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## Ethnobotanical survey of anti-malarial plants used in Ilorin metropolis, Nigeria

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### Abstract

An ethnobotanical survey of medicinal plants used in the treatment of malaria in Ilorin, Kwara State, Nigeria was carried out between March and June, 2019. Ethno-botanical data were collected by oral interview with the aid of a semi-structured questionnaire administered to forty-seven (47) herb sellers. The respondents were aware of the signs and symptoms of malaria and could readily distinguish the ailments from other feverish symptoms and conditions. Symptoms reported include body weakness, high body temperature (hot skin), loss of appetite, coldness, mouth bitterness, headache, coloured eyes (yellow), sleepless night and urine colouration (yellowish). From the study, a total of thirteen (13) plant species belonging to nine (9) families including Aannonaceae, Apocynaceae, Rubiaceae, Ochnaceae were described as being used for the treatment of malaria. The plant parts used were leaves, root, stem bark and seed with roots being the most used plant part. It was also observed that recipes were made from combination of different parts from more than one plant species including bark, root and leaves while some were made from single plant part. The most preferred mode of administration was oral, while decoction and infusion were the most preferred method of preparation. However, the study observed that *Picralima nitida*, *Enanchia chloranta* and *Morinda nucida* were the frequently mentioned plants. Hence, these plant species could be considered as promising candidates for further scientific validation in the search for new, effective and affordable antimalarial drugs.

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### Introduction

Malaria is a major disease problem in tropical regions of the world, and it is an enormous health, social and economic burden globally especially in sub-Saharan Africa [1, 2, 3]. Federal Ministry of

Health in Nigeria (FMH), [4] reported malaria as a major disease in Nigeria becoming more resistant to a number of current drugs and its increase has become a major problem in malaria control [5].

Malaria is a parasitic disease transmitted to man by the bites of anopheles mosquitoes infected with plasmodium species, four of which infect humans: *Plasmodium falciparum* (the deadliest one), *P. vivax*, *P. malariae*, and *P. ovale* [6]. An estimated annual death of 1-3 million from malaria only was made by WHO [7] and Greenwood *et al.* [8] with children being the most vulnerable in sub-Saharan Africa, while it infects between 300-500 million people yearly. Concerted effort had been made in combating the malaria parasite, and the disease vector. Decades ago, many antimalarial drugs were developed from plant-based materials, for example, an alkaloid (quinine) from the bark of *Cinchona* Spp, (Rubiaceae) and artemisinin from *Artemisia annua*, (Asteraceae). Despite some breakthroughs in the synthesis of antimalarial drugs, the parasite has developed resistance to most of the synthetic drugs, hence large population of people in the tropics still rely on plant-based therapy. In the tropical regions of Asia, South America and Africa where the disease is prevalent, people still use *Cinchona* bark and other plants. About 80% of the population of many developing countries still uses traditional medicines for their health care [9, 10]. Over 90% of Nigerians in rural areas and about 40% of the population living in urban areas depend partly or wholly on traditional medicines [11]. Due to economic reasons, most of the people in developing countries are precluded from the luxury of access to modern therapy [12]. This has made the people to rely on plant and

animal resources for their health care over centuries.

A study in Nigeria has shown that urban centers are areas where traditional medicine is widely practiced [13]. Odebiyi [14] also opined that majority of the healthcare practitioners in Nigeria are traditional healers, while Cunningham [15] reported that in Benin City (Nigeria), the ratio of Traditional Medicine Practitioner (TMP) to the population is less than one percent (1%) while that of western medical doctor is comparatively lesser. Many trees and shrubs in Nigeria have medicinal values [16]. The survey and proper documentation of various plants used by TMPs in combating the infant killer disease (malaria) is pre-requisite to the preservation of indigenous knowledge of our rich plant resources.

The use of ethnobotanical survey to document the traditional medicinal plants used in malaria treatment is projected as a valuable tool and pre-requisite to the preservation of indigenous knowledge of our rich plant resources. Currently, natural products of plant sources have been the focus as the main source of new, safer and more effective bioactive compounds with medicinal properties [17] and most information is in the hands of the traditional healers [18]. However, the active substances in these plants are derived from secondary metabolites from the plant extract [19]. Some of these bioactive compounds from such plants are increasingly valued as raw materials in pharmaceutical industries. Therefore, this investigation will provide database for posterity as well as contribute to the progress for

new and alternative natural antimalarial medicines.

