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**Review Article**

# Rotavirus Prevalence and Vaccine Coverage Among Children in Ethiopia: Study Review

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**Abstract:** Rotavirus infection is one of viral infectious disease associated severe dehydration and gastroenteritis among children in both developed and developing countries will be infected with rotavirus in the first five years of life. Therefore, the aim of this review is to derive information of rotavirus prevalence, dominant strains and vaccine coverage in Ethiopia, 2022. Different studies conducted between 2003 to 2020 years. All gathered articles were stored into the mendeley software library and duplicate were identified. The studies were selected using nine evaluation criteria, and then studies which acquired scores above 50% were considered as having a low risk of bias included in review. The data analyzed and finding were presented by tables, bar graph and pie chart. Results of 13 studies selected for review, six studies on prevalence of rotavirus, while seven studies on vaccine coverage. From reviewed studies, 606 22.7% (95% CI = 21.1%-24.3%) tested rotavirus positive out of 2671 enrolled children. Predominant strains of rotavirus detected was G1P [8] 22.2%, G3P [6] 19.7% and G12P [8] 11% and vaccine coverage was 69.8% (95% CI: 66.8, 72.5). Out of vaccinated children, 1344 (92.2%) and 1270 (86.2%) were taken Rota 1 and Rota 2 respectively. The studies revealed that rotavirus common among Ethiopian children and safe effective interventions against rotavirus infection needed to prevent severe disease.

**Keywords:** Rotavirus, Vaccine Coverage, Children, Ethiopia

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## 1. Introduction

Rotavirus infection was responsible for more than 258 million episodes of diarrhea among children in 2016 (95% UI, 193 million to 341 million), an incidence of 0.42 cases per child-year (95% UI, 0.30-0.53). Sub-Saharan Africa, 104 733 deaths from rotavirus infection (95% UI, 83 406-128 842) among those younger than 5 years occurred in sub-Saharan Africa [1].

Despite prevalence of rotavirus infection in developing countries is analogous to that of developed countries; case-fatality in the poorest countries is advanced, due to malnutrition and walls to penetrating health services in a timely manner where not water quality or hygiene/ aseptic conditions have been shown to have an effect in controlling the infection [2].

Encyclopedically, four rotavirus strains predominant (including Latin America) G1P [8], which is responsible for

the maturity of infections; G2P [4], G3P [8], and G4P [8]. In addition to these four, others have been described with serotypes G5, G8, and G9. Serotype G9 is considered to be the world's fifth most-important serotype. In sub-Saharan Africa, although the common mortal rotavirus strains (G1 – G4 and G9) were observed, only G1, G2 and G9 were detected routinely, and the more unusual strains (G8 and p6) were detected more constantly than in other areas of the world [3].

In temperate climates, infections do generally in downtime, while in tropical climates, cases generally do time- round, although seasonal peaks may do in downtime. As a result, a child born in a temperate country after the downtime season won't be exposed to the contagion until the ensuing time, but those born in a tropical country will be exposed to the contagion time- round. Therefore, the average age of onset of

infection is youngish in tropical countries, where children get sick in the first time of life [4].

The most significant transmission medium of rotavirus infections is direct fecal-oral contact, but still under disquisition. The substantiation also points to propagation by slaver driblets and concealment from the respiratory tract. Person-to-person transmission through the hands appears to be responsible for the contagion spreading in unrestricted surroundings, similar as homes and hospitals. Transmission between children in day- care centers is caused by direct contact and through defiled food and/ or toys [5].

The World Health Organization's (WHO) Strategic Advisory Group of Experts (SAGE) on Immunization recommended rotavirus vaccines for global use stated that rotavirus vaccination should be included in every country's public immunization program. Since precluding rotavirus through vaccination is the stylish way to cover children. Thus, WHO initiate support through the GAVI Alliance to eligible countries in Latin America, Eastern Europe, Asia and Africa in 2006, because cost can be a major challenge that developing countries face when introducing new vaccines, numerous of the countries that stand to profit from rotavirus vaccines [6].

New data from recent clinical trials assessing safety and efficacy in real-world, high-mortality settings in Africa demonstrated that rotavirus vaccines significantly reduced severe diarrhea occurrences due to rotavirus. Still, nearly half a million children in developing countries die (including Ethiopia) each time from rotavirus infections [7].

