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Research Article

Unveiling the Realities: Measles Vaccination Knowledge and Misconceptions among Mothers in Rural Eastern Sudan

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Abstract

Background: Despite the introduction of the measles' vaccine in 1963, measles remains a leading cause of death among young children in developing countries.

Objective: The objective of this study was to assess the knowledge of mothers about the measles' vaccine in Refe Khashm Al Girba district, Kassala State.

Methods: A descriptive cross-sectional study was conducted in Refe Khashm Al Girba, Kassala State, Sudan. 300 mothers were enrolled in the study using systematic random sampling techniques. Data were collected using a structured pre-tested questionnaire and analyzed using SPSS version 25. Descriptive statistics were used to summarize the demographic characteristics and knowledge levels of the participants. Chi-square tests were used to assess associations between demographic factors and knowledge levels, with a significance level set at $p < 0.05$.

Results: The study revealed that 93.7% of the mothers were aware of the measles' vaccine, but 68% had incorrect knowledge about the timing of vaccination. Significant associations were found between the mother's educational level ($p = 0.001$) and family income ($p < 0.001$) with knowledge about the measles' vaccine. Mothers with higher educational levels and high family incomes were more likely to have correct knowledge. Furthermore, 36.3% of the participants reported that they were unable to vaccinate their children during visits to health centers due to limited vaccine availability or scheduling issues.

Conclusion: The findings highlight a critical need for targeted educational interventions to improve mothers' correct knowledge of measles vaccination, particularly about the timing of administration. Ensuring consistent vaccine availability at health centers is also essential to improving vaccination rates in the district.

Keywords: *Measles Vaccination; Mother knowledge; Misconceptions; Kassala State; Sudan*

Abbreviations

WHO: World Health Organization; CDC: Centers for Disease Control and Prevention; MMR: Measles-Mumps-Rubella

Introduction

Measles is one of the most contagious viral diseases known to humankind and remains a leading cause of vaccine-preventable deaths among young children globally. Despite the availability of an effective and affordable vaccine, measles continues to pose a significant public health challenge, particularly in low-income countries [1]. The World Health Organization estimates that 140,000 people, mostly children under five years of age, died from measles in 2018 alone [1]. The persistence of measles in certain regions highlights the need for sustained immunization efforts and public health interventions to prevent outbreaks and achieve global eradication goals [2].

Vaccination is widely recognized as the most effective method of preventing measles. The measles' vaccine is typically administered as part of the measles-mumps-rubella (MMR) vaccine, which is given in two doses: the first at 9 - 12 months of age and the second at 15 - 18 months, according to the WHO's recommended immunization schedule [1]. High vaccination coverage typically above 95% is required to achieve herd immunity, which is necessary to prevent the transmission of the virus within communities [3]. However, achieving and maintaining such high coverage levels can be challenging, particularly in regions with limited healthcare infrastructure, cultural barriers, and economic hardships [4].

Globally, considerable progress has been made in reducing the incidence of measles through vaccination. Between 2000 and 2018, global measles deaths decreased by 73%, due to increased vaccination coverage and supplementary immunization activities (SIAs) in many countries [2]. Despite these successes, recent years have seen a resurgence of measles in several regions, driven by gaps in vaccination coverage, vaccine hesitancy, and conflict-related disruptions to health services [4].

In Africa, measles remains endemic in many countries, with periodic outbreaks occurring in both urban and rural areas. According to the WHO African Region, the African continent accounts for a considerable proportion of the global burden of measles, with several countries experiencing large-scale outbreaks in recent years [5]. These outbreaks have been attributed to numerous factors, including low routine immunization coverage, inadequate surveillance systems, and challenges in accessing hard-to-reach populations [3].

Several studies have examined the knowledge and attitudes of mothers toward measles vaccination in different settings. A study conducted in Ethiopia found that while 90% of mothers were aware of the measles' vaccine, only 31% knew the correct timing for vaccination [6]. The study also found that maternal education and access to healthcare services were significant predictors of correct knowledge about measles vaccination [7,8]. Similarly, a study in Nigeria reported that 82% of mothers had correct knowledge about the timing of the measles' vaccine, but cultural beliefs and misinformation were barriers to vaccination [9].