## Materials and methods

### Study Area

Ilorin, the capital city of Kwara State, Nigeria is located on latitude 8° 25'N and 8° 32'N and longitude 4° 30'E and 4° 41'E with an area of about 89 km<sup>2</sup> [20].

It is situated at a strategic point between the densely populated southwest and the sparsely populated middle belt of Nigeria. Ilorin is located in traditional zone between the deciduous woodland of the south and dry savanna of the north of Nigeria [21]. The climate of Ilorin is characterized by both wet and dry seasons. The temperature of Ilorin ranges from 33°C to 34°C from November to January while from February to April the value ranges between 34°C to 53°C [22]. The mean monthly temperatures are very high varying from 25°C to 28.9°C. The diurnal range of temperature is also high in the area. The

rainfall in Ilorin city exhibits greater variability both temporarily and spatially [23]. The total annual rainfall in the area is about 1200 mm [24]. Relative humidity at Ilorin in the wet season is between 75 to 80% while in the dry season it is about 65% [25]. The day time is sunny. The sun shines brightly for about 6.5 to 7.7 hours daily from November to May [26]. The geology of the study area consists of precambrian basement complex rock. The elevation on the western side varies from 273 m to 333 m above sea level while on the Eastern side it varies from 273 m to 364 m. Ilorin is majorly drained by Asa River which flows in a south-north direction [27].

The derived savanna dominates the vegetation of the area. The vegetation type comprises tall grass which is interspersed with scattered trees. The grasses in the area include spear grass, elephant grass, and goat weed. Trees in the area include shear butter, acacia and locust bean trees.

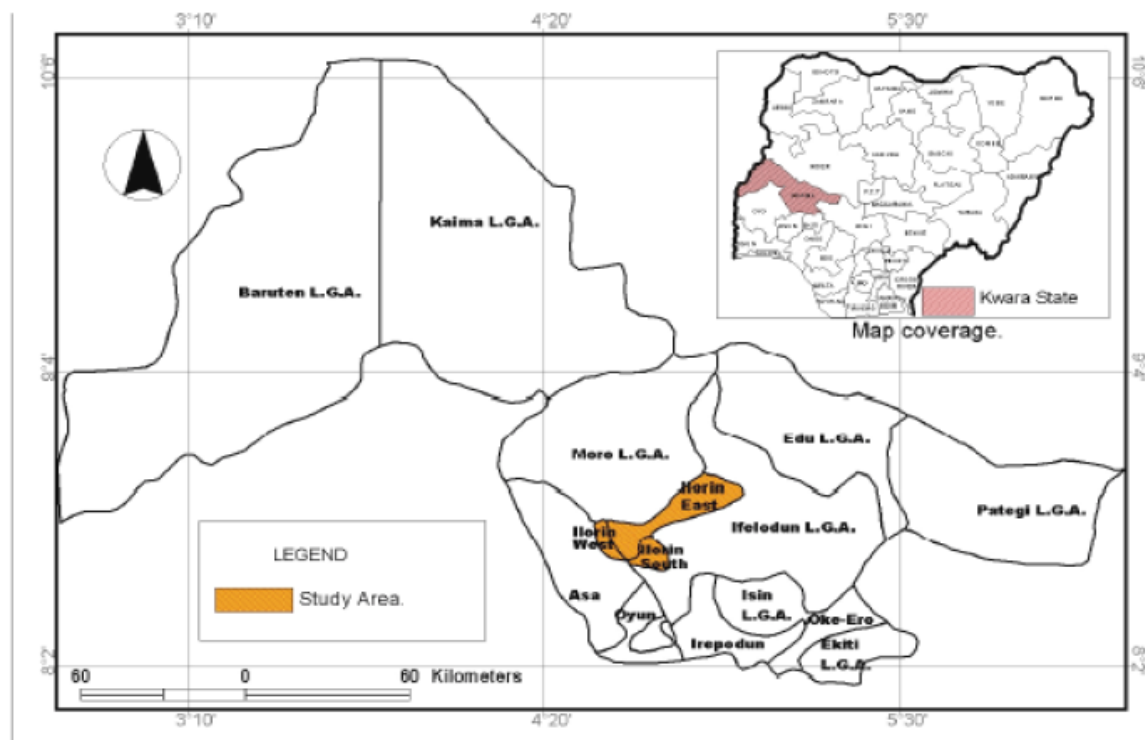


Figure 1: Map of Kwara State Showing the study Area [28].

