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THE EFFECT OF CONSUMPTION OF BOILED WATER OF KERSEN LEAVES ON BLOOD CHOLESTEROL LEVELS IN THE COMMUNITY WONOSARI DISTRICT BOALEMO REGENCY

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ABSTRACT
Hypercholesterolemia is a major risk factor for cardiovascular disease. Increasing interest in natural therapies has encouraged the use of medicinal plants such as Muntingia calabura L. (Kersen), whose leaves contain flavonoids, saponins, tannins, and polyphenols with potential lipid-lowering properties. This study aimed to determine the effect of consuming boiled Kersen (Muntingia calabura L.) leaf water on blood cholesterol levels among residents of Wonosari District, Boalemo Regency. A quantitative study with a pre-experimental one-group pretest-posttest design was conducted involving 39 respondents selected through purposive sampling. Total blood cholesterol levels were measured before and after the intervention using a digital cholesterol meter. Data were analyzed using descriptive statistics, Kolmogorov–Smirnov normality test, homogeneity test, and Paired Samples t-test with a significance level of 0.05. The mean total cholesterol level decreased from 237 mg/dL before the intervention to 188 mg/dL after consuming boiled Kersen leaf water. Most respondents experienced a reduction in cholesterol levels, although one respondent showed an increase, likely associated with uncontrolled dietary intake. Normality and homogeneity assumptions were satisfied ($p > 0.05$). The Paired Samples t-test demonstrated a statistically significant difference between pretest and posttest cholesterol levels ($p < 0.001$). Consumption of boiled Kersen (Muntingia calabura L.) leaf water significantly reduced blood cholesterol levels among residents of Wonosari District. This intervention may serve as a promising complementary non-pharmacological approach for hypercholesterolemia management. Further controlled clinical studies are recommended to confirm its long-term effectiveness and safety.

INTRODUCTION

Hypercholesterolemia remains one of the leading modifiable risk factors for cardiovascular disease (CVD), which continues to be the primary cause of mortality worldwide. The increasing prevalence of hypercholesterolemia is closely associated with unhealthy lifestyles, including diets rich in saturated fats, cholesterol, and processed foods, combined with reduced physical activity. Recent evidence indicates that the global burden of metabolic diseases, including hypercholesterolemia, continues to rise, particularly in low- and middle-income countries, creating substantial challenges for healthcare systems and increasing the incidence of coronary heart disease and stroke [1][2].

Elevated blood cholesterol, particularly low-density lipoprotein cholesterol (LDL-C), accelerates the development of atherosclerosis through the accumulation of lipids within arterial walls. Progressive atherosclerotic plaque formation narrows blood vessels and impairs blood circulation, substantially increasing the risk of myocardial

infarction, ischemic stroke, and other cardiovascular complications. Consequently, effective cholesterol management is essential for reducing cardiovascular morbidity and mortality. Although pharmacological therapies such as statins are widely used, long-term medication use may be associated with adverse effects and reduced patient adherence, encouraging the exploration of complementary non-pharmacological approaches [3].

Growing public interest in medicinal plants has encouraged researchers to investigate natural therapies as alternative strategies for managing hypercholesterolemia. Indonesia possesses abundant biodiversity, including numerous medicinal plants traditionally used for disease prevention and treatment. One promising medicinal plant is Kersen (*Muntingia calabura* L.), whose leaves have long been utilized in traditional medicine. Phytochemical analyses have demonstrated that Kersen leaves contain various bioactive compounds, including flavonoids, tannins, saponins, and polyphenols, which exhibit antioxidant, anti-inflammatory, and lipid-lowering activities [4][5].

The lipid-lowering potential of Kersen leaves is primarily attributed to their flavonoid and saponin contents. Flavonoids may inhibit the activity of 3-hydroxy-3-methylglutaryl coenzyme A (HMG-CoA) reductase, a key enzyme involved in endogenous cholesterol synthesis, while saponins reduce intestinal cholesterol absorption by promoting bile acid excretion. In addition, antioxidant compounds present in Kersen leaves help reduce oxidative stress associated with lipid metabolism disorders. Experimental studies have demonstrated that preparations derived from *Muntingia calabura* improve lipid profiles and reduce oxidative damage in hyperlipidemic animal models, suggesting their potential as a natural intervention for cholesterol management [6][7].

