International Journal of Social Science (IJSS)
Vol.4 Issue.4 December 2024, pp: 341-354
ISSN: 2798-3463 (Printed) | 2798-4079 (Online)
DOI: https://doi.org/10.53625/ijss.v4i4.8894

DOES WATER, HYGIENE, AND SANITATION INDEED DIRECTLY AFFECT CHILDREN'S STUNTING? : A SCOPING REVIEW

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Article Info

Article history:
Received Sept 20, 2024
Revised Oct 17, 2024
Accepted Nov 23, 2024

Keywords:
Water
Hygiene
Sanitation
Stunting
Child

ABSTRACT

Water, sanitation, and hygiene (WASH) refers to the widespread problem of insufficient access to clean water, appropriate sanitation, and effective hygiene practices. Inadequate WASH practices can lead to health issues, including diarrheal illnesses, which hinder children's development and make it more difficult for them to absorb vital nutrients. This study aimed to identify and extract the essential features and components of stunting determinants, including water, sanitation, and hygiene. This research was categorized as a scoping review because it did not appraise or analyze the methodological quality of the included studies. A scoping review design was employed in this investigation. The PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews) criteria were used in this study. A thorough search was carried out using ScienceDirect, EBSCO, and PubMed to find papers published between 2014 and 2024. According to research results, it is currently believed that there are determinant factors that influence stunting, such as water, cleanliness, and sanitation. This has a significant impact on the children's development. Stunting in children under five years of age is at risk due to unclean environments and poor sanitation. Enhanced sanitary facilities and on-site water availability improved the health of expectant mothers and children. Studies have indicated that WASH treatment significantly improves children under five years old with a mean height-for-age z-score

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1. INTRODUCTION

Child stunting is a primary global health concern that affects millions of children around the world; in 2022, stunting affected 22.3% of children under the age of five, or approximately 148.1 million people [1]. A lengthy history of insufficient nutrition or recurrent chronic disease is the cause of stunting, which is a sign of chronic malnutrition [2]. Stunting has consistently decreased over the past decade. The 2030 Sustainable Development Goal (SDG) 2 aims to reduce the prevalence of stunting to 3%, which was not met at the anticipated rate [1].

The World Health Organization (WHO) and UNICEF estimate that 4.5 billion people lack proper sanitation facilities and 2.1 billion people lack access to appropriately regulated drinking water[3] [4]. Poor WASH conditions can cause health problems, such as diarrheal infections, which can impede nutrient absorption and inhibit growth in children[5]. The WHO predicts that improved access to these vital services might prevent up to 1.4 million deaths annually [5]. Aiming for universal access to properly managed water and sanitation by 2030, Sustainable Development Goals (SDGs) have been partially achieved; however, billions of people still lack these essential services. [5].

Reduced risk of stunting in children is associated with access to better water sources and sanitary facilities [6]. The availability, access, stability, and use of food and nutrition security are all affected by inadequate WASH conditions. The WASH initiatives can contribute to a reduction in the global prevalence of childhood stunting [7]. Access to better water sources and sanitary facilities has been linked to a reduced likelihood of children experiencing

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stunted growth [8][9]. There is no discernible link between child stunting and the degree of water service availability in households with piped water. On the other hand, there was no discernible difference in the likelihood of stunting among children who had access to better sanitation and hygiene facilities compared to those who did not [10].

This scoping review aimed to evaluate scientific evidence regarding the connection between child stunting and sanitation, hygiene, and water quality [11]. According to this study, children who have less access to sanitary facilities and clean water are more likely to suffer from stunting.

2. RESEARCH METHOD

The preferred reporting items for systematic reviews and meta-analyses extension for coping reviews (PRISMA-ScR) criteria were used in the scoping review [12]. Without analyzing or evaluating the methodological quality of the included research, the goal of this study is to identify and extract the essential dimensions and components of stunting factors, such as water, hygiene, and sanitation, from numerous studies in the field. As such, this study is categorized as a scoping review [13].

