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MORALITY BEFORE KNOWLEDGE

Household air pollution policy of stunting incidence: A comparative insight of Ethiopia and Indonesia

Rahmadita Zinda Haniifa[1],*

[1] *School of Environmental Science, Universitas Indonesia, Central Jakarta, Jakarta 10430, Indonesia.*
Correspondence: rahmaditaznd@gmail.com

ABSTRACT

Background: Stunting, a condition resulting from chronic malnutrition, has significant repercussions on the physical and cognitive development of children. Household air pollution, primarily attributed to the use of traditional biomass fuels, is a leading contributor to stunting in developing countries. In Ethiopia and Indonesia, household air pollution represents a major public health concern; however, policy responses to address this issue remain insufficient. This study aims to critically examine public policies in both countries link to household air pollution and its impact on stunting. **Methods**: The methodology employed includes a comparative policy analysis to evaluate the policy frameworks in Ethiopia and Indonesia, complemented by bibliometric analysis to trace trends in scientific literature concerning the link among household air pollution and stunting. **Findings:** The findings reveal that Ethiopia has implemented policies focused on replacing solid fuels with cleaner alternatives and promoting the use of more efficient stoves in households, to mitigate the health impacts of household air pollution. In contrast, Indonesia currently lacks dedicated policies aimed at reducing household air pollution and its associated health risks, particularly in relation to stunting. **Conclusion**: Stronger policies and cross-sectoral collaboration are needed, particularly in Indonesia, to mitigate household air pollution's impact on stunting. **Novelty/Originality of this article**: This study provides a comparative analysis of Ethiopia and Indonesia's policies and incorporates bibliometric analysis to map research trends on household air pollution and stunting.

KEYWORDS: Etiophia; household air pollution; Indonesia; public policy; stunting.

1. Introduction

Stunting is a growth impairment primarily caused by prolonged malnutrition (Sinharoy et al., 2020). Stunting has become a serious public health issue in developing countries, including Ethiopia and Indonesia. It directly affects the physical growth and cognitive development of children and can lead to various long-term consequences (Victora et al., 2021), such as reduced productivity, learning abilities, and increased susceptibility to diseases (Soliman et al., 2021). In 2022, it was recorded that 148.1 million children under five suffered from stunting worldwide, with more than half of them residing in developing countries (UNICEF et al., 2023).

Ethiopia, one of the developing countries, has a high stunting rate, with a prevalence of 37% of children under five experiencing stunting and 12% suffering from severe stunting (Ethiopian Public Health Institute, 2023). According to studies conducted in Ethiopia, approximately 67% of adults who experienced stunting during childhood are less

productive, contributing to significant annual economic losses, amounting to 16.5% of the GDP and is linked to 24% of child mortality, 16% of grade repetition, and reduced academic achievement (Ethiopia Brief, 2023).

Stunting is influenced not only by nutritional factors but also by various social, economic, and environmental determinants, including the air quality surrounding the child (Tamirat et al., 2021). Furthermore, recent research indicates that air pollution also plays a significant role in contributing to stunting in children (Schwinger et al., 2022). Household air pollution is one of the major environmental risks in low- and middle-income countries, with an estimated 2.3 million premature deaths and 91.5 million disability-adjusted life years (DALYs) in 2019 attributed to household air pollution, particularly in developing countries (Bennitt et al., 2021). Ethiopia and Indonesia are the countries of focus in this study, where household air pollution significantly impacts the quality of life for children and can exacerbate the issue of stunting. This study aims to compare the household air pollution policies implemented in Ethiopia and Indonesia, in order to understand each country's approach to addressing household air pollution and to identify the differences in the policies applied in these two countries.

2. Methods

2.1 Study area

In Ethiopia, the national prevalence of stunting among children under five years old stands at 36.3%, though this rate varies considerably by region and age group. For children aged 0-23 months, stunting rates range from 19.1% to 47.7%, while for those aged 24-59 months, the prevalence varies between 24.9% and 63.8%. In specific regions, stunting rates are 36.8% in Tigray, 25.5% in the Southern Nations, Nationalities, and Peoples' (SNNP) region, and 40.4% in Amhara. These figures demonstrate significant regional disparities in the prevalence of stunting (Ahmed et al., 2021).
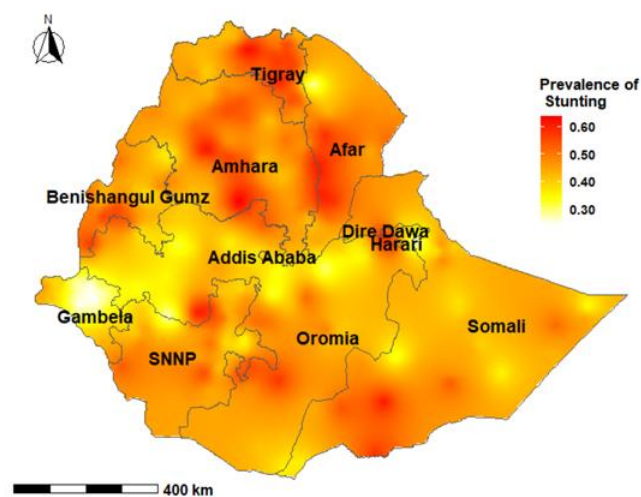