Despite these promising findings, scientific evidence regarding the effectiveness of boiled Kersen leaf water as traditionally consumed by communities remains limited. Most previous studies have evaluated extracts or juice preparations in experimental animals, whereas clinical evidence involving simple herbal preparations commonly used in community settings is still scarce. This gap highlights the need for further investigation into the effectiveness of boiled Kersen leaf water as an accessible, affordable, and culturally acceptable complementary therapy for reducing blood cholesterol levels.

Field observations conducted in Wonosari District, Boalemo Regency, revealed that many residents complained of symptoms commonly associated with elevated cholesterol levels, including chest discomfort, leg pain, nocturnal muscle cramps, excessive drowsiness, weight gain, and decreased appetite. These conditions are believed to be influenced by unhealthy dietary patterns characterized by frequent consumption of high-fat foods, as well as irregular daily activities. According to the Central Statistics Agency (BPS) of Boalemo Regency 2024, Wonosari District has a population of 28,239 residents whose primary occupations are farming and livestock production, resulting in dietary patterns that may contribute to increased cholesterol intake. Consequently, identifying affordable and locally available herbal interventions has become increasingly important for supporting community-based prevention and management of hypercholesterolemia.

Therefore, this study aims to evaluate the effect of consuming boiled Kersen (*Muntingia calabura* L.) leaf water on blood cholesterol levels. The findings are expected to provide scientific evidence regarding the potential use of boiled Kersen leaf water as a complementary non-pharmacological intervention for cholesterol management and to support the utilization of Indonesia's medicinal plant resources in preventive healthcare.

Literatur Review

Hypercholesterolemia

Hypercholesterolemia is a metabolic disorder characterized by elevated blood cholesterol concentrations, particularly low-density lipoprotein cholesterol (LDL-C), which plays a central role in the development of atherosclerosis and cardiovascular diseases. Cholesterol is an essential lipid required for cell membrane integrity, steroid hormone synthesis, vitamin D production, and bile acid formation. However, excessive cholesterol accumulation, especially LDL-C, promotes lipid deposition within arterial walls, initiating endothelial dysfunction and plaque formation that ultimately increases the risk of coronary artery disease, ischemic stroke, and peripheral arterial disease [3][8].

The increasing prevalence of hypercholesterolemia has become a major public health concern due to changes in dietary patterns, sedentary lifestyles, obesity, and population aging. Elevated cholesterol not only contributes to cardiovascular morbidity and mortality but also imposes a substantial economic burden on healthcare systems because of long-term treatment and management costs [3]. Therefore, effective prevention and control of hypercholesterolemia remain essential components of cardiovascular disease prevention.

Cholesterol Metabolism and Cardiovascular Risk

Cholesterol homeostasis is maintained through a balance between endogenous synthesis, intestinal absorption, transport, utilization, and excretion. Approximately 70–80% of cholesterol is synthesized by the liver through the mevalonate pathway, in which the enzyme 3-hydroxy-3-methylglutaryl coenzyme A (HMG-CoA) reductase acts as the rate-limiting enzyme. The remaining cholesterol is obtained from dietary intake [9].

Circulating cholesterol is transported by lipoproteins. Low-density lipoprotein (LDL) delivers cholesterol to peripheral tissues, whereas high-density lipoprotein (HDL) facilitates reverse cholesterol transport by returning excess cholesterol to the liver for excretion. An imbalance characterized by elevated LDL-C and reduced HDL-C promotes oxidative modification of LDL particles, endothelial injury, inflammatory responses, and the formation of atherosclerotic plaques. Progressive plaque accumulation narrows blood vessels and increases the risk of myocardial infarction, ischemic stroke, and other cardiovascular complications [9].

Maintaining cholesterol homeostasis is therefore essential to prevent cardiovascular disease progression. Both pharmacological and lifestyle-based interventions aim to restore lipid balance by reducing LDL cholesterol while improving HDL-mediated cholesterol clearance.

Pharmacological and Non-Pharmacological Management of Hypercholesterolemia

The management of hypercholesterolemia consists of pharmacological and non-pharmacological approaches.

