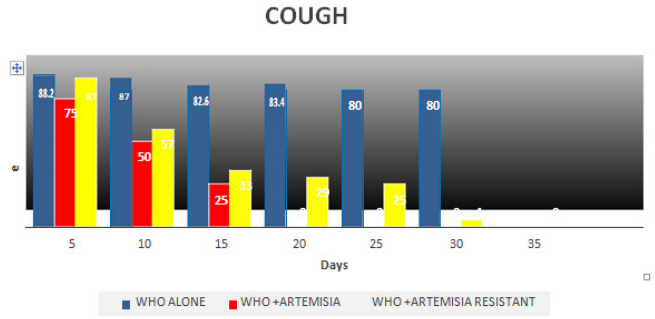


Figure 1 Cough in % of severity.

Temperature in Celsius

Days	WHO ALONE	WHO+ ARTEMISIA	WHO +ARTEMISIA RESISTANT
0	40	40	39.5
5	39	37	38.6
10	38.5	37	37.5
15	38.2	37	37.3
20	38	37	37
25	38	37	37
30	38	37	37

Temperature

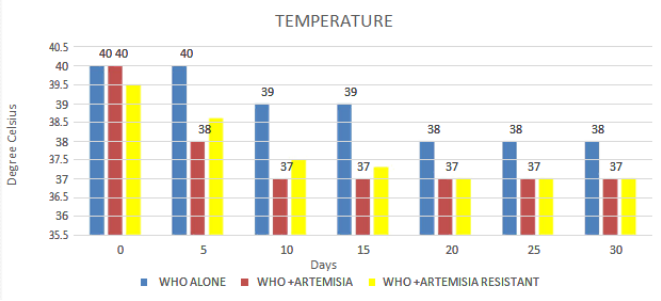


Figure 2 Temperature in Celsius.

Citation: Gisenya P, Kahatwa S, Ogwang PE, et al. Combination treatment of WHO standard drugs and *Artemisia Afra* for pulmonary tuberculosis - A Pilot study of 25 multi resistant patients. *Pharm Pharmacol Int J.* 2024;12(3):97–106. DOI: 10.15406/ppij.2024.12.00440

Weight in Kilograms

Days	WHO ALONE	WHO+ ARTEMISIA	WHO+ARTEMISIA RESISTANT
0	33	35	35
5	36	37	37.4
10	36	40	38
15	36	42	46.6
20	37	44	50.3
25	37	46	54.16
30	37	48	56.96
35			62

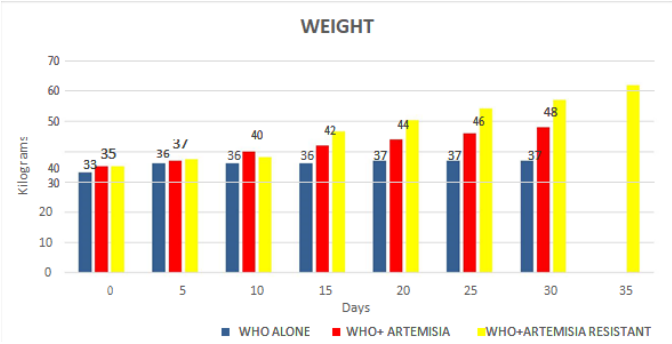


Figure 3 Weight in kilograms.

Cases

We are giving details for 2 cases WHO were outstanding:

First case: Esther:

Ester is a 16-year-old girl who was examined and tested positive on tuberculosis and was treated for 7 months but later developed multi resistant. She was therefore tested and her GeneXpert result was positive.

She started the following regimen along with *Artemisia Afra* infusions.

- Bedaquillin
- Linezolid
- Pretonamid
- Isoniazid
- Ethambutol
- Clofazimine
- Moxifloxacin

After 33 days of treatment, she got released after her Gen expert test turned negative.

Second case: Jonathan: 24 years old, Male

He was on the following treatment:

- Bedaquillin
- Linezolid
- Pretonamid
- Moxifloxacin

After 27 days of the combined treatment, he got his Gen expert negative and was released to go home.

GeneXpert is a rapid test that can simultaneously identify the MTB and resistance to the first line treatment.

