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Saudi' mothers understanding towards pediatrics acute gastroenteritis and its management

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ABSTRACT

Background: Acute Gastroenteritis (AGE) is an emerging infectious disease-causing pediatric morbidity and mortality worldwide. *Method:* A cross-sectional Arabic language anonymous questionnaire-based study was performed among the Saudi mothers' population October – December 2021. *Results:* Up to 1301 Saudi mothers completed the study questionnaire. As for the first action that Mothers should do for a child with AGE, 52.3% of the mothers reported for consult physician, followed by starting ORS (16.7%), giving fluids (6.5%), and increasing frequency of breastfeeding (5.6%). Furthermore, good knowledge level was remarkably higher among young aged mothers (< 25 years) than among old aged group (56 or more) (42.7% vs. 13%, respectively; P=.001). Also, 45.8% of university graduated mothers had a higher understanding level compared to 19.5% of those below the secondary educational level (P=.001). In addition, our result detected good knowledge among 55.2% of mothers who started fluid therapy as the first step for AGE, compared to 48.2% of caregivers who went to a physician and 12.5% of those who consulted pharmacies (P=.001). *Conclusion:* Overall, we found that mothers' knowledge and attitude toward AGE were reasonably good. However, their practice in managing AGE signs and symptoms at home was relatively poor. Factors associated with gastroenteritis management were education, knowledge level, and attitude. Thus, the deficiency of knowledge poor attitude continues to cause a substantial burden on the hospitals.

Keywords: Acute Gastroenteritis, Pediatrics, Mothers Knowledge

1. INTRODUCTION

Acute Gastroenteritis (AGE) is an infection of the gastrointestinal tract that presents with rapid onset of diarrhea, with or without nausea, vomiting, fever, or abdominal pain (Dalby-Payne & Elliott, 2003; Gholam et al., 2019). The causative pathogens are varied according to many factors, such as the year's season. In children, rotavirus is the main prevalent cause of gastroenteritis

(Elizabeth Jane Elliott, 2007; Khoury et al., 2011). However, vaccination showed a significant effect in declining the numbers caused by rotavirus, making norovirus the most common currently (Dennehy, 2011; Elizabeth Jane Elliott, 2007).

AGE is a life-threatening condition that globally considers the leading cause of morbidity and mortality in children (Dennehy, 2011). In United Stated, AGE is the primary cause of 1.5 million outpatient visits, 200,000 hospitalization, and 300 deaths yearly in children younger than 5 years old (Dalby-Payne & Elliott, 2003; Gholam et al., 2019; King et al., 2003). Previous studies conducted in Saudi Arabia showed that AGE prevalence increased last years. In 2007, it accounted for 10-46% (Al Ayed et al., 2013; Khoury et al., 2011; Meqdam & Thwiny, 2007), and reached 65.5% during 2008 to 2010 (Tayeb et al., 2011). AGE was diagnosed clinically with no exact role of laboratory investigation. Physicians must take a detailed history regarding the nature, quantity, and frequency of diarrhea and vomiting. Other characteristic assessments about the oral intake, urine output, history of traveling, and mediation should not be missed (Elizabeth Jane Elliott, 2007; Gholam et al., 2019).

As AGE is an emergency condition and can lead to crucial complications, mothers should have adequate knowledge regarding the signs of dehydration that can lead to their child's life to provide proper home management (Webb et al., 2010). The management of AGE differs according to the level of dehydration. Detecting the early signs of mild to moderated dehydration helps mothers manage their child's case at home with oral rehydration therapy or Oral Rehydration Solution (ORS) before deteriorating the condition until it needs hospitalization (Dalby-Payne & Elliott, 2003; Gholam et al., 2019; Treatment & Diarrhoea, n.d.).

Since most of the cases of paediatric AGE can be handled at home, with mothers serving as primary caregivers, their knowledge about this common paediatric condition is critically important. Therefore, the current study sought to evaluate mothers' knowledge regarding gastroenteritis signs and symptoms and its home management in Saudi Arabia.