Pharmacological therapy primarily includes statins, which inhibit HMG-CoA reductase and effectively reduce hepatic cholesterol synthesis, thereby lowering LDL cholesterol concentrations. Additional lipid-lowering agents such as ezetimibe, PCSK9 inhibitors, and combination therapies are recommended for individuals who fail to achieve lipid targets with statin therapy alone or who present with high cardiovascular risk [10].

Despite their effectiveness, long-term pharmacological treatment may be associated with adverse effects, medication costs, and reduced patient adherence. Consequently, non-pharmacological interventions remain fundamental in hypercholesterolemia management. Lifestyle modification including reducing saturated fat intake, increasing dietary fiber consumption, engaging in regular physical activity, maintaining healthy body weight, smoking cessation, and consuming antioxidant-rich foods has consistently been shown to improve lipid profiles and reduce cardiovascular risk. Interest in medicinal plants with lipid-lowering properties has also increased because they offer accessible, affordable, and potentially safer complementary therapies [10].

Phytochemical Compounds in *Muntingia calabura* L. Leaves

Kersen (*Muntingia calabura* L.) is widely used in traditional medicine because of its rich phytochemical composition. Phytochemical analyses have demonstrated that the leaves contain flavonoids, saponins, tannins, polyphenols, phenolic acids, and other antioxidant compounds that exhibit numerous biological activities, including antioxidant, anti-inflammatory, antimicrobial, antidiabetic, and cardioprotective effects [11][12].

Flavonoids represent one of the most abundant bioactive constituents and are recognized for their strong free radical scavenging capacity. Polyphenols further contribute to antioxidant defense by reducing oxidative stress, while tannins possess anti-inflammatory and antimicrobial properties. Saponins have attracted considerable attention because of their ability to interact with cholesterol molecules and reduce intestinal cholesterol absorption. Collectively, these phytochemicals provide a scientific basis for the traditional use of Kersen leaves in preventing metabolic disorders, including hypercholesterolemia [5].

Mechanisms of Lipid-Lowering Effects of Kersen Leaves

The cholesterol-lowering potential of Kersen leaves is attributed to the synergistic actions of their phytochemical constituents through multiple biological mechanisms.

Flavonoids suppress cholesterol biosynthesis by inhibiting HMG-CoA reductase activity, thereby reducing endogenous cholesterol production. In addition, flavonoids inhibit LDL oxidation, preserve endothelial function, and decrease oxidative stress associated with atherosclerosis [11].

Saponins reduce serum cholesterol by binding cholesterol and bile acids within the gastrointestinal tract, thereby decreasing cholesterol absorption and increasing fecal cholesterol excretion. This mechanism stimulates hepatic conversion of cholesterol into bile acids, ultimately lowering circulating cholesterol levels.

Polyphenols and tannins exert potent antioxidant effects by neutralizing reactive oxygen species (ROS), suppressing inflammatory responses, and protecting vascular endothelial cells from oxidative injury. These combined

mechanisms may improve lipid metabolism and decrease cardiovascular risk associated with hypercholesterolemia [13].

Previous Studies on the Lipid-Lowering Effects of Kersen Leaves

Several experimental studies have demonstrated the therapeutic potential of *Muntingia calabura* in improving lipid metabolism. Sopandi et al. [7], reported that administration of Kersen juice significantly improved lipid profiles in hyperlipidemic rats by reducing total cholesterol and improving overall lipid metabolism.

Similarly, Taslim et al. [6], demonstrated that dietary supplementation with *Muntingia calabura* leaves significantly reduced oxidative stress markers and lipid peroxidation in hyperglycemic animal models. These findings suggest that antioxidant activity contributes substantially to the plant's protective metabolic effects.

Phytochemical investigations conducted by Situmorang et al. [11] and Suvarchala et al. [12] confirmed the presence of abundant phenolic compounds, flavonoids, tannins, and saponins responsible for the strong antioxidant capacity of Kersen leaves. Indraningrat et al. [13], further reported that Kersen leaf extracts possess potent antioxidant and antibacterial activities, supporting their potential application as functional medicinal plants.

Although previous studies have demonstrated promising pharmacological activities of Kersen leaf extracts and juice, evidence regarding the effectiveness of consuming boiled Kersen leaf water on blood cholesterol levels in humans remains limited. Therefore, further clinical investigations are needed to evaluate its efficacy as a simple, inexpensive, and community-based non-pharmacological intervention for hypercholesterolemia.