Fig. 1. The regions of Ethiopia most affected by stunting
(Ahmed et al., 2021)

The number of districts or cities prioritized for stunting prevention interventions has steadily increased from 2018 to 2022. In 2018, 100 districts/cities were identified as priority areas. By 2019, this number increased to 160, and in 2020, an additional 100 districts/cities were added, bringing the total to 260. In 2021, the number rose by another 100, reaching 360 districts/cities. In 2022, there was a significant increase of 154 districts/cities, bringing the total to 514 priority districts/cities for stunting prevention interventions. This trend indicates that the number of stunting cases has continued to rise each year (TP2S, 2023).
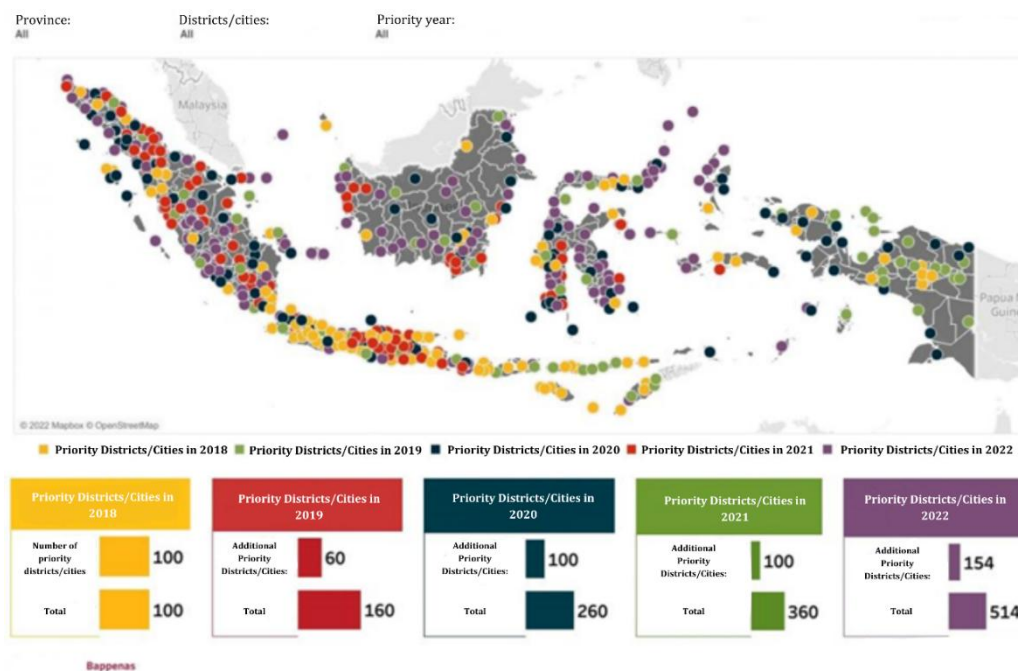
Fig. 2. Priority districts/cities for stunting prevention interventions
(TP2S, 2023)

2.2 Similarities between Ethiopia and Indonesia

Stunting is a prevalent issue in developing or low-income countries. Ethiopia and Indonesia are both developing and low-income nations severely affected by this condition. The occurrence of stunting leads to a decline in human capital quality, which results in reduced cognitive abilities (knowledge), decreased productivity, and increased vulnerability to diseases. These consequences contribute to long-term economic losses for the countries, as is the case with Ethiopia and Indonesia (Risnawati & Munafiah, 2022). Although Ethiopia is known as one of the least affluent countries worldwide, it continues to combat and address the issue of stunting in the same way as Indonesia, focusing on improving child nutrition and public health to reduce the prevalence of this condition. This study adopts a Systematic Literature Review (SLR) alongside bibliometric analysis. The use of SLR allows for the collection of relevant information on a specific subject or topic based on predetermined keywords. Additionally, the SLR method integrates several studies on Household Air Pollution and public policies in Ethiopia and Indonesia. Ethiopia and Indonesia were selected for this study due to their long histories of efforts to combat stunting, from the past to the present.

2.3 Bibliometric analysis and data search methodology

Over the past few decades, bibliometric analysis has emerged as a quantitative method and statistical tool for managing large volumes of academic publications and mapping scientific literature, and its use has expanded across various research fields, including sustainable development. Bibliometric analysis facilitates a comprehensive representation of the interrelationships among articles, journals, keywords, citations, and co-citation networks, thereby enabling researchers to systematically identify potential avenues for future research within a given field. This study adopts a qualitative research approach. This approach analyzes the comparison of air pollution factors in Ethiopia and Indonesia and explores strategies to minimize these issues. The data used in this study is descriptive in nature. The researcher collects data through secondary sources. The secondary data used are sourced from Scopus and Google Scholar. The keywords for this research are *"Household*AND*Air*Pollution*AND*Stunting"* on Scopus, while on Google Scholar, *"Polusi*

Udara Rumah Tangga Stunting". For public policy-related keywords, *"Household*AND*Air*Pollution*AND*Stunting*Ethiophia"* was used on Scopus, while on Google Scholar, "Kebijakan Publik Polusi Udara Rumah Tangga Stunting di Indonesia".