A negative GeneXpert rules out the presence of tuberculosis.

Figure 4 16 years old girl who was examined before treatment and after treatment.

Figure 5 24 years old, male who was examined before treatment and after treatment.

Conclusion

The combined administration of *Artemisia Afra* infusions with second line conventional WHO treatment gave an unprecedent faster resolution of tuberculosis symptoms than conventional treatment alone, which may take up 24 months. Furthermore, as we mentioned before side effects of the WHO pills are unbelievably tough to patients that adherence is very difficult to reach in most cases.[1]

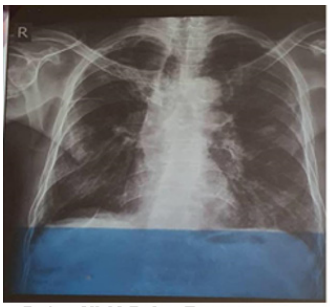
As far as cost is concerned, according to a Californian study, the cost of hospitalization for a multi resistant case was USD 110,900 whereas the treatment for the combination of the WHO pills and *Artemisia Afra* infusion is barely USD 100.[8]

It is the author's opinion that these remarkable results should constitute a wakeup call to different key opinion leaders to address this burden to the society in terms of cost, time wasted in hospital and suffering to the humanity with the unnecessary prolonged hospitalization. [9-24 months versus 35 days]

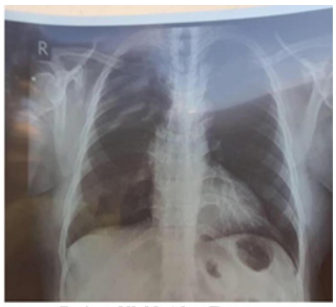
Citation: Gisenya P, Kahatwa S, Ogwang PE, et al. Combination treatment of WHO standard drugs and *Artemisia Afra* for pulmonary tuberculosis - A Pilot study of 25 multi resistant patients. *Pharm Pharmacol Int J.* 2024;12(3):97–106. DOI: 10.15406/ppij.2024.12.00440

Thorax radiography protocol

Identity: patient number 28, Male, adult



Patient N° 28 Before Treatment



Patient N° 28 After Treatment

A. Before treatment:

Right lung:

- Presence of reticular opacities
- Presence of hilar lymphadenopathy
- Scissuritis in the upper lung field. Left lung:
- Presence of reticular opacities in the lower field
- Presence of hilar lymphadenopathy.

Conclusion: probable tuberculous pneumonia with signs of pulmonary fibrosis.

B. After treatment:

On the left and right: no opacity or sign of pneumonia in the two pulmonary fields, no visible after-effects.

The heart and other structures appear normal.

Conclusion: Good clinical remission.

Done in Goma on December 12, 2023.

Dr KAHATWA KIRINGA, Specialist in Internal Medicine.

Artemisia Afra Treatment Video

HEAL AFRICA

Health, Education, Action, Leadership Development

Rue LYN LUSI N° 111, B.P. 319, Goma, Nord Kivu, RD. Congo.

Tel: (+243) 813122342 (+243) 998506304

healafrica.bmail@gmail.com ; www.healafrica.org

PROTOCOL RADIOGRAPHIE DU THORAX

IDENTITE : patient numéro 28, Masculin, adulte

A. Avant traitement :

Poumon droite :

- Présence des opacités réticulaires
- Présence des adénopathies hilaires
- Scissurite dans le champ pulmonaire supérieur.

Poumon gauche :

- Présence des opacités réticulaires dans le champ inferieur
- Présence des adénopathies hilaires.

Conclusion : probable pneumonie tuberculeuse avec signes de fibrose pulmonaire.

B. Apres traitement :

A gauche et à droite : aucune opacité ni signe de pneumonie dans les deux champs pulmonaires pas de séquelles objectivées.

Le cœur et les autres structures ont une apparence normale.

Conclusion : Bonne évolution clinique.

Fait à Goma le 12 Décembre 2023.

Dr KAHATWA KIRINGA Serge

Médecin interniste

CNOM 11718.