In Sudan, there are significant logistical challenges in delivering vaccines to remote areas, including prolonged ongoing conflict, poor road infrastructure, limited transportation options, cultural beliefs and practices and economic barriers [4,10,11]. Moreover, research on maternal knowledge and attitudes toward measles vaccination is limited. The primary objective of this study was to assess the knowledge of mothers in Refe Khashm Al Girba district about the measles' vaccine and to identify the socio-demographic factors that influence their knowledge. The findings of this study may provide insights to inform the design of effective targeted health interventions policies to improve measles vaccination coverage in Refe Khashm Al Girba district and similar settings.

Methods

Study design: Across-sectional design was conducted involving mothers residing in Refe Khashm Al Girba district, Kassala State, Sudan.

Study population and sampling: The target population for this study included all mothers residing in Refe Khashm Al Girba who had at least one child under five years of age.

Sample size estimation and sampling method

We estimated the minimum required sample size (300 mothers) based on the expected prevalence of 50% correct knowledge about the measles' vaccine, 95% confidence level and a margin of error of 5%. A systematic random sampling method was used to select a representative sample of 300 mothers.

Data collection tool: Data were collected using a structured pre-tested pre-coded questionnaire designed specifically for this study. The questionnaire included 3 sections on:

- **Demographic characteristics:** Age, occupation, educational level, number of children, and household income.
- **Knowledge about measles' vaccine:** Awareness of the vaccine, knowledge of the correct timing for vaccination, understanding of vaccine administration (route and site), and awareness of contraindications.
- **Accessibility to healthcare services:** Distance from the nearest health center, mode of transportation used to access healthcare services, and experiences with vaccine availability.

The questionnaire was pre-tested on a small sample of mothers (30 participants) to ensure clarity and reliability. Feedback from the pre-test was used to refine the questionnaire before its administration in the study.

Data collection procedure: Trained data collectors administered the questionnaires through face-to-face interviews with the mothers attending primary health care centers. The data collectors were briefed on the objectives of the study and the importance of maintaining confidentiality. Each interview lasted for 10 - 20 minutes.

Data analysis: Data was entered into SPSS version 25 for analysis. Descriptive statistics used to summarize the demographic characteristics of the participants and the knowledge levels. Chi-square tests were used to examine associations between demographic variables (e.g., educational level, income) and knowledge about the measles' vaccine. The level of significance was set at $p < 0.05$. The results were presented as tables and figures, with key findings highlighted in the narrative.

Ethical considerations: Permission was obtained from the district authority. An informed consent was obtained from all participants before the interviews were conducted. Participants were assured that their responses would be kept confidential and that they could withdraw from the study at any time without any consequences.

Results

Demographic characteristics: The study population consisted of 300 mothers aged between 16 and 42 years, with a mean age of 28.3 years (SD ± 5.0). Most of the participants were housewives (81.3%), and a considerable proportion (41.6%) had attained an intermediate level of education. Most households had a monthly income between 150000 and 200000 Sudanese Pounds as detailed in table 1.

The total number of participants included in this study was 300. The age ranged from 16 to 42 years, with a mean 28.3and STD ± 5.0. Most of them were housewives (81.3%).