In Ethiopia, bacterial and parasitic causes of gastroenteritis are substantially studied, information is scarce about the viral etiologies and utmost of cases remain unidentified due to limited individual styles for the discovery of viral agents [8]. Also, absence of study reviews on rotavirus prevalence, it's strains and vaccine coverage at same time in the country to generalize findings of different cross-sectional studies and recommend. Thus, this review is to give the update rotavirus prevalence, its strains and vaccine coverage in Ethiopia.

## 2. Methods

There are studies conducted on rotavirus and vaccine coverage in different parts of the Ethiopia. Some those studies conducted in the countries were reviewed. These are studies conducted cross-sectional on children variation on age. Reviewed studies carried out in districts and cities of regions in Ethiopia like Oromia, Amhara Southern Nations Nationality region Somali and Addis Ababa city. The studies used stool antigen test to determine rotavirus prevalence, while reverse transcriptase-polymerase chain (RT-PCR) response to identify strains of rotavirus among study populations.

### 2.1. Literature Search Styles

The review was conducted using published studies on the

rotavirus prevalence and vaccine coverage in Ethiopia. Our literature search strategy, selection of publications, and reporting of results were conducted. Papers gathered using quest terms like the PubMed, Google Scholar, and Science Direct databases. The rule of combination was applied to gain applicable papers on rotavirus epidemiology, prevalence, vaccine coverage in Ethiopia since the searching strategy differs from database to database. In addition, manually Google searching and webbing were done on reference lists of the included studies were to pierce fresh papers. Papers were searched without any time restrictions.

### 2.2. Eligibility Criteria

Composition searching wasn't grounded on publication period; still, only English interpretation full- textbook papers were gathered. Since only primary studies published in peer-review journals included, thereby banning reviews, letters, short dispatches, bills, studies conducted through clinical examination only, and conference objectifications. All types of study designs among cases of any age groups reported rotavirus infection prevalence using rapid antigen test or PCR in the Ethiopian settings were included.

### 2.3. Composition Selection

All hunted papers were stored into the mendeley software library, and also indistinguishable were linked and removed. The author sufficiently screened papers grounded on their title, abstract and full textbook to identify potentially eligible studies according to the destined addition criteria. After that, author of this composition developed the data birth form in Microsoft-Excel Spreadsheet and also data were uprooted from full-textbook papers. The data birth distance included the name of the author, study group (subjects), study design, sample size, slice fashion, individual system, total positive finding, and species-specific total positive finding. The investigator was check for consistency, and any inconsistencies were resolved by discussion.

### 2.4. Data Quality Assessment

The quality of the collected studies was assessed using evaluation criteria included nine parameters; slice frame felicitousness, good slice fashion, large sample size, study subject and setting description, proper data analysis, delicacy of styles for the linked conditions, valid dimension for all actors, acceptable statistical analysis, and enough response rate. Eventually, the studies that scores above 50 were considered as low threat of bias and named for review.

### 2.5. Data Analysis

After studies quality checked, the proportion and their prevalence average were calculated using calculator. The data were presented by tables, bar graph and pie chart. The studies prevalence were compared and discussed.

### 3. Results

#### 3.1. Rotavirus of Prevalence

Out of 19 studies reviewed 13 studies score evaluation criteria above  $\geq 50\%$ . Those studies were conducted between 2003 to 2020 years. All those studies conducted on different age group of children. From reviewed six studies on prevalence of rotavirus, 606 (22.7%) tested rotavirus positive out of 2671 enrolled children (Figure 1).

Study conducted in West Showa reported higher prevalence 74% when compared with other studies reviewed together, while lower rotavirus positive (8%) from recent study conducted at Wegera district of Amhara region (Table 1).

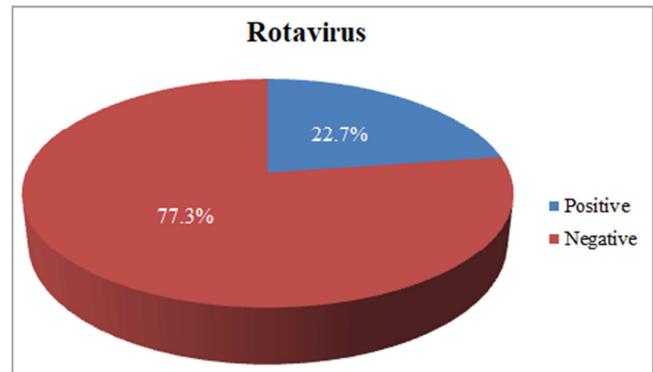


Figure 1. Rotavirus prevalence among children.