2. METHOD

A cross-sectional Arabic language anonymous questionnaire-based study was performed among the Saudi mothers' population for period of three months October 2021. This questionnaire is a modification of a previously implemented familiar one (Alghadeer et al., 2021). Further validation for this modified questionnaire took place by applying the Cronbach Alpha equation to the added questions on the original questionnaire.

Data analysis

After extracting the data, it was reviewed, coded, and gain access to the statistical software IBM SPSS version 22(SPSS, Inc. Chicago, IL). Two-tailed tests were used for all statistical analyses. Statistical significance was described as a P value of less than 0.05. For knowledge questions, each correct answer was given one point, and the total summation of the different items' discrete scores was calculated. A patient with a score less than 60% (22 points) of the maximum score was considered to have poor awareness, while good awareness was considered if he had a score of 60% (23 points or more) of the maximum or more. Descriptive analysis was conducted in all variables based on the frequency and percent distribution, including maternal age, education level, job title, children's data, history of child complaint of AGE, knowledge items regarding AGE, ORS, and perceived awareness AGE. Cross tabulation was used to investigate the distribution of mothers' knowledge level according to their personal data and child attacks of AGE. Pearson chi-square test and exact probability test for small frequency distributions were used to test the relations between the variables.

3. RESULTS

Up to 1301 Saudi mothers completed the study questionnaire. Exact of 398 (30.6%) mothers were from the Western region, 258 (19.8%) from the Eastern region, 244 (18.8%) from the Central region, 221 (17%) from the Northern Region, and 180 (13.8%) from the southern region. Mothers' ages ranged from 18 to 65 years with an average age of 37.5 ± 12.8 years old. University level of education and postgraduate degrees were the most stated educational level (67.9%; 883), while 113 (8.7%) had below secondary educational level. As for work, 581 (44.7%) were housewives, 383 (29.4%) were non-healthcare workers, and 125 (9.6%) were students. An exact of 653 (50.2%) had 2-4 children while 399 (30.7%) had more than four children, and only 249 (19.1%) had one child (table 1).

Table 1 the Sociodemographic statistics of study mothers in Saudi Arabia

Socio-demographic data	No.	%
Region		
Central region	244	18.8%
Northern region	221	17.0%

Eastern region	258	19.8%
Western region	398	30.6%
Southern region	180	13.8%
Age in years		
18-25	143	11.0%
26-35	394	30.3%
36-45	448	34.4%
46-55	239	18.4%
56+	77	5.9%
Educational level		
Below secondary	113	8.7%
Secondary	305	23.4%
University / above	883	67.9%
Work		
Housewife	581	44.7%
Student	125	9.6%
Non-health care worker	383	29.4%
Health care worker	85	6.5%
Retired	127	9.8%
No. of children		
1 child	249	19.1%
2-4	653	50.2%
> 4	399	30.7%

Table 2 Exhibit the distribution of study mothers according to the history of gastroenteritis among their children, Saudi Arabia. 861 (66.2%) mothers stated that their children previously had AGE attacks. It was for one time among 168 (19.5%) of the mothers' children, and for 1-2 times among 150 (17.4%), while 322 (37.4%) mothers reported for more than twice. As for the age of AGE attacks, 253 (29.4%) reported for child age of 1-3 years, 166 (19.3%) at the age of 4-6 years, but 386 (44.8%) reported it was at different ages. An exact 245 (28.5%) mothers said their children were hospitalized due to a previous AGE attack.