A comprehensive exploration was carried out using ScienceDirect, EBSCO, and PubMed to identify publications released between 2014 and 2024. The search was conducted between February 25, 2024, and March 25, 2024. To identify studies on the determinants of stunting, such as water, hygiene, and sanitation in children, the search domain was initially defined using the EBSCO database. Next, keywords and related phrases were retrieved from various sources. Using keywords derived from research titles, such as "Water AND Hygiene AND Sanitation AND Stunting OR Growth Disorder AND Child," a literature search was conducted.

The selection of documents in this article was based on four article search engines, which were then analyzed using the PICO [12] formula with keywords:

P (Population) : Child
I (Intervention) : None
C (Comparison) : Water, Hygiene, Sanitation
O (Outcome) : Stunting

Table 1. Inclusion and Exclusion Criteria

Criteria (PICO)	Inclusion	Exclusion
Population	Child	Adult
Intervention	None	None
Comparators	Water, Hygiene, Sanitation	Do not relate to water, hygiene, and sanitation
Outcomes	Discussing water, hygiene, and sanitation directly affects children's stunting.	Do not about water, hygiene, sanitation, and stunting
Study Design and publication type	Secondary analysis, randomized control, and trial, cross-sectional studies, logistic analysis, case study	A systematic review, Scoping review, and Letter for the editor
blication years	After 2013	Before 2013
Language	English	Doesn't use English

3. RESULTS AND ANALYSIS

3.1. Results

First, papers relevant to the study subjects were chosen based on their titles and abstracts. Articles that met the inclusion criteria, specifically those focusing on the dominant factors contributing to stunting in children, including water, hygiene, and sanitation, were selected. Subsequently, the full text of the articles was reviewed for further evaluation. Key factors related to stunting such as water, hygiene, and sanitation were extracted. A custom spreadsheet was created to systematically extract data from the selected studies [14]. The corresponding author examined the data related to childhood stunting, and the second author evaluated and verified the information.

The authors critically appraised the selected articles to assess their suitability and quality using CEBMa Tools for Synthesis [15]. The determinants of stunting in children, such as water, hygiene, and sanitation, were extracted using a data-collection form [16]. Once the data were extracted and entered into the prepared form, similarities were summarized and categorized based on the experience and expertise of the two experts [17]. After

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the data were extracted and entered into the prepared form, they were summarized for similarities. Stunting, a condition characterized by growth failure in children under five years old, affects both physical and cognitive development due to prolonged malnutrition [18].

Poor sanitation and environmental cleanliness are significant risk factors for stunting in this age group [19]. There was a significant association between the cleanliness of the consumed water and the incidence of stunting. [20]. Determinant factors, such as water, cleanliness, and sanitation, are believed to influence stunting [21]. This is expected to significantly affect children's growth and development [22]. If neglected, this will adversely affect a child's health.