The journal articles selected for this study were published between 2005 and 2024, with a total of 48 journal articles from Scopus and 1 journal article from Google Scholar. The data analysis method used in this paper is bibliometric analysis, which deals with large volumes of publications and the mapping of scientific literature. Additional journals or references related to public policy in Ethiopia and Indonesia were sourced, totaling 3 articles (2 from Ethiopia and 1 from Indonesia). Bibliometric analysis enables researchers to efficiently pinpoint potential future research directions within a specific field by offering a clear visualization of the interconnections between articles, journals, and citation keywords. The bibliometric analysis was performed using VOSViewer version 1.6.20, as it offers visualization and mapping of networks based on co-citations, keyword co-occurrence, and other bibliometric indicators. Before visualizing the topic areas related to the keywords in this paper, there is a data search process. The following outlines the data search process:

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┌──────────────────────────────────────────────┐
│ Records identified through Scopus and Google  │
│ Scholar database searching (n = 100 articles) │
│ with keywords : Household air pollution and   │
│ Stunting                                       │
└──────────────────────────────────────────────┘
                      │
                      ▼
┌──────────────────────────────────────────────┐
│ Records screened from title and abstract      │
│ (n = 49 articles)                              │
└──────────────────────────────────────────────┘
                      │
                      ▼
┌──────────────────────────────────────────────┐
│ Full-text articles assessed for eligibility    │
│ and all included for synthesis (n = 49        │
│ articles (48 Scopus and 1 Google Scholar)     │
└──────────────────────────────────────────────┘
                     (a)
┌──────────────────────────────────────────────┐
│ Records identified through Scopus database     │
│ searching (n = 3) about Household air         │
│ pollution public policy Ethiopia and Indonesia│
└──────────────────────────────────────────────┘
                      │
                      ▼
┌──────────────────────────────────────────────┐
│ Full-text articles assessed for eligibility    │
│ and all included for synthesis (n = 3 → 2)    │
│ Ethiopia and 1 Indonesia                       │
└──────────────────────────────────────────────┘
                     (b)
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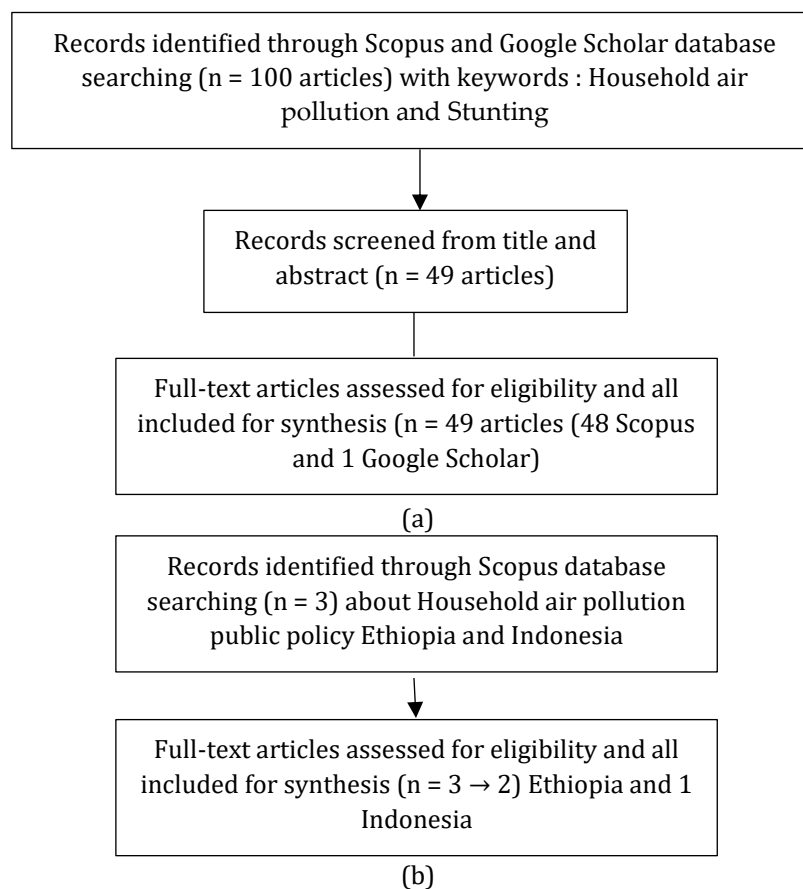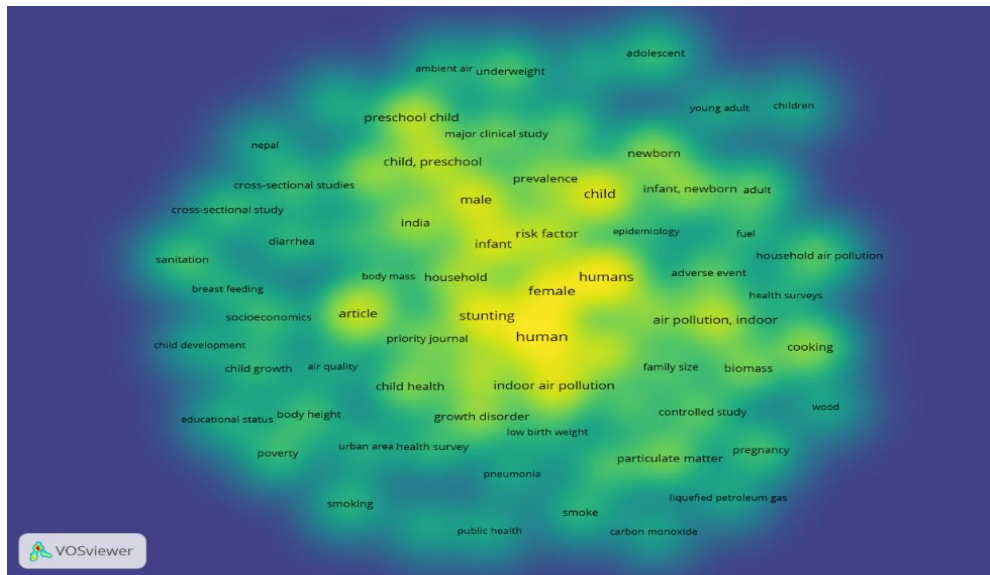
Fig. 3. Data search process: (a) household air pollution on stunting; (b) household air pollution policies related to stunting in two countries (Ethiopia & Indonesia)