Table 2 Distribution of study mothers according to history of gastroenteritis among their children, Saudi Arabia

GE among children	No.	%
Previously had child complained of GE		
Yes	861	66.2%
No	281	21.6%
Don't remember	159	12.2%
If yes, how many times? (n=861)		
1 time	168	19.5%
1-2 times	150	17.4%
> 2 times	322	37.4%
Don't remember	221	25.7%
At which age child had GE? (n=861)		
< 1 year	56	6.5%
1-3	253	29.4%
4-6	166	19.3%
At different ages	386	44.8%
Child was hospitalized due to GE (n=861)		
Yes	245	28.5%
No	616	71.5%

Table 3 displays the distribution of study mothers' knowledge and awareness regarding AGE clinical features, effect, and prevention. As for the first action that should be done for a child with AGE, 52.3% of the mothers stated to consult a physician, followed by starting ORS (16.7%), giving fluids (6.5%), and increasing frequency of breastfeeding (5.6%). As for symptoms of pediatric AGE, the most known among mothers were Diarrhoea (78.7%), followed by Nausea & vomiting (69.9%), Abdominal pain (67.9%), and Loss of appetite (50.1%). An exact 85.7% of the mothers know that gastroenteritis may cause a risk of dehydration. About critical signs of dehydration, Dry mouth and tongue was the most reported (69.6%), followed by pale skin color (63.3%), Decreased urine output (55.6%), the sunken appearance of the eyes or cheeks (50.7%), Lack of attention with lethargy (45.3%), and Cold hands and feet (30.2%). When asking mothers about signs necessitate to consult the child physician, 71.1% selected for Fever over 38°C, followed by Diarrhoea for more than a week (68.6%), Vomiting for three or more days (62.9%), Signs of dehydration (58.9%), Shortness of breath or rapid breathing (56.1%), Appearance of blood with stool (55.6%), and Appearance of green juice with vomiting (46.8%). Regarding preventive measures of AGE among children, the most identified among mothers were Keeping food clean (73.4%), followed by Wash hands regularly (64.2%), Cleaning and disinfection of contaminated surfaces (60.1%), Breastfeeding (51.1%), and having a rotavirus vaccine (39.9%).

Table 3 Distribution of study mothers' knowledge and Awareness regarding GE clinical features, effect, and prevention

Awareness items		No.	%
If you suspect that your child has gastroenteritis, what do you think will be your first action?	Consult physician	680	52.3%
	Start ORS	217	16.7%
	Give Fluids (water / juice)	84	6.5%
	Increase frequency of breast feeding	73	5.6%
	Consult pharmacist	31	2.4%
	Call mother for help	29	2.2%
	Stop breast feeding	28	2.2%
	Don't know	159	12.2%
What are the symptoms of gastroenteritis in children?	Diarrhea	1024	78.7%
	Nausea & vomiting	909	69.9%
	Abdominal pain	883	67.9%
	Loss of appetite	652	50.1%
	Malaise and lethargy	592	45.5%
	Fever	493	37.9%
	Don't know	37	2.8%
Gastroenteritis may cause a risk of dehydration?	Yes	1115	85.7%
	No	83	6.4%
	Don't know	103	7.9%
What are the critical signs of dehydration?	Dry mouth and tongue	905	69.6%
	pale skin colour	824	63.3%
	Decreased urine output	724	55.6%
	Skin is darker than usual	724	55.6%
	The sunken appearance of the eyes or cheeks	660	50.7%
	Lack of attention with lethargy	590	45.3%
	Cold hands and feet	393	30.2%
	No tears when crying	256	19.7%
	Don't know	82	6.3%
In your opinion, you should see a doctor if the child	Fever over 38°C	925	71.1%
	Diarrhea for more than a week	892	68.6%
	Vomiting for three or more days	818	62.9%
	Signs of dehydration	766	58.9%
	Shortness of breath or rapid	730	56.1%

	breathing		
	Appearance of blood with stool	724	55.6%
	Appearance of green juice with vomiting	609	46.8%
	Less than 6 months old	443	34.1%
	Don't know	53	4.1%
Gastroenteritis in children can be prevented by	Keeping food clean	955	73.4%
	Wash hands regularly	835	64.2%
	Cleaning and disinfection of contaminated surfaces	782	60.1%
	Breast feeding	665	51.1%
	Get a rotavirus vaccine	519	39.9%
	Don't know	88	6.8%