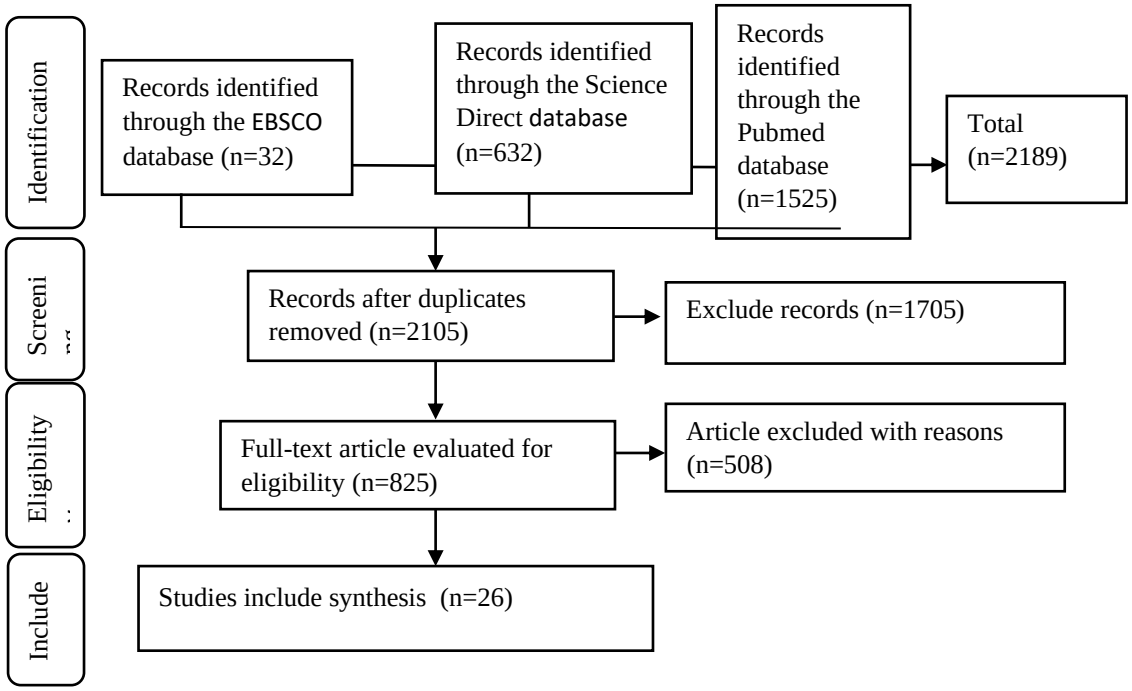

Figure 1. Flow diagram of the literature search and publication selection

The following information was gathered from previously stated databases: 32 EBSCO, 632 Science Direct records, and 1525 records from PubMed. After removing duplicates, 2,105 records were retrieved. A total of 825 papers were selected for full-text examination after the research titles and abstracts were evaluated in accordance with the inclusion criteria; 1,705 papers did not meet the requirements. 26 articles were left for additional review after 508 manuscripts were eliminated during the full-text evaluation stage owing to the exclusion criteria. (Figure 1).

Original research papers that satisfied the inclusion criteria for review were chosen after the article screening findings and eligibility requirements were determined. The results of the study are detailed in the extraction table provided in Table 2.

Table 2. Data Extraction

No.	Author/year/Source	Title of research	Research method	Result
1	[23], EBSCO	Water, Sanitation, and Hygiene: Linkages with Stunting in Rural Ethiopia	This study is a component of a broader controlled experiment that combines community-based nutrition (CBN) treatments with integrated WASH (Water, Sanitation, and Hygiene) and Multiple Use Services (MUS) activities.	The study indicates that WASH determinants, including mothers' handwashing after defecation, children's handwashing before meals, and drinking water sources, account for approximately 7% of the variance in stunting.
2	[24], EBSCO	Acute to Chronic Malnutrition: How Significant	For five distinct locations, three structural equation models (SEMs) were created.	The findings highlight significant geographic differences in health outcomes related to key WASH