RESEARCH METHODS

Research Design

This study employed a quantitative approach using a pre-experimental design with a one-group pretest–posttest design [14]. The study aimed to determine the effect of consuming boiled Kersen (Muntingia calabura L.) leaf water on blood cholesterol levels among residents of Wonosari District, Boalemo Regency. Cholesterol levels were measured before (pretest) and after (posttest) the intervention to evaluate changes following treatment.

Study Setting and Participants

The research was conducted in Wonosari District, Boalemo Regency, Indonesia, in 2024. The study population consisted of community members who experienced elevated blood cholesterol levels. A total of 39 respondents who met the inclusion criteria participated in this study and completed both the pretest and posttest measurements.

Intervention

The intervention consisted of administering **boiled Kersen (Muntingia calabura L.) leaf water** to all respondents according to the predetermined research protocol. Blood cholesterol levels were measured before the intervention and again after the intervention using the same cholesterol measuring instrument to determine the effect of the treatment.

Data Collection

Data collection was carried out using an observation sheet and direct cholesterol measurements. The collected data included:

1. Respondent characteristics (age, sex, and body weight).

2. Blood cholesterol levels before consuming boiled Kersen leaf water (pretest).
3. Blood cholesterol levels after consuming boiled Kersen leaf water (posttest).

Data Processing

The collected data were processed through the following stages:

1. Editing
   All completed observation forms were checked to ensure completeness, consistency, and accuracy before data entry.
2. Coding
   Each respondent and study variable was assigned a numerical code to facilitate data entry and statistical analysis.
3. Data Entry
   The coded data were entered into the Statistical Package for the Social Sciences (SPSS) software for analysis.
4. Data Cleaning
   The entered data were rechecked to identify missing values, inconsistencies, or input errors before statistical analysis.
5. Tabulation
   The processed data were organized into frequency distribution tables and descriptive summary tables to facilitate interpretation.

Data Analysis

1. Univariate Analysis

Univariate analysis was performed to describe the characteristics of respondents, including age, sex, body weight, and cholesterol levels before and after the intervention. The results were presented as frequencies, percentages, means, standard deviations, minimum values, and maximum values.

2. Assumption Testing

Before hypothesis testing, assumption tests were conducted as follows:

a. Normality Test
   The normality of pretest and posttest cholesterol data was assessed using the Kolmogorov–Smirnov test. Data were considered normally distributed when the significance value ($p > 0.05$).
b. Homogeneity Test
   Homogeneity of variance between pretest and posttest data was evaluated before conducting the parametric analysis. The data were considered homogeneous when the significance value (**$p > 0.05$**).

3. Hypothesis Testing

The effect of consuming boiled Kersen leaf water on blood cholesterol levels was analyzed using the Paired Sample t-test, comparing cholesterol levels before and after the intervention. Statistical significance was determined at a 95% confidence level ($\alpha = 0.05$). A p-value < 0.05 indicated a statistically significant difference between pretest and posttest cholesterol levels.

RESEARCH RESULT

Characteristics of Respondents

The characteristics of respondents included age, sex, and body weight. A total of 39 respondents participated in this study. The distribution of respondent characteristics is presented in Table 1.

Table 1. Characteristics of Respondents (n = 39)

Characteristics	n	%
Age (years)		
30–40	29	50.0
41–50	7	35.0
51–56	3	15.0
Total	39	100.0
Sex		

Male	7	35.0
Female	32	65.0
Total	39	100.0
Body Weight (kg)		
38–50	27	40.0
51–60	7	35.0
61–70	3	15.0
71–90	2	10.0
Total	39	100.0

Source: Primary Data, 2024.

As presented in Table 1, most respondents were 30–40 years old (50.0%), followed by those aged 41–50 years (35.0%) and 51–56 years (15.0%). Female respondents constituted the majority of the sample (65.0%), whereas males accounted for 35.0%. Regarding body weight, most respondents weighed 38–50 kg (40.0%), followed by 51–60 kg (35.0%), 61–70 kg (15.0%), and 71–90 kg (10.0%).

Blood Cholesterol Levels Before and After Consumption of Boiled Kersen Leaf Water

Blood cholesterol levels were measured before (pretest) and after (posttest) the intervention. The results are summarized in Table 2.