Table 4 reveals the distribution of study mothers' knowledge regarding oral rehydration solutions. 733 (56.3%) of the study mothers know about ORS. A total of 634 (86.5%) of those who know about ORS told that it prevents child dehydration, 53 (7.2%) think it increases or decreases the Diarrhoea, while 28 (3.8%) told it has no role in treating Diarrhoea. The most frequently mentioned source of information on ORS was physicians (73%), followed by family and friends (10.4%), pharmacists (8.6%), and the internet (7.5%).

Table 4 Distribution of study mothers' knowledge regarding oral rehydration solution

Knowledge regarding ORS	No.	%
Know what oral rehydration solutions (ORS) are?		
Yes	733	56.3%
No	568	43.7%
What is the role of ORS in Diarrhea? (n=733)		
Prevents child dehydration	634	86.5%
Increase or decrease Diarrhea	53	7.2%
Has no role in treating Diarrhea	28	3.8%
Don't know	18	2.5%
Source of information regarding ORS (n=733)		
Physicians	535	73.0%
Pharmacist	63	8.6%
Internet	55	7.5%
Family / friends	76	10.4%
TV	4	.5%

Table 5 illustrates the perceived awareness of study mothers regarding gastroenteritis attacks among children. Exactly 77.1% of the mothers agreed that water is the best drink to replace lost fluids after vomiting or Diarrhoea; 64.3% agreed that babies are more prone to get dehydrated than older children 51.2% think gastroenteritis is contagious. However, 28.9% of the mothers agreed that giving the child's fluids worsens the Diarrhoea, and according to 33.4% of respondents, starving the child for a short period reduces diarrhea-related gastroenteritis. Moreover, 38.6% told Flu vaccines can help prevent gastroenteritis.

Table 5 Perceived awareness of study mothers regarding gastroenteritis attacks among children

Perceived awareness items	Disagree		Neutral		Agree	
	No.	%	No.	%	No.	%
Giving fluids to the child makes worsen the Diarrhea	751	57.7%	174	13.4%	376	28.9%
Gastroenteritis is contagious	401	30.8%	234	18.0%	666	51.2%
Babies are more probably to get dehydrated than older children	194	14.9%	270	20.8%	837	64.3%
Starving the child for a short period reduces Diarrhea associated with gastroenteritis	552	42.4%	315	24.2%	434	33.4%
Flu vaccines can help prevent gastroenteritis	348	26.7%	451	34.7%	502	38.6%
Water is the best drink to replace lost fluids after a bout of vomiting or Diarrhea	135	10.4%	163	12.5%	1003	77.1%

Figure 1 shows mothers' practice regarding pediatric acute gastroenteritis and its management. The most-reported practice was consulting physician (60.5%), followed by start fluid therapy (22.3%), giving ORS (7%), calling mothers and friends for help (4.9%), consulting pharmacist (2.8%), stopping breastfeeding (1.5%), and increase breastfeeding (1%). Figure 2 demonstrates the overall level of knowledge of Saudi mothers regarding pediatric acute gastroenteritis and its management. 531 (40.8%) had a higher understanding level regarding pediatric acute gastroenteritis and its management, while 770 (59.2%) had a poor knowledge level.