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No.	Author/year/Source	Title of research	Research method	Result
		Water, Sanitation, and Hygiene Factors Change With Health Outcomes and Geographies in the Western Highlands of Guatemala	Five WASH (Water, Sanitation, and Hygiene) variables were included in each SEM: Animal Pen/Floor Type, Sanitation Type, Water Source, and Water Treatment.	infrastructure, with improved sanitation emerging as the most consistently critical factor across models, and the floor transmission pathway identified as a major contributor to child stunting in all locations.
3	[25], EBSCO	Child Stunting Reduction in Aceh Province: Challenges and a Way Ahead	In-depth interviews, document reviews, and Focus Group Discussions (FGDs) were among the data gathering methods used in this qualitative study to examine the government, agencies, and stakeholders in Aceh's attempts to reduce child stunting.	Efforts to reduce childhood stunting in Aceh face several obstacles, including low work engagement, insufficient breast milk production, inadequate support from husbands hindering exclusive breastfeeding, pregnant women's reluctance to consume iron and folic acid supplements and supplemental foods due to unpleasant taste and perceived side effects, and a lack of knowledge and skills among Posyandu cadres concerning child stunting.
4	[26], EBSCO	Reduction in child mortality in Ethiopia: analysis of data from demographic and health surveys	The estimation of Ethiopia's child mortality rates was done between 2000 and 2011 using information from three Demographic and Health Surveys. The number of child lives saved in 2011 was estimated using the Lives Saved Tool (LiST), and coverage indicators for high-impact child health treatments were computed.	LiST research indicates that in 2011, an estimated 60,700 fewer child fatalities were largely attributed to improvements in water, sanitation, and hygiene interventions (13%), a reduction in stunting rates (13%), and a decrease in wasting rates (18%).
5	[27], EBSCO	Factors linked to Tanzania's drop in the death rate from diarrhea among children under five between 1980 and 2015	The Lives Saved Tool (LiST) is intended to assess how many lives were spared as a result of alterations in risk factors or intervention coverage between 1980 and 2015. Additionally, it calculates the number of deaths that might be spared by important programs focusing on nutrition, diarrhea, water, sanitation, and hygiene (WASH) by 2030.	The reduction in diarrhea-related deaths among children under five is linked to the use of oral rehydration solution (ORS), declines in stunting prevalence, vitamin A supplementation, rotavirus vaccination, improvements in age-appropriate breastfeeding practices, and changes in wasting prevalence, with estimates suggesting up to a 90% decrease in diarrhea-related deaths if direct interventions for nutrition, diarrhea, and WASH (water, sanitation, and hygiene) were universally implemented.
6	[28], EBSCO	Community-level environmental characteristics	The Demographic and Health Surveys (BDHSs) of Bangladesh were conducted in	The multilevel model revealed a nonlinear relationship between stunting and rainfall, vegetation

No.	Author/year/Source	Title of research	Research method	Result
		predictive of childhood stunting in Bangladesh - a study based on the repeated cross-sectional surveys	three waves (2007, 2011, and 2014) from which the study's data were taken. The stunting of children under five was the main outcome variable of interest. Rainfall (millimeters [mm] per year), temperature (degrees Celsius [°C]), vegetation index (which ranges from 0 to 10,000, denoting least to greatest vegetation), distance to protected areas (measured in meters [m]), and distance to water bodies (measured in meters [m]) were among the environmental factors that were examined.	index, and distance to protected areas, with stunting positively correlated with distance to bodies of water and negatively correlated with temperature, suggesting that environmental factors can serve as predictors of stunting.
7	[29], EBSCO	Drivers of the progress achieved by Peru in reducing childhood diarrhea mortality: a country case study	Datasets on child mortality and the use of interventions to prevent diarrhea were examined in the study. With the use of the Lives Saved Tool (LiST), an investigation was conducted on the causes of the decrease in deaths associated to diarrhea between 1980 and 2015.	The percentage of diarrhea-related deaths among children under five decreased from 17.8% in 1980 to 4.9% in 2015, with more than half (53.9%) of this reduction attributed to advancements in water, sanitation, and hygiene, as analyzed using the Lives Saved Tool (LiST).
8	[30], Science Direct	This cross-sectional study investigates the relationships between diarrhea, malnutrition, and dehydration and the conditions of water, sanitation, and hygiene (WASH) in schools across Metro Manila, Philippines.	The study examined data from a multistage cluster sample of students in grades 5, 6, 7, 9, and 10 (about 10–15 years old) to look into WASH facilities and hygiene behaviors. To investigate the correlations between these characteristics, multiple logistic regression was employed.	Dehydration can result from inadequate water availability in school restrooms, while improper handwashing is often associated with diarrhea; lack of water in these facilities, not using school restrooms, and insufficient hygiene education in schools can contribute to stunting, with a correlation observed between malnutrition and the absence of sanitation regulations in schools.
9	[31], Science Direct	This study examines the impact of interventions targeting water quality, sanitation, handwashing, and nutrition on the incidence of diarrhea and child growth in rural Kenya.	The WASH Benefits experiment involved pregnant women and children living in rural Kenyan communities, and the results were evaluated after one or two years of follow-up.	Neither the combined intervention group addressing water, sanitation, and handwashing, nor the individual treatments targeting handwashing, sanitation, and water quality, had a significant impact on linear growth.
10	[32],	This study assesses	Evaluations were carried out	Counseling and nutrient