Table 2. Blood Cholesterol Levels Before and After the Intervention

Variable	Mean (mg/dL)
Pretest	237
Posttest	188

Source: Primary Data, 2024.

Overall, blood cholesterol levels decreased after respondents consumed boiled Kersen (Muntingia calabura L.) leaf water. Of the 39 respondents, 38 experienced a reduction in cholesterol levels, whereas one respondent showed an increase in cholesterol level after the intervention.

One respondent demonstrated an increase in cholesterol level from 186 mg/dL to 208 mg/dL following the intervention. This finding represents an individual variation and does not alter the overall trend observed in the study, in which the majority of respondents experienced reduced cholesterol levels after consuming boiled Kersen leaf water.

Descriptive statistics for cholesterol measurements are presented in Table 3.

Table 3. Descriptive Statistics of Cholesterol Levels

Variable	Pretest	Posttest
Valid (N)	39	39
Mean	251.46	154.64
Standard Error	4.51	4.08
Standard Deviation	28.15	25.46
Variance	792.47	648.13
Minimum	186	103
Maximum	299	208

The descriptive analysis demonstrates that the average cholesterol level decreased after the intervention. Furthermore, the posttest data showed lower variability than the pretest results, indicating a more homogeneous distribution of cholesterol levels following the consumption of boiled Kersen leaf water.

Assumption Testing

Normality Test

Prior to hypothesis testing, the normality of the data distribution was examined using the Kolmogorov–Smirnov test. The results are presented in Table 4.

Table 4. Normality Test Results

Variable	Sig.	Interpretation
Pretest	0.486	Normally distributed
Posttest	0.167	Normally distributed

Source: Primary Data, 2024.

Both pretest and posttest cholesterol data had significance values greater than 0.05, indicating that the data were normally distributed. Therefore, parametric statistical analysis using the Paired Sample t-test was considered appropriate.

Homogeneity Test

The homogeneity test was performed before conducting the paired comparison. The results are shown in Table 5.

Table 5. Homogeneity Test Results

Variable	Sig.	Interpretation
Pretest–Posttest	0.209	Homogeneous

Source: Primary Data, 2024.

The homogeneity test produced a significance value of 0.209 ($p > 0.05$), indicating that the variance of the pretest and posttest data was homogeneous.

Effect of Boiled Kersen Leaf Water on Blood Cholesterol Levels

Paired Sample Correlation

The relationship between pretest and posttest cholesterol measurements was evaluated using the Paired Sample Correlation test.

Table 6. Paired Sample Correlation

Variables	N	Correlation	Sig.
Pretest–Posttest	39	0.282	0.228

Source: Primary Data, 2024.

The paired correlation analysis showed a weak positive correlation ($r = 0.282$) between pretest and posttest cholesterol measurements. However, the relationship was not statistically significant ($p = 0.228$).

Paired Sample t-Test

The effectiveness of boiled Kersen leaf water in reducing blood cholesterol levels was evaluated using the Paired Sample t-test.

Table 7. Paired Sample t-Test Results

Comparison	p-value	Interpretation
Pretest vs Posttest	<0.001	Significant difference

Source: Primary Data, 2024.

The Paired Sample t-test demonstrated a statistically significant difference between cholesterol levels before and after the intervention ($p < 0.001$). Therefore, the study findings indicate that consumption of boiled Kersen (Muntingia calabura L.) leaf water significantly reduced blood cholesterol levels among residents of Wonosari District, Boalemo Regency.

DISCUSSION

This study demonstrated that the consumption of boiled Kersen (Muntingia calabura L.) leaf water was associated with a significant reduction in blood cholesterol levels among residents of Wonosari District, Boalemo Regency. The average total cholesterol level decreased from 237 mg/dL before the intervention to 188 mg/dL after the intervention, indicating a mean reduction of 49 mg/dL. Statistical analysis using the paired-samples *t*-test showed a significant difference between pretest and posttest cholesterol levels ($p < 0.001$), suggesting that the intervention effectively reduced blood cholesterol levels. These findings indicate that boiled Kersen leaf water has the potential to serve as a complementary non-pharmacological approach for managing hypercholesterolemia.