3. Results and Discussion

3.1 VOSViewer-based visualization of topic areas

In VOSViewer, the analysis was conducted with a minimum threshold of 10 connections between articles. This resulted in the identification of four distinct clusters, represented by red, green, blue, and yellow, illustrating the interrelationships among various topics. VOSViewer can display bibliometric mapping in three different visualizations: Network Visualization (Fig. 5), Overlay Visualization (Fig. 6) and Density Visualization (Fig. 7).

Fig. 5. Network visualization

Figure 5 shows the clusters in each topic area or keyword studied. It can be seen that stunting, household air pollution, cooking, and biomass are grouped in the red cluster. This indicates a strong relationship among these four keywords, as evidenced by a study conducted by Mulat and colleagues in Jimma City, Ethiopia. The study found that household air pollution is a contributing factor to stunting in Jimma City, Mainly resulting from the widespread reliance on solid cooking fuels or biomass for cooking (Mulat et al., 2024).

Fig. 6. Overlay visualization

Figure 6 shows the research trends over the years, with the topic of household air pollution marked in yellow, indicating that research on this topic began in 2020. A study by Sinharoy and colleagues (2020) revealed that household air pollution is often a contributing factor to stunting, although it is frequently overlooked due to its indirect impact. This study emphasizes the importance of considering household air pollution as a critical determinant influencing the incidence of stunting, which, despite its known effects on health, still receives limited attention in the context of stunting research in children (Sinharoy et al., 2020).

Fig. 7. Density visualization

As shown in Figure 7 below, the number of studies conducted is represented with darker colors indicating a higher volume of research on a particular topic. Lighter or less saturated colors suggest that research on that topic is still limited. In this case, the topic of household air pollution appears less saturated, indicating that research on this topic has not been extensively conducted or is still relatively shallow. This suggests that household air pollution as a health issue still requires more attention in research to better understand its impact and develop more effective solutions. The public policies related to household air pollution and its connection to stunting stem from the issue of malnutrition, as shown in Figure 8 below. These policies link malnutrition, which includes both stunting and wasting, to child development and the impacts of household air pollution. Although malnutrition encompasses both conditions, the network visualization displayed indicates that only stunting is connected to malnutrition. This suggests that, in the public policies analyzed, addressing stunting is the primary focus, while wasting does not appear as a related factor within this context.

Fig. 8. Network visualization keywords based on public policy

Figure 9 shows that research related to public policies on stunting, specifically those linked to household air pollution, has been conducted by Adam Bailes. This research was subsequently explored in more depth by other researchers, including Merces de Onis, Joan