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	Science Direct	the effects of interventions on diarrhea incidence and child growth in rural Bangladesh that focus on nutrition, hygiene, handwashing, and water quality.	at one- and two-year intervals to gauge the effects of Water, Sanitation, and Hygiene (WASH) treatments on expectant mothers and children in rural Bangladesh as part of the WASH Benefits study.	supplementation resulted in a modest increase in linear growth; however, neither the individual treatments nor the combined water, sanitation, and handwashing strategy had a significant effect on linear development. The addition of water, sanitation, and handwashing interventions did not offer any additional benefits beyond those achieved through nutrition alone.
11	[33], Science Direct	This study explores the influence of geospatial and environmental factors on the prevalence of stunting, wasting, and underweight among children in rural regions of South and Southeast Asia. It provides empirical evidence on how geographical and environmental variables contribute to these nutritional outcomes.	Poisson regression analysis is used in this study to analyze data from the most recent rounds of the Demographic and Health Survey (DHS), which were carried out in Timor-Leste, Bangladesh, Pakistan, Nepal, and Cambodia.	This study reveals that children aged 0 to 59 months in rural South and Southeast Asian regions experience high rates of stunting, wasting, and underweight, with significant variations in malnutrition rates observed both across and within nations, as well as between clusters or primary sample units.
12	[34], Science Direct	This study examines the impact of increased supplementary feeding and enhanced water, sanitation, and hygiene (WASH) practices on stunting and anemia in children exposed to HIV living in rural Zimbabwe.	In two rural districts of Zimbabwe, this study used cluster randomization to perform a 2 x 2 factorial trial. Clinical Trials.gov has the trial filed with the number NCT01824940.	There were no adverse or trial-related serious events, and the WASH intervention had no effect on either the duration or the hemoglobin concentration.
13	[22], Science Direct	This study evaluates the effects of expanded supplemental feeding and better WASH (water, sanitation, and hygiene) on anemia and stunting in children in rural Zimbabwe, both	The study conducted a cluster-randomized, community-based, 2 × 2 factorial trial across two rural districts in Zimbabwe. The objective was to evaluate the impact of interventions by comparing four groups: those receiving infant and young child feeding (IYCF) interventions versus those not receiving IYCF, and	The IYCF (Infant and Young Child Feeding) intervention led to a reduction in stunting from 35% (620 out of 1,872 children) to 27% (514 out of 1,872 children) and decreased anemia from 13.9% (245 out of 1,845 children) to 10.5% (193 out of 1,845 children). In contrast, the WASH (Water, Sanitation, and Hygiene) intervention did not impact anemia