### Data collection

### Sampling techniques and sample size

The study covered a period of three months, from March to June 2019. Three (3) major herb markets were selected from the core of

Ilorin metropolis. The markets were Oja'ba, Oja titun and Alanamu.

From the preliminary survey of the study area, population census of the herb sellers comprising the study populations were:

**Table 1: Study population and sample size**

Study population (Markets)	Sample frame	Sample size	% sample size
Oja'ba	25	14	56%
Oja titun	34	18	52.94
Alanamu	28	15	53.57
<b>Total</b>	<b>87</b>	<b>47</b>	<b>54.02</b>

Sample size (n) =  $\frac{N}{1+(N)(0.1)^2}$  (using Yamane equation for population sampling)

$$n = \frac{87}{1+(87)(0.1)^2} = \frac{87}{1.87} = 46.52 \text{ approx. } 47$$

Sample size (n) = 47 (54.02% of the study population)

Study population = N

Where n = Sample size (Total number of respondents).

### Data collection

Semi-structured questionnaire was used to interview the respondents about their knowledge of plants used in the treatment of malaria. Interviews were based on a checklist of questions prepared beforehand in English and interpreted to the respondents in local language (Yoruba) and responses filled into the questionnaire after each interview. Information regarding local names of medicinal plants, plants part(s) used, mode of preparation, method of extraction, administration, dosage used and other medicinal uses were recorded on the spot.

Based on ethno-botanical information provided by informants, specimens were collected and numbered for identification. Identification was done in the field as well as in the herbarium of the Federal College of Wildlife Management of Forestry Research Institute of Nigeria, New Bussa, Niger State, Nigeria with the help of experts, by comparison with authentic specimens, illustrations and taxonomic keys.

### Data processing and analysis

Available data were processed, analyzed using Special Package for Social Science

(SPSS 17) and interpreted to find the result of the study. Data collected were transferred to a master sheet to facilitate tabulation. The analyzed data were then represented in tabular and graphical form.

## Results

### Demographic characteristics of respondent

A total number of forty-seven (47) respondents were interviewed, with majority (48.94%) within the age range of 40-49

years; 6.38% falls within the age range of 18-29 years while 12.77% were above 60 years. All respondents were married female (probably due to social understanding that women play an important role in local health through sale of herbs) and practice Islam religion (presented in table 2). Also, majority (74.47%) of the respondents were involved in trading of other commodities while 19.15% were civil servants and 6.38% were students.

**Table 2: Demographic characteristics of respondents**

Variables	Specification	No. of Respondents
Age	18-29	3
	30-39	6
	40-49	23
	50-59	9
	60 and above	6
Marital status	Married	47
	Single	0
Sex	Female	47
	Male	0
Religion	Islam	47
	Christianity	0
	Others	0
Other occupations	Student	3
	Trader	35
	Civil servant	9