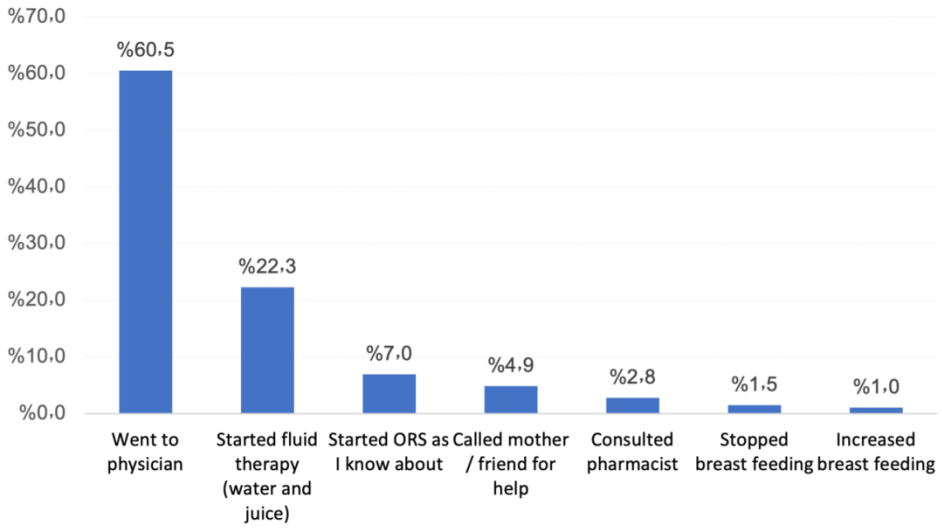

Figure 1 Saudi mothers practice regarding paediatric acute gastroenteritis and its management

Figure 2 overall knowledge levels of Saudi mothers regarding paediatric acute gastroenteritis and its management

Table 6 displays the distribution of Saudi mothers' overall knowledge regarding gastroenteritis attacks among children by their personal data. Young mothers (under 25 years) had a statistically significant higher level of understanding in comparison to older mothers (56 or more) (42.7% vs. 13%, respectively; P=.001). Also, 45.8% of university graduated mothers had a good comprehension level compared to 19.5% of those below the secondary educational level (P=.001). An exact 56.5% of mothers' healthcare profession had good understanding compared to 40.4% of housewives (P=.001). Our result detected an excellent knowledge level among 46.6% of mothers with child complained of AGE compared to 28.5% of those who did not (P=.001). Also, Our finding detected good knowledge among 55.2% of mothers who started fluid therapy as the first step for AGE compared to 48.2% who went to a physician and 12.5% of those who consulted pharmacies (P=.001).

Table 6 Distribution of Saudi mothers' overall knowledge regarding gastroenteritis attacks among children by their personal data

Factors		Overall knowledge level				p-value
		Poor		Good		
		No	%	No	%	
Region	Central region	142	58.2%	102	41.8%	.057
	Northern region	176	79.6%	45	20.4%	
	Eastern region	118	45.7%	140	54.3%	
	Western region	226	56.8%	172	43.2%	
	Southern region	108	60.0%	72	40.0%	
Age in years	18-25	82	57.3%	61	42.7%	.001*
	26-35	222	56.3%	172	43.7%	
	36-45	239	53.3%	209	46.7%	
	46-55	160	66.9%	79	33.1%	
	56+	67	87.0%	10	13.0%	
Educational level	Below secondary	91	80.5%	22	19.5%	.001*
	Secondary	200	65.6%	105	34.4%	
	University / above	479	54.2%	404	45.8%	
Work	Housewife	346	59.6%	235	40.4%	.001*
	Student	84	67.2%	41	32.8%	
	Non-health care worker	203	53.0%	180	47.0%	
	Health care worker	37	43.5%	48	56.5%	
	Retired	100	78.7%	27	21.3%	
No. of children	1 child	159	63.9%	90	36.1%	.122
	2-4	370	56.7%	283	43.3%	
	> 4	241	60.4%	158	39.6%	
Previously had child complained of GE	Yes	460	53.4%	401	46.6%	.001*
	No	201	71.5%	80	28.5%	
	Don't remember	109	68.6%	50	31.4%	
If yes, how many times?	1 time	80	47.6%	88	52.4%	.063
	1-2 times	93	62.0%	57	38.0%	
	> 2 times	156	48.4%	166	51.6%	
	Don't remember	131	59.3%	90	40.7%	
At which age child had GE?	< 1 year	35	62.5%	21	37.5%	.001*
	1-3	134	53.0%	119	47.0%	
	4-6	113	68.1%	53	31.9%	
	At different ages	178	46.1%	208	53.9%	
Child was hospitalized due to GE	Yes	143	58.4%	102	41.6%	.067#
	No	317	51.5%	299	48.5%	
	Don't remember	0	0.0%	0	0.0%	

