



## Dietary intake as one of gastroenteritis causes among Sudanese children under 5 years

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### Abstract

Children's poor eating practices and nutritional deficits lead to inflammation in the digestive tract, which subsequently results in fever, cramping in the abdomen, diarrhoea, vomiting, and dehydration or all of them, which might occasionally result in serious issues. Thus, educating mothers about nutrition is one of the most crucial approaches to prevent this. This study aimed to assess the contribution of food consumption to the development of gastroenteritis in Sudanese children under five years of age. This cross-sectional study was carried out over the period (June to November 2022) at seven health care centres from seven regions in Khartoum State using a pre-tested questionnaire-based approach generated both paper-based and electronically. It was carried out with 639 child mothers who had visited such centres as outpatients along with their children participated in the study. Among the children, the majority (54.9%) were female, the majority (45.1%) were in the 1 to <3-year age group, the majority (59.8%) were from villages, the majority (53.5%) had been weaned and were consuming additional foods, and the majority (39.1%) suffered from gastroenteritis or had experienced it more than three times. Along with the significance of mothers' knowledge, there is a statistically significant variable ( $p = <0.001$ ) between the forms of gastroenteritis and the meal types that started with. For this reason, it's critical to counsel mothers and make them aware of the value of providing their children with a healthy diet.

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## Introduction

Up to date gastroenteritis remains a common illness among infants and children throughout the world (Vasco *et al.*, 2014). Especially in low-income economies and is responsible for 10% of the overall burden globally including sub-Saharan Africa (Iturriza *et al.*, 2020). Mortality due to childhood diarrhoea has decreased over the recent decades due to improved detection, preventive and proper treatment; nonetheless, acute gastroenteritis is still a major concern ((Arowolo *et al.*, 2019). globally, gastroenteritis is responsible for an estimated 19% deaths in children under five years (Boschi *et al.*, 2008). globally, around 1.3 million people were died due to diarrhoea and of the total deaths about 0.54 million were children of under-five years of age. Majority of the mortality were occurred in developing countries (WHO/UNICEF, 2015). Gastroenteritis, characterized by diarrhoea with or without vomiting, is a major cause of morbidity and mortality in children. Although it is generally a mild disease that sometimes resolves spontaneously, it is one of the most common reasons for hospitalization and is associated with a significant burden of disease (Pieścik *et al.*, 2013). There are some studies that have shown that there are increasing cases of nutritional problems in children, and that up to 50% of healthy children suffer from nutritional problems, and up to 80% of children suffering from these problems. Suffering from delayed growth may have difficulties feeding (Phalen *et al.*, 2013; Al-Hindi *et al.*, 2017). There are a number of factors that are directly related to diarrhoea in children, especially those under 5 years of age, such as the quality of water used for drinking, cooking, cleaning tools, and feeding practicing, and the quality of the environment in which children live, Early breastfeeding initiation, maintenance of breastfeeding, complementary feeding, time to the start of complementary feeding, hygiene of complementary foods, and child vaccination were some of the practices associated with childhood diarrhoea. Colostrum or breast milk, which is rich in nutrients, has benefits to minimize infectious diseases, primarily acute diarrhoea (Tadesse *et al.*,

2016). Diarrhoea in children represents a serious challenge to public health among children when complementary feeding begins, as the general hygiene of food is considered one of the risk factors associated with it, in the case of unhygienic practices for transporting it or containing disease-causing microorganisms (Agustina *et al.*, 2013). Also, the main causes of gastritis are viruses and bacteria, and in rare cases food poisoning and other factors. The severity and frequency of gastrointestinal symptoms have different effects on the condition of different groups of sick children related to their quality of life (Liu *et al.*, 2016). Likewise, feeding disorders in children include a wide range of difficulties that lead to poor oral intake, including, such as choosing foods that are inappropriate for the child's age, oral motor dysfunction, or limited appetite (Thapar *et al.*, 2020). The World Health Organization explains that complementary feeding begins when breastfeeding is insufficient to meet the infant's nutritional needs, which requires eating additional meals, which must begin after the age of 6 months for the child. It is also important to continue breastfeeding for a period of not less than two years in addition to introducing solid foods (Green *et al.*, 2021).

Little research has been conducted in a different context in Sudan on the factors associated with this with gastroenteritis among children less than five years of age and due to on-going lifestyle changes, this study was intended to learn more about the dietary intake and nutritional status on the clinical outcome of gastroenteritis in children.