No.	Author/year/Source	Title of research	Research method	Result
		individually and collectively.	those receiving water, sanitation, and hygiene (WASH) interventions versus those not receiving WASH interventions.	or stunting.
14	[35], Science Direct	Sanitation and child health in India	The model that forms the basis of the empirical method combines the views of epidemiologists, demographers, and economists.	Sanitation coverage positively impacts height growth during early childhood, particularly for girls.
15	(Derek Headey & Giordano Palloni, 2019)	Perspectives From Subnational Panel Data Throughout 59 Countries Regarding Water, Sanitation, and Child Health	The study employed a rigorous research methodology to examine the effects of investments in water, sanitation, and hygiene (WASH) on the health outcomes of children. Building a panel of subnational areas and using difference-in-difference (DID) regressions were key components of the essential methodological approach, which looked at the association between gains in child health and WASH infrastructure over time.	While piped water in households is associated with a reduced incidence of childhood stunting, overall improvements in water availability generally do not show a significant relationship with health outcomes. Conversely, enhancements in sanitation have minimal impact on stunting or wasting but substantially reduce the prevalence of diarrhea and child mortality.
16	Jean H Humphrey et. Al (2019)	Independent and synergistic effects of enhanced water, sanitation, and hygiene, along with improved complementary feeding, on child stunting and anemia in rural Zimbabwe: A cluster-randomized trial.	To assess the individual and combined effects of improved infant and young child feeding (IYCF) practices and household water, sanitation, and hygiene (WASH) interventions on child health outcomes.	The study found that the IYCF intervention significantly reduced anemia and stunting, leading to increased hemoglobin levels and improved mean length-for-age Z scores. In contrast, the WASH intervention did not significantly affect the prevalence of diarrhea or these outcomes.
17	Stephanie O. Sangalang, et. Al (2022)	Enhancing health literacy, handwashing, malnourishment, and dehydration through school-based water, sanitation, and hygiene (WaSH) intervention: a cluster-randomized controlled trial in Metro Manila,	The research employed a cluster-randomized controlled trial (c-RCT) methodology, focusing on public schools in Metro Manila, inside the National Capital Region of the Philippines. In order to improve the accuracy of the intervention comparison, the intervention groups were bigger in this study, which used a parallel group design with an uneven allocation ratio	The prevalence of undernutrition did not significantly decrease, and there was no improvement in height-for-age and body mass index-for-age Z scores (HAZ, BAZ) or overall health literacy (HL) scores. Stunting was reduced by low-intensity health education, whereas overnutrition decreased due to high-intensity health education..

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		Philippines	of schools to the control group (CG) and intervention groups (IGs).	
18	Uttara Partap et al.	Features and associations of stunting in Malaysian youth and young adults (6–19 years old)	Using information from the South East Asia Community Observatory Health and Demographic Surveillance System (SEACO HDSS) in Segamat, Malaysia, the study used a cross-sectional design.	The study revealed a significant prevalence of stunting, with notable discrepancies in categorization and prevalence estimates depending on the reference used. There was only modest agreement (κ = 0.73) between the two references for the crude prevalence of stunting, with the CDC reporting 29.2% and the WHO reporting 19.1%.
19	Ethan K. Gough, Et. al	Impact of Improved Complementary Feeding and Enhanced Water, Sanitation, and Hygiene (WASH) on Environmental Enteric Dysfunction in Children in Rural Zimbabwe: A Cluster-Randomized Controlled Trial	In order to evaluate the individual and combined effects of improved Water, Sanitation, and Hygiene (WASH) and Infant and Young Child Feeding (IYCF) treatments on child stunting and anemia at 18 months of age, the SHINE trial used a 2x2 factorial cluster-randomized design..	The Sanitation Hygiene Infant Nutrition Efficacy (SHINE) experiment was a cluster-randomized controlled trial conducted in rural Zimbabwe that investigated the effects of improved infant and young child feeding (IYCF) and water, sanitation, and hygiene (WASH) interventions—such as handwashing stations, latrines, and water purification—on children's environmental enteric dysfunction (EED).
20	Mathias Altmann, Et.al	A pragmatic cluster-randomized controlled trial in Chad examined the efficacy of a household water, sanitation, and hygiene package on an outpatient program for severe acute malnutrition.	The study evaluated the efficacy of an outpatient therapeutic feeding program in conjunction with a household WASH package for treating severe acute malnutrition (SAM) in Chad..	The study comes to the conclusion that although including a home WASH package did not reduce the rates of post-recovery relapses, it did improve the recovery participants' children.
21	Kazi Istiaque Sanin, et. al	Food Safety Procedures and Stunting in School-Aged Children: Results of an Observational Study from a Bangladeshi Urban Slum	The observational study first concentrated on 187 of 265 enrolled children in an urban slum in Bangladesh, using data from the MAL-ED birth cohort.	The bivariate analysis revealed that stunting was significantly associated with factors such as consuming ready-made or street food more than three times a day, water treatment, the presence of insects or pests in the cooking area, and caregivers' handwashing habits after using the restroom. After adjusting for relevant variables, only water treatment and frequent consumption of prepared or street food remained significantly linked with stunting.
22	Intje Picauly, Et. al	Preventing Stunting in Dryland Areas of East Nusa Tenggara	The study looked at 7,835 children using cross-sectional data from the National Social	The study found that a history of infectious disorders such as worms, diarrhea, and ARI increases the