Table 1. Rotavirus prevalence reported by different studies.

Study area	Stool sample tested	Rotavirus positive	Percentage (%)	References
Jimma	154	41	26.6	[8]
Addis Ababa	1759	352	20	[9]
Awassa	200	44	22	[10]
West shewa	19	14	74	[11]
Wegera	225	18	8	[12]
Gambo	314	137	43.6	[13]

#### 3.2. Rotavirus Strains Among Children

Three studies identified the common strains among study participants. The most rotavirus genotype predominantly detected was G1P [8] 22.2%, G3P [6] 19.7% and G12P [8] 11% (Figure 2).

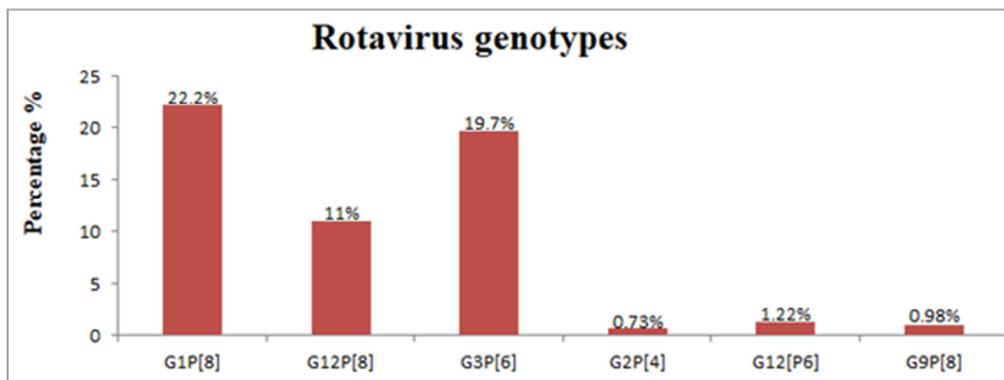


Figure 2. Dominant rotavirus genotypes.

#### 3.3. Rotavirus Vaccine Coverage

The studies in Ethiopia reported vary rotavirus vaccine coverage. From the reviewed studies, the highest coverage reported from Debre Markos 93.4%, while lowest from Jigjiga city 36.6%. The of rotavirus vaccine coverage is 69.8% (Table 2).

Table 2. Reported rotavirus vaccine coverage in Ethiopia.

Study area	Coverage	References
Dabat and Gondar Zuria districts	76.60%	[14]
Sekota Zuria district	80%	[15]
Minjar-Shenkora district	75.6%	[16]
Debre Markos Town	93.4%	[17]
Sinana district	76.8%	[18]
Mecha district	49.3%	[19]
Jigjiga district	36.6%	[20]

Among vaccinated children, 1344 (92.2%) and 1270 (86.2%) were taken Rota 1 and Rota 2 respectively (Figure 3).

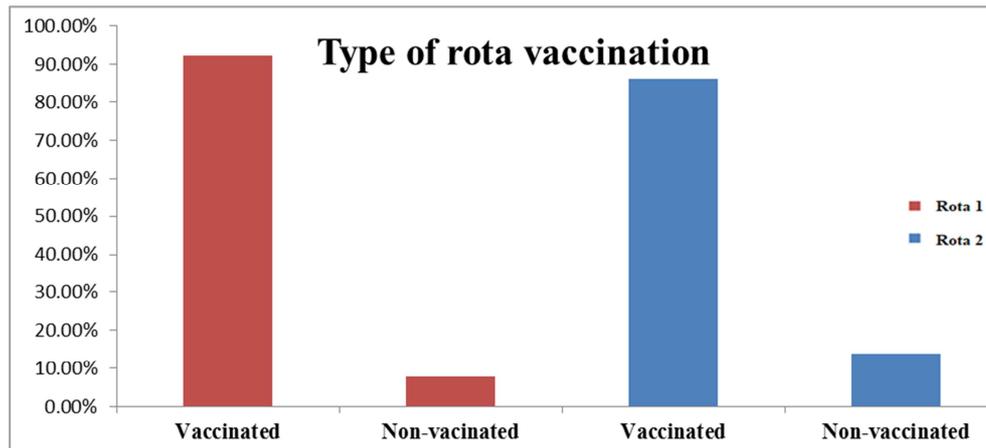


Figure 3. Types of Rota vaccination of children in Ethiopia.