Variables		Frequency	Percentage
Mother age group	16-20 years	21	7%
	21-25 years	65	21.6%
	26-30 years	129	43%
	31-35 years	60	20%
	>36 years	25	8.4%
	Total	300	100%
Occupation of the mother	Housewife	244	81.3%
	Skilled person	91	30.3%
	Professional	5	1.6%
	Total	300	100%
Number of children	<3	104	34.7%
	< 5	176	55.7%
	<7	20	6.6%
	Total	300	100%
The educational level of the mother	Primary	1	6.7%
	Intermediate	8	6.3%
	Secondary	7	6.3%
	University	0	0.0%
	Illiterate	1	20.0%
	Total		100%
Occupation of the father	Professional	35	11.6%
	Skilled person	249	83%
	Unemployed	16	5.4%
	Total	300	100%
Monthly income of the family based on Sudanese Pound	<150000	29	9.7%
	150000-200000	215	71.7%
	>200000	56	18.7%
	<150000	29	9.7%

Table 1: *Distribution of population according to basic characteristics.*

Knowledge about measles' vaccine

A significant majority of the mothers (93.7%) reported being aware of the measles' vaccine. Despite the elevated level of awareness, only 24.3% of the mothers correctly identified the appropriate time for administering the measles' vaccine (at 9 months). The majority (68%) incorrectly believed that the vaccine should be administered at 6 months. This finding suggests a significant gap in knowledge that could have implications for vaccination coverage and the prevention of measles outbreaks. Most mothers (89.7%) correctly identified that the measles' vaccine is administered via injection, and 96.3% knew the correct site of injection (the upper arm). However, 8.9% mistakenly believed that the vaccine could be administered orally, indicating confusion about the administration routes for different vaccines.

Variables	Knowledge rating				P-value
	Poor <40	Average 40-60	Good 61-80	Very good >80	
Age					0.127
16-20	1 (5%)	2 (10%)	8 (40%)	9 (45%)	
21-25	5 (7.7%)	3 (4.6%)	39 (60%)	18 (27.7%)	
26-30	8 (6.2%)	11 (8.5%)	88 (68.2%)	22 (17.1)	
31-35	2 (3.3%)	5 (8.3%)	34 (56.7%)	19 (31.7%)	
36 and more	2 (8.3%)	3 (12.5%)	9 (37.5%)	10 (41.7%)	
Educational level of the mother					0.001
Primary	1 (6.7%)	6 (40.0%)	4 (26.7%)	4 (26.7%)	
Intermediate	8 (6.3%)	13 (10.3%)	88 (69.8%)	17 (13.5%)	
Secondary	7 (6.3%)	4 (3.6%)	67 (60.4%)	33 (29.7%)	
University	0 (0.0%)	0 (0.0%)	18 (43.9%)	23 (56.1%)	
Illiterate	1 (20.0%)	1 (20.0%)	2 (40.0%)	1 (20.0%)	
Monthly income of the family based on SP					0.0001
<150000	29 (9.7%)	1 (3.6%)	16 (57.1%)	11 (39.3%)	
150000 - 200000	215 (71.7%)	21 (9.8%)	142 (66.4%)	37 (17.3%)	
>200000	56 (18.7%)	2 (3.6%)	20 (36.4%)	30 (54.5%)	
Number of children					0.201
<3	4 (4.0%)	12 (12.0%)	42 (42.0%)	42 (42.0%)	
<5	11 (6.3%)	5 (2.9%)	125 (71.4%)	34 (19.4%)	
<7	2 (10.5%)	6 (31.6%)	9 (47.4%)	2 (10.5%)	

Table 2: *Effect of socio-demographic factors on knowledge.*

In table 2 age has shown no significance with knowledge of mothers about measles vaccination. The educational level was significant with mother knowledge, p-value 0.001. Mothers of children with educational level secondary school and above had better knowledge about measles vaccination. Income was significant with mother knowledge of measles' vaccine. Mothers of children with income 150000 SP and above had better knowledge about measles vaccination.

Factors associated with knowledge

The study found a significant association between the mother's educational level and her knowledge about the measles' vaccine (p = 0.001). Mothers with secondary education or higher were more likely to have correct knowledge about the vaccine, particularly about the timing of administration.