## Materials and methods

This cross-sectional study was conducted from June 2022 to November 2022, with the aim of evaluating Mothers knowledge of the importance of breastfeeding, risk factors for gastroenteritis, and health practices in children less than 5 years of age. the study was conducted in Khartoum State, the capital of Sudan, which is located in the middle of the populated area of Sudan, with an area located between the western side of the Blue Nile River, the eastern and northern sides, the western side, and

the eastern side of the White Nile State, which consists of three main cities: Bahri, Khartoum, and Omdurman, from which a number of health centres was chosen as follows: Halfaya Health Centre, Al-Naw Health Centre, Abu Saad Health Centre, Umm Badda Centre, East Nile Health Centre, Hilla Koko, Jabal Awliya Health Centre. Mothers with her child from under 5 years who frequent the health centres which provide nutrition, vaccination, and another services were chosen randomly. Data was collected through a questionnaire format to achieve the goal of this study. It consisted a set of questions for mothers, it relates to their level of knowledge, health practices, data on other factors that influence weaning food practices, educational level, marital status, and economic level. Personal care, dealing with a sick child, water source, review relevant literature and previous studies related to this to evaluate the effect of food intake as one of the causes of gastroenteritis among Sudanese children under five years old and how to deal with the child and the child health status. The questionnaire included all mothers who agreed to be interviewed after clarifying the aim of the study, and all mothers who

did not have the desire to answer the questionnaire were excluded. Quantitative data were analysed by use of SPSS V22.

*Ethical consideration*

According to research ethics, the research was permitted after submitting a letter to the state Ministry of Health, and initial data collection was conducted after approval.

**Results**

The demographic features of the children who answered the questionnaire through their mothers are displayed in Table 1, with most of the children being between the ages of one and three. (%44.6), 54.9% are female, the majority are from villages (59.8%), most mothers (46.5%) are between the ages of 31 and 40, and 2% are alone with no one to support the family. Many of them (60.9%) are employed, have only completed secondary school (43.3%), have families with three to five children (37.1%), and have moderately high incomes (57.4%) for the most part. About a year is the average child spacing (51.3%).

**Table 1.** The Socio demographic data of the participants due to the questionnaire used

		Frequency	%	Valid %	Cumulative %
1. Age	Valid				
		< year	273	42.7	42.7
		1 to <3	285	44.6	44.6
		3 to 5	81	12.6	12.5
	Total	639	100.0	100.0	100.0
2. Gender	Valid				
		Male	288	45.1	45.1
		Female	351	54.9	55.0
	Total	639	100	100.0	100.0
3. Residence	Valid				
		City	257	40.2	40.2
		Village	382	59.8	59.9
	Total	639	100.0	100.0	100.0
4. Mother age	Valid				
		< 20	43	6.7	6.7
		21 to 30	122	19.1	19.1
		31 to 40	297	46.5	46.6
		> 40	176	27.7	27.7
	Total	639	100.0		100.0
5. Marital status	Valid				
		Married	626	98	98
		Divorce	9	1.4	1.4
		Widowed	4	0.6	0.6
	Total	639	100.0	100.0	100.0
6. Occupation	Valid				
		Has job	250	39.1	39.1
	Has no job	389	60.9	60.9	100.0

	Total	639	100.0	100.0	
7. Mother education					
Valid	University	187	29.3	29.3	37.1
	Secondary	277	43.3	43.3	69.6
	Primary	147	23.0	23.0	94.0
	Illiterate	28	4.4	4.4	100.0
	Total	639	100.0	100.0	
8. Number of children					
Valid	< 3	292	45.7	45.7	45.9
	3 to 5	237	37.1	37.1	82.9
	> 5	109	17.1	17.1	100.0
	Total	639	100.0	100.0	
9. Father income					
Valid	low	230	36	36	36
	moderate	367	41.8	41.8	41.8
	high	36	5.6	5.6	5.6
	Father not found	6	.9	.9	100.0
	Total	639	100.0	100.0	
10. Child spacing					
Valid	< year	202	31.6	31.6	31.6
	Year	328	51.3	51.3	51.3
	>2 years	109	17.1	17.1	100.0
	Total	639	100.0	100.0	

**Table 2.** Information of the mothers who were surveyed about breastfeeding and gastroenteritis among children

		Frequency	%	Valid %	Cumulative %
1. Received nutritional advices					
Valid	Yes	231	36.2	36.2	36.2
	No	408	63.8	63.8	100.0
	Total	639	100.0	100.0	
2. Knowledge about rehydration					
Valid	Yes	321	46.2	46.2	46.3
	No	318	49.8	49.8	100.0
	Total	639	100.0	100.0	
3. Breastfeeding important					
Valid	Yes	390	61	61	61
	No	249	39	39	100.0
	Total	639	100.0	100.0	
4. Causes of gastroenteritis					
Valid	Yes	339	53.1	53.1	53.1
	No	300	46.9	46.9	100.0
	Total	639	100.0	100.0	