No.	Author/year/Source	Title of research	Research method	Result
		Province, Indonesia via Path Analysis Model	Economics Survey and the Indonesian Nutritional Status Survey. The path analysis showed that the decrease of stunting prevalence is positively impacted by both targeted and sensitive intervention programs, such as access to healthcare and nutritional support.	likelihood of malnutrition, whereas a healthy diet reduces it. Additionally, stunting has been associated with environmental factors like open defecation and sanitation practices, suggesting that improving environmental conditions, particularly cleanliness, could help reduce the incidence of stunting.
23	Jacqueline M. Lauer et al.	In rural southwest Uganda, unsafe drinking water is linked to poor growth outcomes and environmental enteric dysfunction in young children.	The Uganda Birth Cohort Study was the parent study for the cross-sectional, observational design employed in this investigation. The compartment bag test (CBT) was utilized to evaluate the quality of the water, and the L test served as a stand-in marker for EED.	The study found that the amount of safe water (free from Escherichia coli contamination) in less than half of the households was not correlated with the quality of the water sources. The report suggests that enhancing WASH conditions, particularly by improving the quality of drinking water in homes, should be a key component of nutrition improvement initiatives.
24	Matthew C Freeman et al.	A randomised controlled trial conducted in Western Kenya examined the effects of a demand-side integrated WASH and nutrition community-based care group intervention on behavioural change.	The study focused on behavioral outcomes related to food hygiene, mealtime and eating patterns, and compound cleanliness. It employed a cluster-randomized trial design to evaluate the effectiveness of the intervention with the standard care strategy.	The findings showed that the intervention-receiving households significantly improved a number of behaviors, such as keeping a clean space for food preparation, storing food properly, having a working handwashing station, giving kids thickened porridge, and providing a safe place for them to play.
25	Anitha Seetha et al.	To what extent does instruction on food safety, hygiene, and varied diets have an immediate and substantial impact? An Initiative to Reduce Undernutrition in Children in Rural Malawi	In Mzimba and Balaka districts, a randomized controlled study including 179 mothers and their under-two-year-old children evaluated the program's impact on three undernutrition indicators: stunting, underweight, and wasting.	The study indicated that the training led to a significant reduction in underweight and wasting among children, with improvements becoming more pronounced over the 21-day intervention period. Although stunting did not show significant improvement during this period, there was a trend towards improvement, suggesting potential benefits with extended intervention durations.
26	Amy Desai et al.	The Pilot Study of the Impact of the SHINE Trial Infant Feeding Intervention on Maternal Education and Infant Nutrition	The study assessed newborn nutritional intake using 24-hour recall and diverse techniques to measure mother knowledge. Iron, folate, zinc, and calcium were among the essential elements that were	The training improved mothers' knowledge of appropriate newborn feeding techniques and led to a notable increase in the adequacy of infants' dietary intake. The study demonstrated that the intervention modules provided by village health

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		in Rural Zimbabwe	lacking in the babies' diets at baseline.	professionals effectively enhanced the nutritional condition of the newborns in the study group.

The features of the 26 selected studies are listed in Table 2. The earliest research was released in 2016, and the most recent in 2019. Among the studies reviewed, five were secondary analyses [4,5,6,7,11], two used path analysis [2,14], one used content analysis [3], one used logistic analysis [8], and five studies were designed using randomized control and trial and cross-sectional [1,9,10,12,13], as listed in Table 2. Three studies were conducted in Zimbabwe, two in Ethiopia, two in India, and two in Bangladesh, and the other studies were carried out in a number of other nations. (Table 2).