Matji, Nicolal Petry, Adelheid W. Onyango, Fabiar Rohner, James P. Wirth, and Bradley Woodruff. They expanded the study on the relationship between household air pollution and stunting and further explored the role of public policy in addressing this issue.
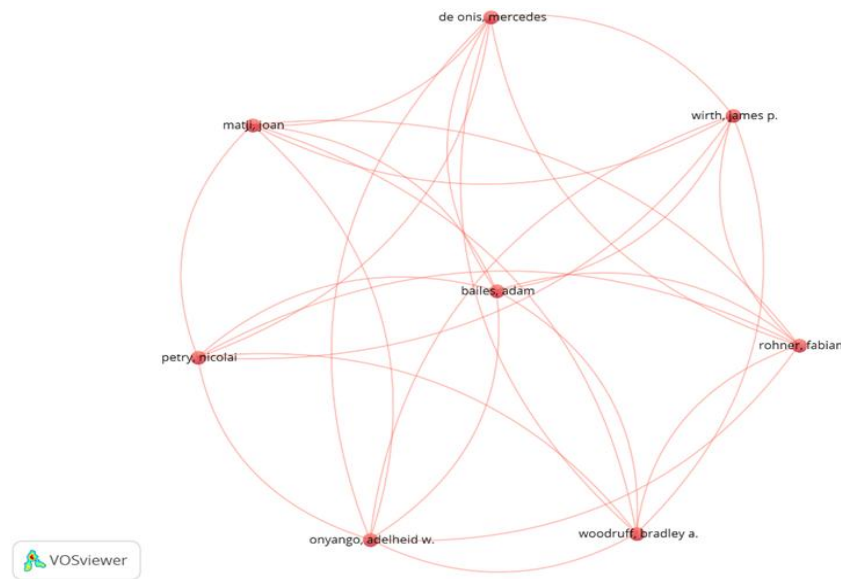

Fig. 9. Network visualization author based on public policy

Mercedes de Onis contributed to the WHO report "Childhood Stunting: A Global Perspective," which links global stunting to environmental factors, including household air pollution affecting child growth (de Onis & Branca, 2018). Joan Matji participated in the UNICEF report "Public Health Nutrition and Stunting in Developing Countries," focusing on policies to reduce household air pollution and stunting by improving access to clean energy (UNICEF, 2019). Nicolai Petry contributed to the WHO report "Environmental Health and Child Nutrition," which examines how household air pollution impacts child health and stunting, alongside policies to mitigate its effects (WHO, 2024).
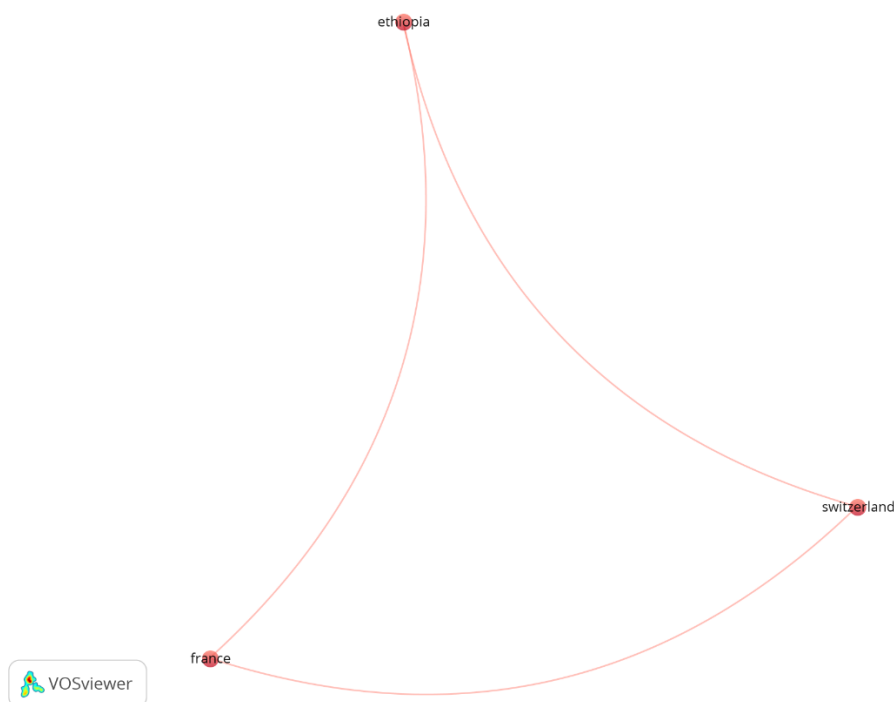
Fig. 10. Network visualization countries based on public policy

Adelheid W. Onyango and Fabian Rohner contributed to the UNICEF and WHO report "Nutrition and Environmental Factors in Child Growth," exploring the link between environmental factors like air pollution and child nutrition (UNICEF & WHO, 2021). James P. Wirth and Bradley A. Woodruff contributed to the WHO report "The Role of Public Policy in Reducing Household Air Pollution," which discusses policies in countries like Ethiopia to tackle household air pollution and stunting (WHO, 2020). Figure 10 shows that three countries have conducted research related to public policies on household air pollution: Ethiopia, France, and Switzerland. Research from these countries focuses on the impact of household air pollution on public health, particularly stunting, as well as the policy efforts implemented to reduce these risks. Each country has its own approach and policies to address the issue of household air pollution and its effects on children's health.