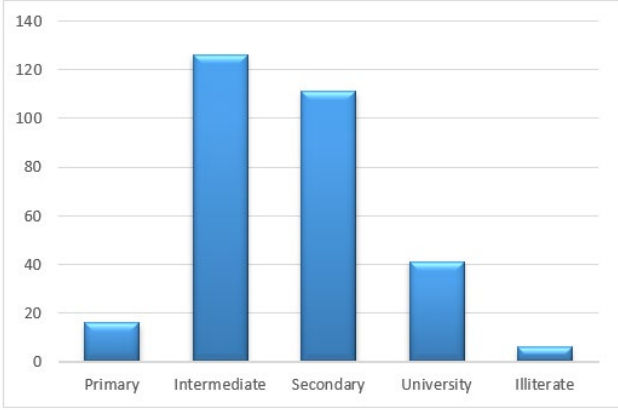

Figure 1: *Mothers' educational level.*

Most mothers, 125 (41.6%) had intermediate educational level.

Higher household income was also significantly associated with better knowledge about the measles' vaccine (p < 0.001). Mothers from households with an income of 150000 Sudanese Pounds or more were more likely to have correct knowledge. This finding underscores the importance of socio-economic factors in determining access to health information and services.

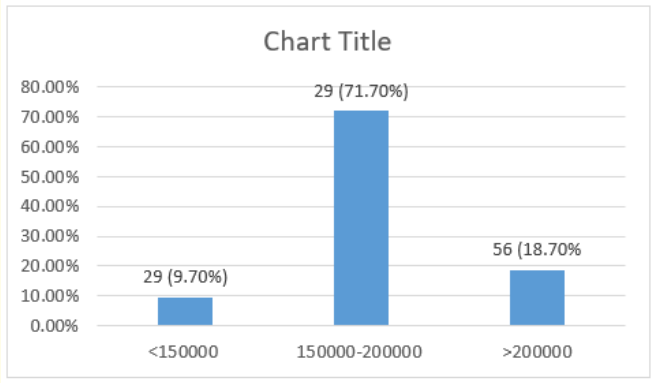

Figure 2: *Monthly income of the family.*

Majority of participant 215 (71.7%) had monthly income 150000 to 200000 Sudanese Pounds.

Misconceptions and barriers to vaccination

More than half of the mothers (56.3%) incorrectly cited diarrhea as a contraindication for measles vaccination. This misconception could lead to unnecessary delays in vaccination and increase the risk of measles outbreaks, particularly in areas where diarrheal diseases are common.

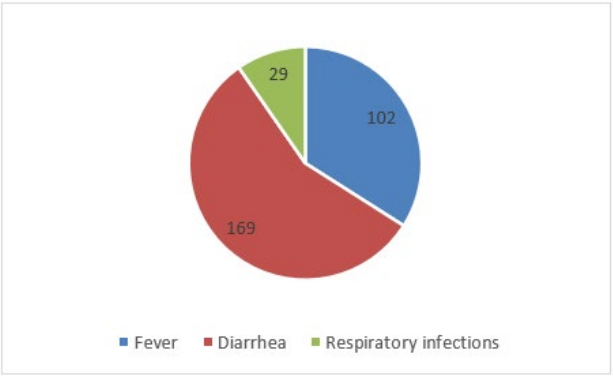

Figure 3: *Reasons for not giving measles' vaccine to the child.*

The majority 169 (56.3%) of participants cited that diarrhea is a contraindication of measles vaccination.

While most mothers (42.7%) lived within 1-2 km of a health center, a considerable proportion (36.3%) reported instances where they were unable to vaccinate their children due to the unavailability of the vaccine or health workers. These accessibility issues highlight the challenges faced by mothers in ensuring their children are fully vaccinated.

Discussion

This study revealed several significant findings regarding the knowledge and misconceptions about measles vaccination among mothers in Refe Khashm Al Girba district, Kassala State, Sudan. First, the study found that 93.7% of mothers were aware of the measles vaccine. This high level of awareness aligns with similar findings in Ethiopia, where Getahun., *et al.* (2020) reported 90% awareness among mothers. Awareness levels in Nigeria were also high, though slightly lower at 82% [9]. This widespread awareness can be attributed to the global and regional efforts by health authorities and organizations like the World Health Organization (WHO) to promote immunization programs. However, awareness does not necessarily translate into accurate knowledge, as evident from the gaps discussed below.