HEAL AFRICA

Original French version of the report above. [N°28]

The authors wish to declare that there is no conflict of interest in this study and recommend further studies on a larger cohort [300 people] to confirm what was observed in vitro by our colleagues Prof. Pamela Weathers[4] and in vivo by Dr Jerome Munyangi on the Buruli Ulcer[5] in dealing with Mycobacterium Species.

Finally, the authors acknowledge special support from different people who accompanied them financially, intellectually, and morally for the completion of this humble task and encourage others to pursue the fight against multi resistance of the mycobacterium tuberculosis[6] thus reducing cost,[8] suffering and burden to society.

As the WHO extract below rises an alarm on the recently discovered drugs because of their heavy toxicity it is our hope that this cheap, fast, and non-toxic solution[7] will be considered for further research to address this burden that affects so many.

Drug-resistant tuberculosis remains a driving factor behind the worldwide tuberculosis epidemic, and shorter, safer, and more effective treatment regimens are needed.[6]

In 2020, a total of 157,903 cases of rifampin-resistant tuberculosis were reported, and 25,681 of these cases involved additional resistance to core drugs (i.e., levofloxacin or moxifloxacin, bedaquiline, and linezolid), although this case count is probably an underestimate.

Currently, treatment lasts between 9 and 24 months and involves multiple drugs that have serious side effects, including cardiac toxic effects, neuropathy, and liver dysfunction.

Within the past decade, the approval of several drugs for the treatment of drug resistant tuberculosis has heralded a new era in treatment. Bedaquiline, a diarylquinoline, inhibits mycobacterial ATP synthase and is licensed for use in the treatment of drug-resistant tuberculosis. Pretomanid is a nitroimidazooxazine with activity against replicating and dormant mycobacteria through inhibition of mycolic acid biosynthesis and nitric oxide release, respectively.

Linezolid is a repurposed oxazolidinone that inhibits mycobacterial protein synthesis, but its prolonged use is associated with peripheral neuropathy and myelosuppression, (WHO guidelines).[1]

Additional information of detailed results is given in the tables below:

Table 1 Day 0 mean temperature 39.5 Celsius cough 100% weight 35 Kgs

No	Age	Sex	Location	Fever	Cough	Weight
N0001	32	M	IJENDA	38	100	33
N0002	33	M	IJENDA	40	100	34
N0003	35	M	RUSAKA	40	100	33
N0004	28	M	RUSAKA	39	100	35
N0005	26	M	IJENDA	38	100	36
N0006	24	M	MUSAGA	40	100	35
N0007	35	F	RUSAKA	40	100	38
N0008	39	F	MWARO	39	100	35
N0009	41	M	RUTANA	39	100	38
N0010	42	M	KIBUMBU	39	100	34
N0011	45	M	RUTANA	41	100	37
N0012	40	M	IJENDA	39	100	34
N0013	41	M	MURUNGA	38	100	30
N0014	42	M	MUGONGO MANGA	41	100	36
N0015	47	F	IJENDA	40	100	36
N0016	27	M	KIBUMBU	38	100	34
N0017	33	M	MWARO	41	100	37
N0018	29	M	MUGONGO MANGA	38	100	36
N0019	22	M	RUSAKA	40	100	37
N0020	28	F	IJENDA	40	100	39
N0021	26	M	IJENDA	39	100	36
N0022	24	F	MWARO	39	100	33
N0023	27	F	RUSAKA	40	100	36
N0024	42	M	BIKANKA	40	100	34
N0025	42	F	MUSAGA	41	100	33

Table 2 Day 05 mean temperature 38.6 Celsius cough 87% weight 37.4 Kgs

No	Age	Sex	Location	Fever	Cough	Weight
N0001	32	M	IJENDA	37	90	35
N0002	33	M	IJENDA	39	90	36
N0003	35	M	RUSAKA	39	85	35
N0004	28	M	RUSAKA	38	90	37
N0005	26	M	IJENDA	38	90	37
N0006	24	M	MUSAGA	39	90	38
N0007	35	F	RUSAKA	39	85	40
N0008	39	F	MWARO	39	90	36
N0009	41	M	RUTANA	38	90	40
N0010	42	M	KIBUMBU	38	80	36
N0011	45	M	RUTANA	40	80	39
N0012	40	M	IJENDA	37	80	36
N0013	41	M	MURUNGA	37	90	33
N0014	42	M	MUGONGO MANGA	40	95	37
N0015	47	F	IJENDA	39	90	38
N0016	27	F	KIBUMBU	37	80	37
N0017	33	M	MWARO	40	80	39
N0018	29	M	MUGONGO MANGA	38	80	38
N0019	22	M	RUSAKA	39	90	39
N0020	28	F	IJENDA	39	80	41
N0021	26	F	IJENDA	39	90	42
N0022	27	M	MWARO	38	90	36
N0023	24	F	RUSAKA	39	80	36
N0024	42	F	BIKANKA	39	95	36
N0025	42	M	MUSAGA	40	80	37