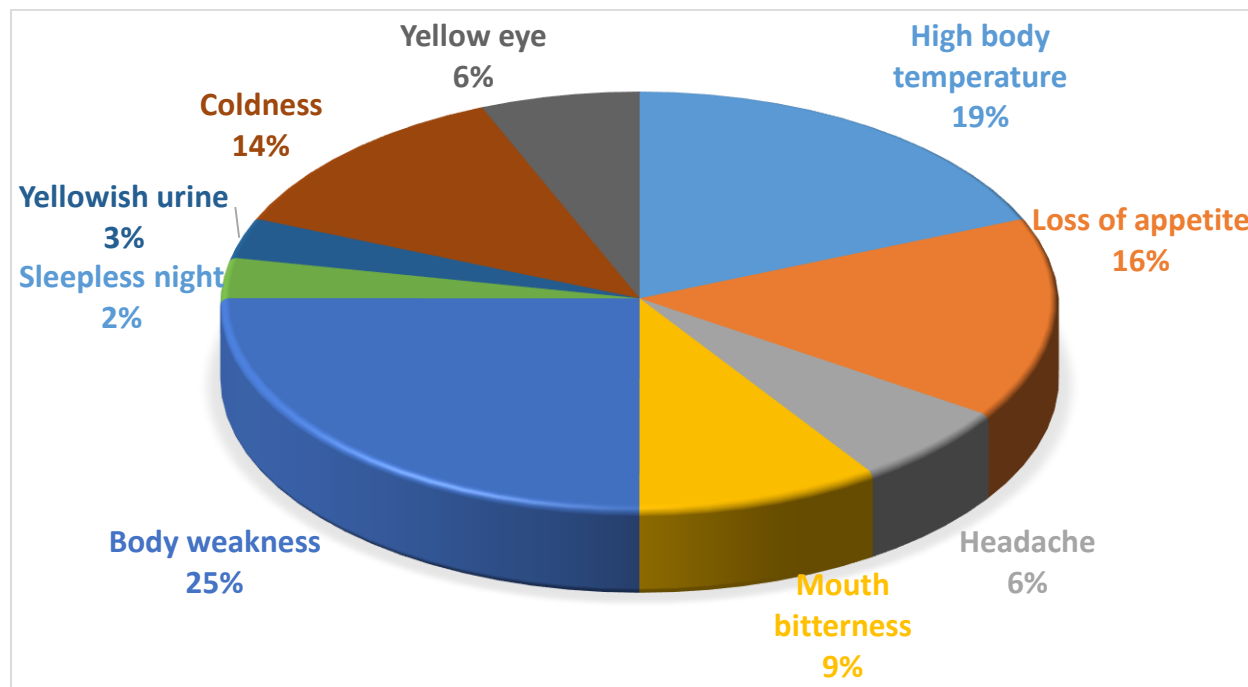
### Signs and symptoms of malaria

The study revealed that the respondents were aware of the signs and symptoms of malaria

and could readily distinguish the ailment from other feverish conditions. Symptoms reported as signs of malaria infection as established by number of respondents

(percentage) include body weakness, high body temperature (hot skin), loss of appetite, coldness, mouth bitterness, headache,

coloured eyes (yellow), sleepless night and urine colouration (yellowish) as presented figure 2.