The reduction in cholesterol levels observed in this study is biologically plausible because Kersen leaves contain several bioactive compounds, including flavonoids, saponins, tannins, and polyphenols, which are known to influence lipid metabolism. Flavonoids possess potent antioxidant activity that reduces oxidative stress and inhibits lipid peroxidation, thereby improving lipid metabolism and protecting vascular endothelial cells. Saponins contribute by binding cholesterol and bile acids in the gastrointestinal tract, reducing intestinal cholesterol absorption and promoting cholesterol excretion. Meanwhile, polyphenols and tannins help suppress oxidative damage and inflammatory processes associated with dyslipidemia, resulting in improved lipid profiles.

The present findings are supported by Solikhah and Solikhah [15], who demonstrated that ethanol extract of Muntingia calabura leaves significantly reduced total cholesterol, triglycerides, and LDL while increasing HDL levels in hyperlipidemic mice. Their study identified the highest dose of Kersen leaf extract as the most effective in improving lipid parameters, suggesting that the plant possesses substantial antihyperlipidemic activity. Although the preparation used in their study was an ethanol extract rather than boiled leaf water, both interventions utilize the same medicinal plant containing similar phytochemical constituents responsible for cholesterol-lowering effects.

Additional evidence was reported by Taslim et al. [6], who found that dietary supplementation with Muntingia calabura leaves significantly reduced reactive oxygen species (ROS) and malondialdehyde (MDA) concentrations in hyperglycemic experimental animals. Reduced oxidative stress contributes to improved lipid metabolism because oxidative damage is one of the primary mechanisms underlying hypercholesterolemia and cardiovascular disease. Therefore, the antioxidant properties of Kersen leaves may partly explain the significant decline in cholesterol levels observed in the present study.

Similarly, Kurang [4], demonstrated that methanolic extracts of Kersen leaves possess high antioxidant activity and contain abundant phenolic compounds and flavonoids. These phytochemicals are capable of scavenging free radicals, protecting lipoproteins from oxidation, and improving overall metabolic homeostasis. Such findings provide mechanistic support for the cholesterol-lowering effects observed after consumption of boiled Kersen leaf water.

An interesting finding in the present study was that one participant experienced an increase in cholesterol level following the intervention. Field observations indicated that this respondent routinely consumed several cups of coffee daily during the intervention period. Excessive coffee consumption, particularly unfiltered coffee, contains diterpenes such as cafestol and kahweol, which may elevate serum cholesterol concentrations. Consequently, dietary habits and lifestyle factors may have influenced the treatment outcome in this individual and partially reduced the observed intervention effect.

Overall, the present findings strengthen existing evidence that Muntingia calabura leaves possess lipid-lowering potential. Although most previous studies have employed ethanol extracts or animal models, the current study extends the available evidence by demonstrating beneficial effects of boiled Kersen leaf water in a community-based pretest–posttest intervention. This suggests that a simple herbal preparation may provide a practical, affordable, and culturally acceptable complementary strategy for reducing blood cholesterol levels, particularly in communities with limited access to long-term pharmacological therapy.

Nevertheless, several limitations should be acknowledged. This study employed a pre-experimental one-group pretest–posttest design without a control group, limiting the ability to establish definitive causal relationships. In addition, dietary intake, physical activity, and other lifestyle factors were not fully controlled during the intervention period, which may have influenced cholesterol outcomes. Future studies using randomized

controlled trials with larger sample sizes, longer intervention periods, and comprehensive monitoring of confounding variables are recommended to confirm the effectiveness and clinical applicability of boiled Kersen leaf water in the management of hypercholesterolemia.

CONCLUSION

The findings of this study demonstrate that the consumption of boiled Kersen (*Muntingia calabura* L.) leaf water effectively reduced blood cholesterol levels among residents of Wonosari District, Boalemo Regency. These results indicate that boiled Kersen leaf water has the potential to serve as a complementary non-pharmacological intervention for managing hypercholesterolemia. The cholesterol-lowering effect may be attributed to the presence of bioactive compounds, including flavonoids, saponins, tannins, and polyphenols, which contribute to improved lipid metabolism and antioxidant activity. Therefore, boiled Kersen leaf water may be considered a natural alternative to support cholesterol management. Further studies employing randomized controlled trials, larger sample sizes, and longer intervention periods are recommended to confirm its effectiveness, determine the optimal dosage, and evaluate its long-term safety.

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