What was the first practice you did when you noticed the symptoms of gastroenteritis in your child?	Went to physician	270	51.8%	251	48.2%	
	Started fluid therapy (water and juice)	86	44.8%	106	55.2%	
	Started ORS as I know about	37	61.7%	23	38.3%	
	Called mother / friend for help	30	71.4%	12	28.6%	.001*
	Increased breast feeding	6	66.7%	3	33.3%	
	Stopped breast feeding	10	76.9%	3	23.1%	
	Consulted pharmacist	21	87.5%	3	12.5%	

P: Pearson X^2 test *#: Exact probability test* ** P < 0.05 (significant)*

4. DISCUSSION

In the initial stage of the study, mothers' knowledge of AGE clinical features was evaluated beside its effects, and prevention. When asked what mothers should do the first step for a child with GE, 52.3 % of mothers said they would consult a physician. These findings seem similar to another study, which found that 120 (73%) of parents chose a family physician as their medical advice' source about their children's AGE (O'loughlin et al., 1995). The low utilization rate of ORS by mothers (n= 217; 16.7%) when managing AGE at home reflects Insufficient level of knowledge regarding its efficacy as a therapy. A previous study found that (n= 53; 32%) parents were advised to use ORS, but only 9% did so14 (Elliott et al., 1996). Another research concluded that (n= 65; 44%) parents offered ORS to their children at home before hospital presentation15 (McCann et al., 2002). As part of this study, diarrhea (78.7%) was the most frequently reported symptom of pediatric AGE by mothers, followed by nausea and vomiting (69.9%). The majority of mothers (85.7%) know that gastroenteritis may lead to dehydration. Among those who knew critical signs of dehydration, dry mouth and tongue were reported the most frequently (69.6%), while in another local study, only (n= 366; 32.1 %) of the enrolled mothers could identify thirst and dry mouth as an obvious sign of dehydration (Alghadeer et al., 2021).

When mothers were asked what indications should prompt them to seek medical attention for their children, 71.1 % chose fever above 38°C, and more than half of the sample (55.6%) only reported the appearance of blood with stool as an indication to consult a physician. A recent Saudi study reported similar results in which the passage of bloody stool, according to (n= 553; 49%) of the mothers, is an obvious critical sign that necessitates a hospital or physician visit (Alghadeer et al., 2021). That showed Saudi mothers had a good status of understanding than mothers from different countries. Based on a study carried on in Ethiopia, (n= 154; 39.5 %) of mothers reported that passing bloody stool is a sign of serious diarrhea (Merga & Alemayehu, 2015). Additionally, (n= 27; 20.8 %) of mothers in a study conducted in Nepal considered red-colored diarrhea to be "the most serious diarrhea" (Mukhtar et al., 2011). Adequate knowledge about the critical signs of childhood diarrhea is important as the early referral of a child with severe diarrhea is essential for appropriate treatment.

The subjects demonstrated effective preventive measures in AGE prevention methods for children. The most often identified among mothers was keeping food clean (73.4 %). However, roughly half of them (51.1 %) agreed that breastfeeding might prevent AGE, and 39.9 % reported having a rotavirus vaccination as a preventive strategy. A local study found that the higher percentage of mothers (n= 808; 70.9 %) believed that hand washing helps prevent diarrhoeal-related illness; similarly, (n= 835; 64.2%) of mothers in our study indicated hand washing as a preventive measure (Alghadeer et al., 2021). Regarding overall knowledge of pediatric AGE, 531 (40.8 %) of Saudi mothers had good knowledge and understanding of pediatric AGE and how to treat it, whereas 770 (59.2%) showed a low level of understanding. In terms of demographics, we noted that young mothers (under 25 years) had a higher comprehension level than older mothers (56 or more) significantly. (42.7% vs. 13%, respectively; P=.001). In addition, 45.8% of university-educated mothers had good knowledge than 19.5 % of mothers with less than a secondary educational level (P=.001).