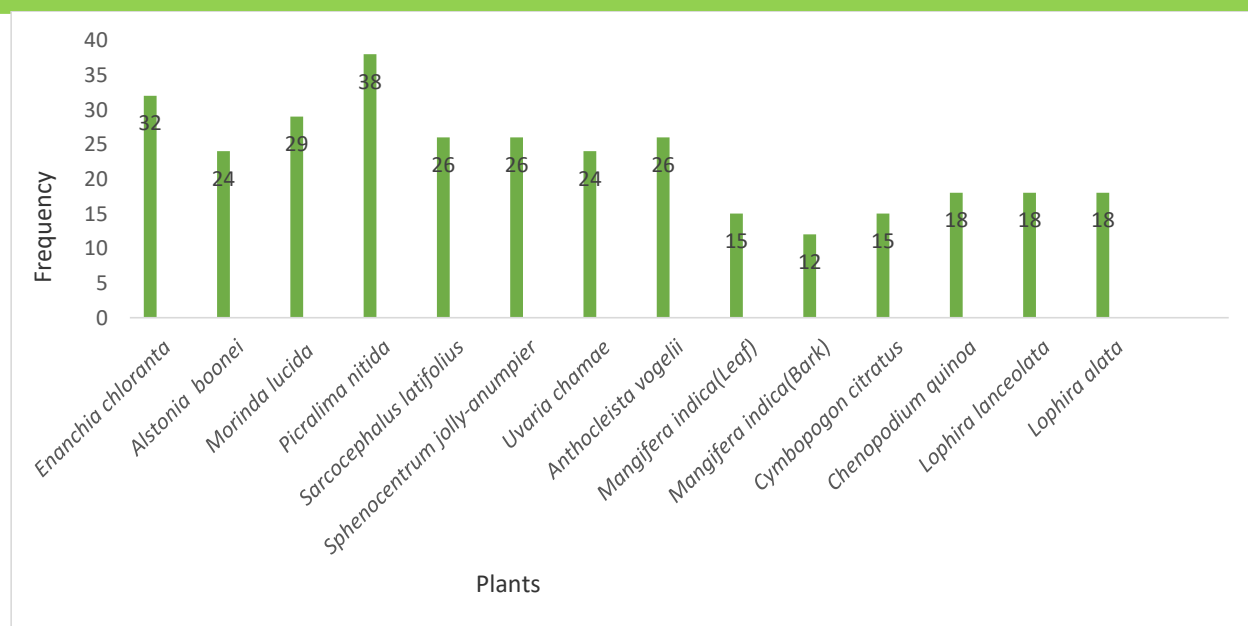


**Figure 2: % of respondents' experience on signs and symptoms for the diagnosis of malaria in the study area.**

### Frequency of plants prescription for malaria treatment

The frequency of prescription of various herbs mentioned during survey is presented

in Figure 3. The most commonly mentioned plants were *Picralima nitida* (38) *Enanchia chloranta* (32) and *Morinda lucida* (29).



**Figure 3: Frequency of plants prescription for malaria treatment**

#### Medicinal plants and parts used for the treatment of malaria in Ilorin

A total number of thirteen (13) plant species belonging to nine (9) families were documented as being used for the treatment

of malaria. The Families included Annonaceae, Apocynaceae, Rubiaceae, Ochnaceae. The plant parts used were leaves, root, stem bark and seeds (presented in table 3). The roots were the most used plant part then, stem bark and leaves.



**Table 3: List of medicinal plants and parts used for the treatment of malaria in Ilorin**

S/No	Botanical name	Family Name	Local name	Common name	Part used	Other uses
1	<i>Alstonia boonei</i>	Apocynaceae	Epo ahun	Pattern wood Stool wood	Bark	Infection
2	<i>Anthocleista vogelii</i>	Longaniaceae	Sapo	Cabbage Tree	Root	Diabetes
3	<i>Chenopodium quinoa</i>	Amaranthaceae	Epo ara	Wild quinoa	Bark	
4	<i>Cymbopogon citratus</i>	Poaceae	Ewe tea	Lemon grass	Leave	
5	<i>Enanchia chloranta</i>	Anonaceae	Awopa	Anamu	Bark	
6	<i>Lophira alata</i>	Ochnaceae	Paran funfun	Iron wood	Root	Pile and infection
7	<i>Lophira lanceolata</i>	Ochnaceae	Paran pupa	Red iron wood	Root	Pile and Infection
8	<i>Mangifera indica</i>	Anacardiaceae	Epo mangoro/ Ewe mangoro	Mango	Leave/ Bark	
9	<i>Morinda lucida</i>	Rubiaceae	Oruwo	Brimstone tree	Root	Infection
10	<i>Picralima nitida</i>	Apocynaceae	Abeere	Picralima	Seed	Stomach ache
11	<i>Sarcocephalus latifolius</i>	Rubiaceae	Egbesi	African peach	Root	Jaundice
12	<i>Sphenocentrum jolly-anumpier</i>	Menispermaceae	Akerejupon	Sphenocentrum	Root	Cough
13	<i>Uvaria chamae</i>	Annonaceae	Eruju	Cluster pear/Bush banana	Root	Typhoid

### Medicinal plants combination used for the treatment of malaria in Ilorin

It was observed that recipes were made from combination of different parts from more than one plant species mostly root and leaves

(presented in table 4), while some were made from single plant part. The most preferred mode of administration was oral, while decoction and infusion were the most preferred methods of preparation.

**Table 4: Medicinal plants combination used for the treatment of malaria in Ilorin**

S/No	Recipe	Solvent of choice	Method of preparation	Dosage and administration
1.	<i>Enanchia chloranta</i> , <i>Alstonia boonei</i> , <i>Morinda lucida</i> , <i>Picralima nitida</i> , <i>Spenocentrum jolly-anumpier</i> , <i>Uvaria chamae</i> , <i>Anthocleista vogelii</i> , <i>Mangifera indica</i>	Water or fermented maize water, carbonated water (e.g 7up)	Decoction (boil) Infuse in carbonated water	when boiled, 300 ml (one cup full) to be taken morning and evening for 3days -when infused in carbonated water 50 ml to be taken morning and evening for 7 days
2.	<i>Enanchia chloranta</i> , <i>Alstonia boonei</i> , <i>Sarcocephalus latifolus</i> , <i>Morinda lucida</i> , <i>Lophira lanceolate</i> , <i>Lophira alata</i> , <i>Picralima nitida</i> , <i>Anthocleista vogelii</i> , <i>Uvaria chamae</i>	Water/ fermented maize water	Decoction (boil and allow to cool)	300 ml to be taken morning and evening for 3-7 days
3.	<i>Mangifera indica</i> , <i>Cymbopogon citratus</i> , <i>Morinda lucida</i> , <i>Picralima</i>	Water/ fermented maize water	Decoction (boil)	300 ml to be taken morning and evening for 4days