3.2. Synthesis of Results

This scoping article focuses on crucial components, such as stunting, water, hygiene, sanitation, and children. Gaining thorough knowledge of the subject requires the comprehension of these elements. This article highlights the significance of these elements and their roles in the discussion. With this knowledge, one will be able to understand the subject and its significance with confidence. In addition, elements taken from research that are recurrent in several articles, as well as how frequently they occur, are recognized as markers of their significance. After reviewing various studies, the most significant dimensions and components mentioned were as follows:

3.3. Water and Stunting in Child

Access to safe drinking water, sanitation, and hygiene (WASH) services is recognized as a fundamental human right [36]. Despite significant progress, millions of people still need access to these necessities. This situation poses significant health risks, potentially leading to the spread of diseases and mortality [37] [38]. It is essential to provide WASH services to safeguard the health and well-being of all individuals [39].

Millions of people lack access to sanitation and clean water every day. It is important to ensure that the health of the mothers and children is not adversely affected by water collection [40]. Depending on who is responsible for fetching the water, it can cause serious health problems. To reduce child deaths and diarrhea, it is not just the type of toilet facility that matters, but also the percentage of people who use improved sanitation facilities. The high percentage of people using these facilities is crucial. Enhanced sanitary facilities and on-site water availability have been demonstrated to improve the health of expectant mothers and their children [41].

Access to safe water and adequate sanitation are essential for controlling schistosomiasis, as improvements in these areas can reduce the transmission of the disease [42][43]. The prevalence of schistosome infections can be reduced by improving access to clean water and sanitary facilities. Unfortunately, most research on this subject has been observational in nature and of low quality [44].

In South Asia, there is a correlation between flooding and malnourishment in children. Girls are more susceptible to stunting from anomalous rainfall than males. However, boys are generally less likely to suffer stunting [45].

3.4. Hygiene and Stunting in Child

Evidence regarding the impact of poor WASH condition on children's nutritional status is mixed [46]. Research indicates that WASH interventions can significantly improve the mean height-for-age Z-score of children under five years old [47]. The age of the child and the type of intervention (single or combination) affect how WASH affects linear development. Notably, the best results for improving children's nutritional health typically come from combining WASH treatments [48].

Children who wash their hands are less likely to experience stunting or wasting. Furthermore, there is a strong correlation between the chlorination of the piped water supply and enhanced cleanliness and lower odds ratios for fever, cough, respiratory problems, diarrhea, and Giardia lamblia infections [49].

3.5. Sanitation and Stunting in Child

To improve child health and nutrition and to achieve wider Sustainable Development Goals (SDGs), it is imperative that safe sanitation facilities be made available and that open defecation is completely eradicated [50]. The prevalence of waterborne infections has increased because millions of people lack access to sanitary facilities and better water sources. Stunting and diarrhea decrease when the cleanliness objective is exceeded by 60% [41]. A guest study states that as of April 3, 2024, approximately 2.4 billion people—roughly one-third of the world's population—do not have access to better sanitary facilities. Of these people, 13 percent defecate in public. Additionally, the research states that South Asia and Sub-Saharan Africa had the lowest rates of sanitation coverage. [51].

Research has shown that improving Water, Sanitation, and Hygiene (WASH) treatments alone has improved children under two years' Height-for-Age Z-scores (HAZ) across the period of 18 to 60 months. Weight-

for-height Z-scores (WHZ) may benefit from the combination of WASH treatments and nutrition programs, which have been proven to have even more substantial benefits for HAZ and Weight-for-Age Z-scores (WAZ). The inclusion of WASH in dietary programs may improve the growth of children [52].

4. CONCLUSION

A basic human right is the provision of WASH (safe drinking water, sanitation, and hygiene) services, which must be upheld to guarantee each person's health and well-being. While research shows that WASH treatments can considerably increase children under five years' mean height-for-age Z-score, there is conflicting evidence regarding the influence of inadequate WASH conditions on children's nutritional health. Improving the health and nutrition of children requires the removal of open defecation and provision of safe sanitation facilities. Waterborne infections are common because millions of people lack access to sanitary facilities and better water sources.

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International Journal of Social Science (IJSS)
Vol.4 Issue.4 December 2024, pp: 341-354
ISSN: 2798-3463 (Printed) | 2798-4079 (Online)

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