Despite high awareness, only 24.3% of mothers correctly identified the appropriate timing for administering the measles vaccine (9 months of age). A significant proportion (68%) incorrectly believed it should be administered at 6 months. Similar misconceptions about vaccine timing were reported in Ethiopia, where only 31% of mothers had correct knowledge [6]. However, a study in Nigeria found that 82% of mothers correctly identified the timing [9], suggesting regional variations in maternal knowledge. These discrepancies may stem from differences in the effectiveness of health education campaigns, healthcare infrastructure, and maternal interactions with healthcare providers. In settings like Refe Khashm Al Girba, rural location and limited access to trained healthcare personnel likely contribute to knowledge gaps. Misunderstandings about vaccine schedules could also arise from informal advice within communities or conflicting information from unqualified sources.

The study also observed that 89.7% of mothers knew the measles vaccine is administered via injection, and 96.3% identified the upper arm as the correct site. These findings are consistent with observations in other sub-Saharan African settings, where mothers showed relatively accurate knowledge about vaccine administration methods [7,12]. However, the misconception among 8.9% of mothers that the vaccine could be administered orally highlights the potential confusion caused by the simultaneous promotion of oral vaccines for other diseases, such as polio. This indicates the need for clear, specific educational materials to differentiate between vaccines.

Educational level and household income were significantly associated with correct knowledge about the measles vaccine. Mothers with higher educational levels (secondary or above) demonstrated better knowledge, a trend also reported in Ethiopia [8] and Nigeria [9]. Similarly, mothers from higher-income households had better knowledge, reflecting findings from studies in Sudan [13] and other low-resource settings [14]. The positive correlation between education and knowledge suggests that educated mothers may have better access to reliable health information through formal channels. Conversely, low-income households may face barriers such as limited access to health education and healthcare services, exacerbating knowledge gaps. Targeted interventions focusing on these vulnerable groups are essential to bridging disparities.

A significant number of mothers (56.3%) incorrectly cited diarrhea as a contraindication for measles vaccination. This misconception could lead to unnecessary delays and missed opportunities for vaccination. Similar beliefs were reported in studies from Sudan and other African countries, where cultural and traditional practices often influenced vaccination decisions [10,11]. This finding underscores the importance of addressing misinformation through culturally sensitive health education campaigns. Training healthcare workers to proactively dispel such misconceptions during routine visits could improve vaccination rates.

Accessibility problems were reported by 36.3% of mothers, who were unable to vaccinate their children due to unavailability of vaccines or health workers. Similar logistical challenges have been documented in studies across sub-Saharan Africa, including Sudan [10,14]. Poor supply chain management, lack of trained personnel, and scheduling inconsistencies are common in low-resource settings [15,16]. Interventions to ensure consistent vaccine availability and reliable staffing at health centers are critical to addressing these barriers, as well mobile health teams and community-based immunization campaigns could also enhance vaccine accessibility in remote areas [15].

Conclusion and Recommendations

This study has highlighted the elevated level of awareness among mothers in Refe Khashm Al Girba district about the measles' vaccine. However, significant gaps in correct knowledge, particularly about the timing of vaccination, were identified. These gaps are associated with the mother's educational level and household income, suggesting that socio-economic factors play a critical role in determining health knowledge and behavior. Targeted educational campaigns should be implemented to improve mothers' knowledge about the correct timing of measles vaccination. These campaigns should be tailored to the needs of mothers with lower levels of education and those from lower-income households. Additional research is needed to explore the barriers to vaccination in more depth, particularly in rural and underserved areas. Understanding the specific challenges faced by mothers in these settings can help to inform more effective interventions.

Ethics Approval and Consent to Participate

Permission was taken from the district authority. A written informed consent was obtained from all participants before their involvement in the study. Confidentiality of information was maintained through the process of research project.

Data Availability

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that they have no competing interests.

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