Each node focused on public policy regarding household air pollution in both Ethiopia and Indonesia has the same node size, indicating an equal number of publications. These nodes represent the strength of the relationship between keywords and countries. Policies on household air pollution related to stunting can be considered still limited, due to the relatively few researchers addressing this issue as a factor contributing to stunting, especially in Indonesia. This can be seen in Figure 10. Ethiopia was one of the first countries to study public policies related to household air pollution and its impact on stunting. Ethiopia's examination of public policies regarding household air pollution and stunting demonstrates the country's commitment to ongoing research and innovation in this field. This ensures that policies are continually updated and adapted to address this critical public health issue.

3.2 *Study of household air pollution as a factor in stunting occurrence in Ethiopia and Indonesia*

Household air pollution, a critical component of air pollution, significantly impacts global health. In 2015, solid fuel use in households caused 2.8 million deaths worldwide (Cohen et al., 2017). Reducing household air pollution has become a priority within the Sustainable Development Goals due to its disproportionate impact on children, particularly in developing countries with low socio-economic status (WHO, 2018).

Children in low-income households in developing nations are especially vulnerable to household air pollution, characterized by factors such as reliance on traditional solid fuels like wood, animal dung, and agricultural residues, which increase disease risks and contribute to stunting. Additionally, children are often involved in household activities like cooking without proper ventilation, exacerbating exposure. Furthermore, their underdeveloped immune systems heighten susceptibility to the harmful effects of pollutants (Kurata et al., 2020). Visualizations from VOSViewer reveal a positive correlation between household air pollution and stunting. This pollution, stemming from biomass cooking and indoor smoking, adversely affects children, especially those under five. Research in Ethiopia confirms that children in households using solid fuels experience slower growth compared to those in homes with less dependence on such fuels (Younger et al., 2022). Inefficient biomass combustion releases harmful pollutants such as PM2.5, PM10, carbon monoxide, and carbon dioxide, all of which exacerbate health issues. Studies indicate that children exposed to high levels of household air pollution face up to a 90% increased risk of stunting (Pun et al., 2019). This pollution largely emanates from solid fuels like wood and charcoal, which are commonly used for cooking, lighting, and heating (Shaddick et al., 2021). Ethiopia experiences high household air pollution due to widespread use of biomass fuels, with 98% of children exposed, contributing to 5% of the national disease burden and an estimated 50,203 deaths annually (Central Statistical Agency, 2016; Avis & Bartington, 2024). Vulnerable groups, especially children and women, face increased exposure, particularly in households with poor ventilation and inefficient stoves (Balmes, 2019; Sinharoy et al., 2020).

Biomass fuel use is influenced by socio-economic factors, such as household wealth and maternal education. Studies show that improved housing materials, such as cement or

ceramic flooring, help reduce stunting by lowering the risk of infectious diseases (Tustingi et al., 2020). In Indonesia, household air pollution contributes to stunting, often overshadowed by concerns about water, sanitation, and nutrition. Children in low-income households are exposed to air pollution levels up to 20 times higher than WHO limits (UNICEF, 2020). Smoking is a significant contributor, with 85.4% of smokers smoking at home, directly increasing second-hand smoke exposure for children (Kemenkes, 2023).

Stunting is closely linked to households with smoking parents, where children are exposed to cigarette smoke for extended periods (Muchlis et al., 2023). Tobacco products represent a significant expenditure for low-income families (Nayab et al., 2022). Research in Palembang identifies cooking fuels, smoking, and other household factors as significant contributors to stunting, with a clear correlation between household air pollution and stunting (Septiawati et al., 2018).

3.3 Study on regulation and public policies

3.3.1 Regulations and public policies on stunting in Ethiopia

Ethiopia has committed to several global and national initiatives, with the goal of ensuring that children are free from malnutrition, including stunting. Among the array of national initiatives, the Seqota Declaration stands out, endeavoring to obliterate stunting in children under the age of two by 2030. Concurrently, the Health Sector Transformation Plan ambitiously seeks to diminish stunting prevalence in children under five from a staggering 40% to a more favorable 26% by the conclusion of 2020 (FMOH, 2015). The Ministry of Health of Ethiopia has outlined three policy options to reduce and ultimately eliminate stunting. The first option is specific nutrition interventions. While these nutrition interventions have been implemented in Ethiopia, the documentation of their implementation remains limited, and the national coverage is not yet well-documented. Nevertheless, the Ethiopian government has carried out various initiatives through the National Nutrition Program, which includes the implementation of specific nutrition interventions such as growth monitoring and counseling, deworming, nutrition screening, vitamin A supplementation, salt iodization, and the management of malnutrition.