The study administered in Nepal, Colombia, and Tanzania also found similar results (Rehan et al., 2203; Merali et al., 2018; Mwambete & Joseph, 2010). In addition, 46.6 % of mothers with children who complained of AGE showed a high level of knowledge, compared to 28.5 % of mothers who did not (P=.001). This detection is in line with a previous study that showed mothers' basic knowledge about diarrhea increases with prior experience managing the disease (Anidi et al., 2002). We found that caregivers' attitude is significantly correlated with their level of knowledge ($p < 0.001$), which is in turn affected by education, 55.2 % of mothers who started fluid therapy as the first step for AGE had high knowledge, compared to 48.2 % of those who went to a doctor and 12.5 % of those who went to pharmacies. This detecting is in line with a study carried on in Ethiopia (Mekonnen et al., 2018).

The next objective was to assess mothers' understanding regarding oral rehydration solutions. 733 (56.3 %) of the participants were aware of using ORS. 634 (86.5 %) of mothers stated that it prevents child dehydration. Similar findings were reported in two studies conducted in Saudi Arabia and Nigeria, and most of the mothers were aware of using ORS (n= 706; 62%), (n= 154; 76%),

respectively (Alghadeer et al., 2021b; Onyekwere et al., 2011). Moreover, Physicians were the most often reported source of ORS knowledge in our study (73%). Local study support this finding where physicians were the main resource of mothers regarding ORS (n= 573; 50.3%) (Alghadeer et al., 2021); moreover, another study showed the main resources of mother were families/friends (n= 159; 76%) and paediatricians (n= 121; 58%) (Kudlova, 2010).

Furthermore, the present study was focused to determine the mothers' attitude regarding pediatric AGE. 77.1 % of mothers agreed that water is the best drink to replenish lost fluids after vomiting or diarrhea, 64.3 % agreed that babies are more likely than older children to get dehydrated, and 51.2 % agreed gastroenteritis is communicable. The variation in understanding of childhood AGE might be attributed to differences in mothers' educational levels. On the other side, 28.9 % of mothers believed that feeding fluids to the child worsen diarrhea, and 33.4 % believed that starving the child for a short time decreases diarrhea linked with gastroenteritis. Efforts should be made to educate mothers about gastroenteritis attacks among children.

In this study, the following limitations were noted. First, the limited period in which the study was carried out may lead to over or under-reporting of AGE since AGE disease has some seasonal variations. Second, the assessment of AGE prevalence was based on caregivers' reports, which may have introduced some recall bias. Third, our study did not include determinant factors like nutritional factors due to the limitation of time and resources. Future studies will address these limitations.

Conclusions and Recommendations

The current study explored socio-economic, environmental, and knowledge-related factors associated with AGE diseases in several regions, Saudi Arabia. Overall, our study found that mothers' knowledge and attitude toward pediatric AGE were reasonably good. At the opposite, their practice of managing AGE signs and symptoms at home was relatively poor. Aspects associated with gastroenteritis management were education, knowledge level, and attitude. Thus, the deficiency of knowledge poor attitude continues to cause a substantial burden on the hospitals. Therefore, as countries aim to alleviate pressure on healthcare systems, focusing on parental concerns highlights the need for efforts and interventions that enable parents to assume informed responsibility for their children's care and treatment when they have a fever or diarrhea disease.

Ethical approval

The study was approved by the Medical Ethics Committee of University of Hail (ethical approval code H-2021-167).

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Author's contributions

All the authors contributed to the selection of the idea, proposal writing, data collection, data entry and analysis, results and discussion writing and final revision of the article.

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Conflict of interests

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

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