Citation: Gisenya P, Kahatwa S, Ogwang PE, et al. Combination treatment of WHO standard drugs and *Artemisia Afra* for pulmonary tuberculosis - A Pilot study of 25 multi resistant patients. *Pharm Pharmacol Int J.* 2024;12(3):97–106. DOI: 10.15406/ppij.2024.12.00440

Table 3 Day 10 mean temperature 37.5 Celsius cough 57% weight 37 Kgs

No	Age	Sex	Location	Fever	Cough	Weight
N0001	32	M	IJENDA	37	75	37
N0002	33	M	IJENDA	37	50	38
N0003	35	M	RUSAKA	38	50	39
N0004	28	M	RUSAKA	38	75	39
N0005	26	M	IJENDA	37	50	39
N0006	24	M	MUSAGA	37	50	39
N0007	35	F	RUSAKA	38	75	40
N0008	39	F	MWARO	38	50	39
N0009	41	M	RUTANA	37	50	41
N0010	42	M	KIBUMBU	37	50	39
N0011	45	M	RUTANA	37	75	39
N0012	40	M	IJENDA	37	50	38
N0013	41	M	MURUNGA	37	50	37
N0014	42	M	MUGONGO MANGA	37	50	39
N0015	47	F	IJENDA	38	75	39
N0016	27	M	KIBUMBU	37	50	39
N0017	33	M	MWARO	38	50	41
N0018	29	M	MUGONGO MANGA	37	50	39
N0019	22	M	RUSAKA	38	50	40
N0020	28	F	IJENDA	38	75	41
N0021	26	M	IJENDA	38	75	40
N0022	24	F	MWARO	37	50	39
N0023	27	F	RUSAKA	37	50	39
N0024	42	M	BIKANKA	38	50	38
N0025	42	F	MUSAGA	38	50	38

Table 4 Day 15 mean temperature 37.3 Celsius cough 33% weight 46.6 Kgs

No	Age	Sex	Location	Fever	Cough	Weight
N0001	32	M	IJENDA	37	25	42
N0002	33	M	IJENDA	37	25	43
N0003	35	M	RUSAKA	37	25	43
N0004	28	M	RUSAKA	37	50	44
N0005	26	M	IJENDA	37	25	47
N0006	24	M	MUSAGA	37	25	48
N0007	35	F	RUSAKA	37	25	46
N0008	39	F	MWARO	37	50	44
N0009	41	M	RUTANA	39	50	48
N0010	42	M	KIBUMBU	39	50	49
N0011	45	M	RUTANA	37	25	45
N0012	40	M	IJENDA	37	25	46
N0013	41	M	MURUNGA	39	50	47
N0014	42	M	MUGONGO MANGA	39	50	47
N0015	47	F	IJENDA	37	25	48
N0016	27	F	KIBUMBU	37	25	46
N0017	33	M	MWARO	37	25	48
N0018	29	M	MUGONGO MANGA	37	25	49
N0019	22	M	RUSAKA	37	50	47
N0020	28	F	IJENDA	37	25	48
N0021	26	F	IJENDA	37	25	48
N0022	27	M	MWARO	37	25	47
N0023	24	F	RUSAKA	37	50	48
N0024	42	F	BIKANKA	37	25	49
N0025	42	M	MUSAGA	37	25	48

Citation: Gisenya P, Kahatwa S, Ogwang PE, et al. Combination treatment of WHO standard drugs and *Artemisia Afra* for pulmonary tuberculosis - A Pilot study of 25 multi resistant patients. *Pharm Pharmacol Int J.* 2024;12(3):97–106. DOI: 10.15406/ppij.2024.12.00440