Table 1. Status of the implementation of Ethiopia's specific nutrition intervention policies

Types of Specific Nutrition Interventions	National Coverage	Data Sources	Verification/Monitoring and Evaluation Facilities	Description
Severe Acute Malnutrition Management	N/A	EPHI PHEM	Verification Method is Not Well Known	
Management of Moderate Acute Malnutrition	N/A	NDRMC	Verification Method is Not Well Known	
Periconceptional Folate Supplementation	**	FMOH	Verification Method is Not Well Known	Only in 6 districts
Provision of Vitamin A to Children Aged 6–59 Months	45 %	EDHS 2016	Proportion of Children Aged 6–59 Months Receiving Vitamin A Supplements	
Balanced Energy Protein for Pregnant Women	**	FMOH	Verification Method is Not Well Known	Has not started yet
*Some Micronutrient Supplementation During Pregnancy	**	FMOH	Verification Method is Not Well Known	Has not started yet
Calcium Supplementation for Pregnant Women	**	FMOH	Verification Method is Not Well Known	Has not started yet

Zinc Supplementation for Preventing Stunting in Children Aged 6–59 Months	**	FMOH	Verification Method is Not Well Known	Specifically for the Ethiopian population undergoing therapy
Early Initiation of Breastfeeding	73 %	EDHS 2016	Proportion of Children Initiating Breastfeeding Within 1 Hour of Birth	
Exclusive Breastfeeding	58 %	EDHS 2016	Proportion of Children Under 6 Months of Age Exclusively Breastfed	
Continued Breastfeeding	76 %	EDHS 2016	Proportion of Children Breastfed Until 2 Years of Age	
Complementary Feeding	7 %	EDHS 2016	Proportion of children receiving nourishment in alignment with the Minimum Acceptable Diet criteria	

Note: Supplementation of certain micronutrients is not recommended for pregnant women as a means to improve maternal and perinatal outcomes (*). National coverage is unknown (**).
(Dagmawit Solomon et al., 2019)

The second option involves nutrition-sensitive interventions. These interventions focus on ensuring adequate food access, a healthy environment, and sufficient healthcare services. Nutrition-sensitive interventions span a diverse array of domains, including agricultural and food security initiatives, educational frameworks, water, sanitation, and hygiene (WASH) systems, healthcare provisions coupled with family planning, the empowerment of women, social protection mechanisms for women and children, in addition to fostering early childhood development (ECD). As clearly outlined in the National Nutrition Plan, Ethiopia has developed various nutrition initiatives across different sectors for the period 2016–2020. However, several of these programs were not fully implemented or did not achieve the desired outcomes. Despite this, the government has continued to emphasize the importance of integrating nutrition-sensitive interventions into broader development strategies to combat malnutrition, including stunting, across the country.

Table 2. Status of implementation of nutrition-sensitive intervention policies in Ethiopia.

Sector	Approach	Indicator	Status	Remarks
Agriculture	Improved access to local food	Minimum diet for children aged 6 – 23 months	7%	EDHS 2016
Agriculture	Food Diversification	Diet diversity for women of reproductive age	6.7%	Specific regions
Education	Access to basic education & school nutrition	Girls enrolled	**	SBCC
WASH (*Water, Sanitation, and Hygiene*)	Water & Sanitation Access	Households with access to clean water	58%	EDHS 2016
Health	Adolescent & Antenatal Services	Antenatal Care from skilled providers	62%	EDHS 2016
Empowerment	Access & control of resources	Women owning land	40%	EDHS 2016

Note: **National coverage unknown
(Dagmawit Solomon et al., 2019)

The third option involves policies that shift towards a multisectoral approach, which has now become an independent, consolidated government entity. Ethiopia's contemporary initiatives underscore a profound policy dedication to addressing nutritional challenges, epitomized by the formulation of the National Nutrition Strategy, the National Nutrition Program, and the enactment of comprehensive national food and nutrition policies in 2018. Moreover, the Ethiopian government has instituted an intricate implementation framework, comprising entities such as the National Nutrition Coordination Body and the

National Technical Nutrition Committee. This intervention prioritizes sectors that have been integrated and coordinated to bring about the desired and expected changes. However, the implementation of this intervention in Ethiopia still faces challenges, including limited capacity in coordination and monitoring, insufficient resources, and a need for greater alignment between sectors to effectively address the nutrition challenges in the country.

3.3.2 Regulations and public policies on stunting in Indonesia

Stunting is a global health issue significantly impacting children's physical and cognitive development, particularly during early childhood. In Indonesia, accelerating stunting reduction is a national priority outlined in Presidential Regulation No. 72 of 2021. This policy aims to meet children's nutritional and health needs while fostering an environment conducive to optimal growth through a multisectoral approach. The regulation establishes two main strategies by implementing specific interventions that address direct causes such as maternal and child nutrition and sensitive interventions that target indirect causes like sanitation, access to clean water, and family welfare. These strategies are implemented through a convergent, holistic, and integrative framework that involves stakeholders from the national to village levels.

The national strategy includes five pillars which consist of strengthening leadership commitment, promoting behavioral change communication, integrating specific and sensitive interventions, enhancing food and nutrition security, as well as advancing systems for data, research, and innovation. Target groups include adolescents, prospective brides, pregnant women, breastfeeding mothers, and also children under five. Key actions involve identifying high-risk families, providing targeted assistance, and monitoring stunting cases. Priority locations are determined by local government commitment, stunting prevalence, and poverty levels. Indicators include increased nutrition supplementation for pregnant women with Chronic Energy Deficiency (CED), consumption of iron tablets, exclusive breastfeeding, and monitoring the growth of children under five.