## 4. Discussions

Rotavirus infection is a significant public health concern in developing countries with poor socio-economic situations and the lack of appropriate sanitation and hygiene. This review shows the pooled prevalence of rotavirus infection among under-five children with acute gastroenteritis in Ethiopia to be 22.7% (95% CI = 21.1%, 24.3%). This finding is comparable with a systematic review report from Latin America and Caribbean countries which reported a pooled prevalence of 24.3% [21] and Ethiopia 23% [22]. However, this prevalence is lower than eight African countries which reported 40% [23], and systematic reviews in Iranian children reported 35% and 39.9% [24, 25]. The differences could be explained by the variations in the sample diagnosis methods, numbers of reviewed studies, sample size, study enrollment criteria, the study period and immunization status of children.

This review the dominant G/P types combination in this study were G1P [8], G3P [6], G12P [8] which occupied around 22.2%, 19.7%, and 11% of the rotavirus strains respectively. The G1P [8] prevalence in this review similar with in China reported (23.0%) [26], other study in China (24.5%) [27], surveillance data in South and East African countries 23.8% [28], meta-analysis study done in Africa (22.64%) [29]. However, G1P [8] finding in present review higher than systematic review in Ethiopia 13.6% [22]. This difference might be due to amount of reviewed studies, criteria of studies selection and method of analysis.

On other hands, the second dominant types in current review G3P [6] prevalence alike report of systematic review in Ethiopia 14.2% [22], but higher than report of surveillance data in South and East African countries (3.7%) [28]. This difference might be due to variation in geographical area.

Regarding rotavirus vaccine coverage, in this review the pooled prevalence of rotavirus coverage was 69.8% (95% CI: 66.8, 72.5). This finding similar with Philippines (70.0%) [30], Kenya (67.2%) [31]. However pooled prevalence of rotavirus coverage in this review lower than that of WHO 2018 86% [32], Bangladesh (82%) [33], Ghana (77.0%) [34], Zimbabwe (76.0%) [35].

On other hand, pooled prevalence of rotavirus vaccine coverage in present review higher than Madagascar (49.1%) [36], Uganda (55.8%) [37], Nigeria 34.4% [38], systematic review in Ethiopia 47.0% [39]. This difference might be due to variation in literate level, socio-economic status, health facilities access, geographical region, number of study reviewed.

Limitations of this review: In current review meta-analysis not done, also few primary cross-sectional studies included. On other hand, pre-vaccine and post-vaccine studies not separately reviewed.

## 5. Conclusion

This review of studies on rotavirus prevalence and vaccine coverage among children show effective interventions needed in Ethiopia against rotavirus infection to prevent severe disease. It is important to monitor the diversity of rotavirus strains. Likewise, current vaccine coverage in the country is lower than the target of the country 98% by 2020. Hence, this might initiate policy makers and the public Control of Diarrheal Conditions (CDD) towards the expansion of rotavirus vaccine to help and manage rotavirus associated diarrhea among children. The established surveillance system and the data generated can be used to cover the impact of a rotavirus vaccination program on severe rotavirus complaint in Ethiopia.

## 6. Recommendation

Based on this review, farther work is demanded to give a broader picture on the burden of rotavirus in children through long-term community-grounded surveys and epidemiological studies at indigenous as well as public situations. The farther serotyping study of rotaviruses should be conducted that can contribute for future rotavirus vaccine development worldwide.

Although rotavirus infection reduced after vaccination program introduced in Ethiopia, but it should be covered by surveillance systems to measure effectiveness and impact. In addition, all family members and day-care centers should

ameliorate aseptic practices, bettered sanitation and ménage waste water that can help to reduce severe occurrences of diarrhea.

## Abbreviations

CI: Confidence Interval; EPI: Expanded Programme on Immunization; GAVI: Global Alliance for Vaccine and Immunization; RT-PCR: Reverse Transcriptase Polymerase Reaction Chain; SAGE: Strategic Advisory Group of Experts; VP: Viral protein; WHO: World Health Organization.

## Author Contribution

AA: conceptualization, formal analysis, investigation, software, validation, visualization, writing – review & editing and approving original manuscript draft.

## Availability of Data and Materials

Data essential for the conclusion are included in this manuscript. Additional data can be obtained from the corresponding author on a reasonable request.

## Consent for Publication

Not applicable.

## Conflict of Interests

The authors declare that they have no competing interests.

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