Table 5 Day 20 mean temperature 37 Celsius cough 29% weight 50.3 Kgs

No	Age	Sex	Location	Fever	Cough	Weight
N0001	32	M	IJENDA	37	25	49
N0002	33	M	IJENDA	37	25	49
N0003	35	M	RUSAKA	37	25	52
N0004	28	M	RUSAKA	37	25	53
N0005	26	M	IJENDA	37	25	49
N0006	24	M	MUSAGA	37	25	50
N0007	35	F	RUSAKA	37	25	49
N0008	39	F	MWARO	37	25	51
N0009	41	M	RUTANA	37	50	50
N0010	42	M	KIBUMBU	37	50	49
N0011	45	M	RUTANA	37	25	50
N0012	40	M	IJENDA	37	25	49
N0013	41	M	MURUNGA	37	50	49
N0014	42	M	MUGONGO MANGA	37	50	51
N0015	47	F	IJENDA	37	25	52
N0016	27	M	KIBUMBU	37	25	49
N0017	33	M	MWARO	37	25	53
N0018	29	M	MUGONGO MANGA	37	25	50
N0019	22	M	RUSAKA	37	25	51
N0020	28	F	IJENDA	37	25	53
N0021	26	M	IJENDA	37	25	50
N0022	24	F	MWARO	37	25	50
N0023	27	F	RUSAKA	37	25	50
N0024	42	M	BIKANKA	37	25	49
N0025	42	F	MUSAGA	37	25	49

Table 6 Day 25 Mean Temperature 37 Celsius Cough 25% Weight 54.16 Kgs

No	Age	Sex	Location	Fever	Cough	Weight
N0001	32	M	IJENDA	37	25	53
N0002	33	M	IJENDA	37	25	52
N0003	35	M	RUSAKA	37	25	54
N0004	28	M	RUSAKA	37	25	55
N0005	26	M	IJENDA	37	25	52
N0006	24	M	MUSAGA	37	25	56
N0007	35	F	RUSAKA	37	25	54
N0008	39	F	MWARO	37	25	52
N0009	41	M	RUTANA	38	25	53
N0010	42	M	KIBUMBU	38	25	55
N0011	45	M	RUTANA	37	25	56
N0012	40	M	IJENDA	37	25	54
N0013	41	M	MURUNGA	38	25	55
N0014	42	M	MUGONGO MANGA	38	25	56
N0015	47	F	IJENDA	37	25	54
N0016	27	F	KIBUMBU	37	25	55
N0017	33	M	MWARO	37	25	54
N0018	29	M	MUGONGO MANGA	37	25	52
N0019	22	M	RUSAKA	37	25	53
N0020	28	F	IJENDA	37	25	55
N0021	26	F	IJENDA	37	25	56
N0022	27	M	MWARO	37	25	55
N0023	24	F	RUSAKA	37	25	54
N0024	42	F	BIKANKA	37	25	54
N0025	42	M	MUSAGA	37	25	55

Citation: Gisenya P, Kahatwa S, Ogwang PE, et al. Combination treatment of WHO standard drugs and *Artemisia Afra* for pulmonary tuberculosis - A Pilot study of 25 multi resistant patients. *Pharm Pharmacol Int J.* 2024;12(3):97–106. DOI: 10.15406/ppij.2024.12.00440