This comprehensive approach aims to address the multidimensional causes of stunting and contribute to sustainable development goals. Additionally, environmental factors, including household air quality, play a critical role. Policies addressing household air pollution in Ethiopia and Indonesia offer valuable insights into how environmental interventions can improve maternal and child health outcomes.

3.3.3 Regulations and public policy on household air pollution in Ethiopia and Indonesia

Facing the high levels of household air pollution in Ethiopia, the government has designed several public policies aimed at improving air quality and public health. According to the Policy Brief Ethiopia, which discusses public policies for controlling household air pollution, two main steps have been set to reduce the impact of household air pollution on health, namely replacing solid fuels with clean energy sources and introducing more efficient, sustainable stoves (Mulat et al., 2024) (TUM, 2023). Below is an in-depth explanation of these policies.

Replacing solid fuels with clean energy sources, particularly through the use of LPG gas, is a crucial step in addressing household air pollution. The use of solid fuels, such as firewood and charcoal, for cooking is the primary cause of household air pollution in Ethiopia. These fuels produce fine particulate matter (PM2.5), which is associated with various health issues, particularly respiratory diseases. Ethiopia's policy focuses on transitioning to cleaner fuels like LPG, which have low emissions and meet WHO standards (Pope et al., 2021). The government promotes LPG adoption through assistance and educational programs, especially in rural areas, while these initiatives aim to raise awareness of the health benefits and efficiency of clean fuels while reducing reliance on harmful solid fuels. In addition to transitioning to clean fuels, Ethiopia's policy on household air pollution also emphasizes replacing traditional stoves with more efficient, sustainable, and safer alternatives. Traditional stoves, reliant on solid fuels, generate high emissions that

contribute to respiratory issues such as coughing, chest pain, and shortness of breath (Quansah et al., 2017). Modern stoves, designed to reduce emissions and improve energy efficiency, use less fuel while providing optimal heat output, aligning with local cooking practices (World Bank, 2018). The Ethiopian government facilitates this transition by collecting traditional stoves to prevent continued usage and distributing new stoves at low or no cost to ensure accessibility, particularly for low-income households (LaFave et al., 2021).

Modern stoves distributed in Ethiopia meet critical criteria, including compatibility with clean fuels like LPG, environmental friendliness, and efficiency. Designed with three burners, these stoves support cooking multiple dishes simultaneously, catering to the needs of large households and encouraging adoption (Thomas et al., 2015). Meanwhile, Indonesia faces significant challenges in implementing similar policies. Although the country initiated a kerosene-to-LPG conversion program in 2007 (Hendri et al., 2013), it remains incomplete, particularly in remote and rural areas where reliance on solid fuels like firewood and charcoal persists. High indoor air pollution levels from solid fuels contribute to respiratory illnesses, especially among low-income households with limited access to clean fuels (State of Global Air, 2022). Key barriers in Indonesia include inadequate infrastructure for equitable LPG distribution, particularly in remote regions, and the higher cost of LPG compared to solid fuels. This economic disparity drives low-income families to continue using hazardous fuels, disproportionately affecting women, who are primarily responsible for cooking and thus more vulnerable to household air pollution-related illnesses (Candrasari et al., 2023).

Compared to Ethiopia, Indonesia's household air pollution control policies require stronger measures and broader implementation. Recommendations include enhancing subsidies for clean fuels like LPG, increasing public awareness about the health impacts of indoor pollution, and fostering government-private sector collaborations to expand fuel distribution to underserved areas. While Indonesia has made initial efforts, its implementation lacks the comprehensive and structured approach demonstrated by Ethiopia.

4. Conclusions

Public policy is importance in addressing household air pollution as a significant factor in improving public health and reducing stunting, particularly in developing countries like Ethiopia and Indonesia. The comparison reveals that Ethiopia has adopted a more comprehensive approach to household air pollution, including transitioning from solid fuels and distributing efficient stoves, which Indonesia could emulate. Key steps for Indonesia include providing subsidies for clean fuels like LPG, improving distribution infrastructure to remote areas, and increasing public awareness of the health risks associated with solid fuels. By implementing a more integrated and inclusive policy, Indonesia can reduce stunting rates and improve public health. These actions align with the Sustainable Development Goals (SDGs), particularly those focused on health and well-being. The adoption of such policies will not only improve quality of life but also reduce the economic burden of health costs related to household air pollution.

Author Contribution
The author is solely responsible for the entire process of this research and article preparation. The contributions include formulating the research idea, data collection, data

analysis, interpretation of the results, writing the manuscript, and final revisions prior to publication.

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Not available.

Informed Consent Statement
Not available.

Data Availability Statement
Not available.

Conflicts of Interest
The author declare no conflict of interest.

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Biography of Author

Rahmadita Zinda Haniifa, School of Environmental Science, Universitas Indonesia, Central Jakarta, Jakarta 10430, Indonesia.
- Email: rahmaditaznd@gmail.com
- ORCID: N/A
- Web of Science ResearcherID: N/A
- Scopus Author ID: N/A
- Homepage: N/A