	<i>nitida, Sphenocentrum jolly-anumpier</i>			
4.	<i>Morinda lucida</i>	Carbonated water (e.g 7up)	Infuse in carbonated water	50 ml to be taken morning and evening for 7 days
5.	<i>Picralima nitida</i>	Carbonated water (e.g 7up)	Infuse in carbonated water	50 ml to be taken morning and evening for 5 days
6.	<i>Picralima nitida, Chenopodium quinoa, Cymbopogon citatus, Mangifera indica, Enanchia chloranta, Lophira lanceolata, Lophira alata, Sphenocentrum jolly-anumpier</i>	Water/fermented maize water	Decoction (boil and allow to cool)	300 ml to be taken morning and evening for 3-5 days

## Discussion

Dominant role of women in the study area conformed to report of Fashola [29] and Akinsoji and Oke [30] that established significant role of women herb sellers in local health. Symptoms of malaria reported in this study are in agreement with study conducted in Sangere community of Adamawa State, Nigeria [31]. The selection of medicinal plants used for the treatment of malaria in Ilorin metropolis, Kwara State shows similarity with those used in other parts of Nigeria [32, 33]. Majority of the plants also

have similarity with those reported for malaria ethno-therapy in Ogun State [34].

From the study, it was observed that *Picralima nitida*, *Enanchia chloranta* and *Morinda lucida* are the most used plants for malarial treatment in the study area. This may indicate that these plants have high anti-malarial activity. *M. lucida* which is one of the most prescribed plants by the herb sellers for malarial treatment is reported to be widely known as plant possessing antimalarial property attributed to anthraquinones and anthranquinols isolated from the plant [35].

*Sarcocephalus latifolius*, *Alstonia boonei*, *Petivera alliacea*, and *Mangifera indica* had also been reported to have significant antimalarial property [36, 37]. The prescriptions were both mono-plant and poly-plant, with poly-plant prescription dominating. This is in agreement with Omosun *et al* [5] who reported similar observation in the treatment of malaria in Abia State, Nigeria.

The combination of different plants and parts in the preparation of antimalarial herbal remedy was not uncommon among respondents and it was believed that some plants enhance the action of other herbs. This can indicate an increase on permeability of the Plasmodium membrane to anti-parasitic substances or an inhibition of pump mechanism of eliminating the drugs [38].

The decoction and infusion are given in prescribed measures and specific dosage forms for effective performance. The parts used, mode of preparation, application and dosage have similarity with those reported in different parts of the country [39, 31, 32, and 34].

### Conclusion

This survey has documented the medicinal plants used for malaria therapy by herb sellers in Ilorin metropolis, Kwara State. The plants listed have been reported by the

respondents to be safe when used as herbs. In the case of prevalence of resistance developed by malaria parasite, the recorded medicinal plants combination could cure malaria within a short period which shows their high efficacy and possibility of potent active ingredient against the parasite. However, the survey further observed that *Picralima nitida*, *Enanchia chloranta* and *Morinda lucida* showed the highest incidence of encounter. Thus, in the face of growing unaffordable modern drugs, screening of all the above-mentioned plants for anti-malarial activity could be carried out in order to justify their local usage. Further study on the listed plants can lead to the isolation (and possibly the identification) of potentially active compounds, which may be regarded as future promising phyto-therapeutics in the search for new, effective and affordable anti-malarial drugs.

Moreover, considering the fact that most of these useful plants are grown in the wild, and that the numerous human activities in an attempt to exploit natural resources constitute big problems in destruction of these plants, there is urgent need to map out strategies for conservation of these plants to avoid their extinction in the nearest future.

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