Table 7 Day 30 mean temperature 40 Celsius cough 4% weight 57 Kgs

No	Age	Sex	Location	Fever	Cough	Weight
N0001	32	M	IJENDA	37	0	56
N0002	33	M	IJENDA	37	0	57
N0003	35	M	RUSAKA	37	0	57
N0004	28	M	RUSAKA	37	0	58
N0005	26	M	IJENDA	37	0	56
N0006	24	M	MUSAGA	37	0	59
N0007	35	F	RUSAKA	37	0	58
N0008	39	F	MWARO	37	0	57
N0009	41	M	RUTANA	37	25	56
N0010	42	M	KIBUMBU	37	25	58
N0011	45	M	RUTANA	37	0	56
N0012	40	M	IJENDA	37	0	55
N0013	41	M	MURUNGA	38	25	56
N0014	42	M	MUGONGO MANGA	38	25	58
N0015	47	F	IJENDA	37	0	59
N0016	27	M	KIBUMBU	37	0	57
N0017	33	M	MWARO	37	0	55
N0018	29	M	MUGONGO MANGA	37	0	55
N0019	22	M	RUSAKA	37	0	59
N0020	28	F	IJENDA	37	0	57
N0021	26	M	IJENDA	37	0	56
N0022	24	F	MWARO	37	0	55
N0023	27	F	RUSAKA	37	0	59
N0024	42	M	BIKANKA	37	0	59
N0025	42	F	MUSAGA	37	0	56

Table 8 Day 35 mean temperature 37 Celsius cough 0.8% weight 62 Kgs

No	Age	Sex	Location	Fever	Cough	Weight
N0001	32	M	IJENDA	37	0	60
N0002	33	M	IJENDA	37	0	62
N0003	35	M	RUSAKA	37	5	61
N0004	28	M	RUSAKA	37	0	63
N0005	26	M	IJENDA	37	0	64
N0006	24	M	MUSAGA	37	0	63
N0007	35	F	RUSAKA	37	5	62
N0008	39	F	MWARO	37	0	63
N0009	41	M	RUTANA	37	0	62
N0010	42	M	KIBUMBU	37	0	61
N0011	45	M	RUTANA	37	0	60
N0012	40	M	IJENDA	37	0	63
N0013	41	M	MURUNGA	37	0	62
N0014	42	M	MUGONGO MANGA	37	5	63
N0015	47	F	IJENDA	37	0	62
N0016	27	F	KIBUMBU	37	0	64
N0017	33	M	MWARO	37	0	63
N0018	29	M	MUGONGO MANGA	37	0	61
N0019	22	M	RUSAKA	37	0	59
N0020	28	F	IJENDA	37	0	62
N0021	26	F	IJENDA	37	0	61
N0022	27	M	MWARO	37	0	64
N0023	24	F	RUSAKA	37	0	65
N0024	42	F	BIKANKA	37	5	63
N0025	42	M	MUSAGA	37	0	62

Citation: Gisenya P, Kahatwa S, Ogwang PE, et al. Combination treatment of WHO standard drugs and *Artemisia Afra* for pulmonary tuberculosis - A Pilot study of 25 multi resistant patients. *Pharm Pharmacol Int J.* 2024;12(3):97–106. DOI: 10.15406/ppij.2024.12.00440

Acknowledgments

None.

Conflicts of interest

The authors declare that they have no conflicts of interest.

References

1. WHO guidelines.
2. Bagire PG, Ogwang PE, Lusi JKM, et al. Artemisia Afra infusions clinical benefits as a complementary treatment to "WHO" approved drugs against tuberculosis. *Pharm Pharmacol Int J*. 2022;10(5):157–166.
3. Gisenya P, Ogwang PE, Katotola E, et al. Pilot study to compare the use of the national program drugs ALONE versus their combination with *Artemisia Afra* infusions for the treatment of pulmonary tuberculosis. *Pharm Pharmacol Int J*. 2023;11(4):118–128.
4. Martini MC, Zhang T, Williams JT, et al. Artemisia annua and Artemisia Afra extracts exhibit strong bactericidal activity against Mycobacterium Tuberculosis. *J Ethnopharmacol*. 2020:262:113191.
5. Munyangi J, Lutgen P. *Artemisia Afra cures Buruli ulcer with high efficacy*. Malaria World. 2017.
6. Gygli SM, Borrell S, Trauner A, et al. Antimicrobial resistance in Mycobacterium tuberculosis: mechanistic and evolutionary perspectives. FEMS Microbiol Rev. 2017;41(3):354–373.
7. Mukinda JT, Syce JA. Acute and chronic toxicity of the aqueous extract of Artemisia Afra in rodents. *J Ethnopharmacol*. 2007;112(1):138–144.
8. Oh P, Pascopella L, Barry PM, et al. A systematic synthesis of direct costs to treat and manage tuberculosis disease applied to California, 2015. *BMC Res Notes.* 2017;10:434.