**Table 3.** Explains mothers 'response about the practices in feeding children, how the weaned

		Frequency	%	Valid %	Cumulative %
1. Breastfeeding					
Valid	Breastfeeding	297	46.5	46.5	46.5
	Weaned	342	53.5	53.5	99.5
	Total	639	100.0	100.0	
2. Breastfeeding duration					
Valid	< 6 months	101	15.8	15.8	15.8
	Year	208	32.6	32.6	32.6
	> year	33	5.1	5.1	5.1
	Breastfeeding	297	46.5	46.5	100.0
	Total	639	100.0	100.0	
3. Weaning causes					
Valid	Pregnancy	151	23.6	23.6	23.6
	Child disease	51	8	8	8
	Mother disease	50	7.8	7.8	7.8
	Others	90	14.1	14.1	14.1
	Not weaned	297	46.5	46.5	100.0
	Total	639	100.0	100.0	
4. Weaning method					
Valid	Put foreign material ion breast	171	26.8	26.8	26.8
	Suddenly	71	11.1	11.1	11.1

	Gradually	100	15.6	15.6	15.6
	Not weaned	297	46.5	46.5	100.0
	Total	639	100.0	100.0	
5. Feeding method					
Valid	Spoon	72	11.3	11.3	11.3
	Hand	150	23.5	23.5	23.5
	Bottle only	159	24.9	24.9	24.9
	All mentioned	130	20.3	20.3	20.3
	Not started weaning food	128	20.0	20.0	100.0
	Total	639	100	100	
6. Weaning food started time					
Valid	<4 months	196	30.7	30.7	30.7
	>4 months	315	49.3	49.3	49.3
	Not started	128	20.0	20.0	100.0
	Total	639	100.0	100.0	
7. Weaning food that the baby started with					
Valid	Soft food	150	23.5	23.5	23.5
	Home made	172	26.9	26.9	26.9
	Milk product	155	24.3	24.3	24.3
	Others	34	5.3	5.3	5.3
	Not started	128	20.0	20.0	100.0
	Total	639	100.0	100.0	
8. Most food used					
Valid	Kisrah	37	5.8	5.8	5.8
	Eggs	51	8	8	8
	Rice	100	15.6	15.6	15.6
	Bread	101	15.8	15.8	15.8
	Milk products	171	26.8	26.8	26.8
	Others	51	8	8	8
	Not started	128	20.0	20.0	100.0
	Total	639	100.0	100.0	
9. Drinking water					
Valid	Boiled water	147	23	23	23
	Bottle water	121	18.9	18.9	18.9
	tab water	371	58.1	58.1	100.0
	Total	639	100.0	100.0	

**Table 4.** Mothers' responses about their children's health status

		Frequency	%	Valid %	Cumulative %
1. Type of suffered disease					
Valid	Gastroenteritis (vomiting & diarrhoea)	341	53.4	53.4	53.4
	Not suffered	258	40.4	40.4	93.7
	Other diseases	40	6.3	6.3	100.0
	Total	639	100.0	100.0	
2. Gastroenteritis disease frequency					
Valid	<3 times	201	31.5	31.5	31.5
	3 to 5	250	39.1	39.1	39.1
	Frequency many times	137	21.4	21.4	21.4
	Not suffered	51	8.0	8.0	100.0
	Total	639	100.0	100.0	
3. Child weight					
Valid	Under weight	130	20.3	20.3	20.3
	Over weight	87	13.6	13.6	13.6
	Normal weight	422	66.0	66.04	100.0
	Total	639	100.0	100.0	
4. Eating disorders with the start of weaning food					
Valid	Yes	300	47	47	47
	No	211	33.0	33.0	33.0
	Not started	128	20.0	20.0	100
	Total	639	100.0	100.0	
5. Vaccination started					
Valid	Yes	571	89.3	89.3	89.3
	No	62	9.7	38.0	100.0
	Total	639	100.0	100.0	

6. Regular vaccination					
Valid	Yes	380	59.5	59.5	59.5
	No	259	40.5	40.5	100
	Total	639	100.0	100.0	
7. Child has been to the physician before					
Valid	Yes	246	38.5	38.5	38.5
	No	393	61.5	61.5	100.0
	Total	639	100.0	100.0	
8. Have been hospitalized before					
Valid	Yes	85	13.3	13.3	13.3
	No	554	86.7	86.7	100.0
	Total	639	100.0	100.0	
9. Food allergy					
Valid	Yes	18	2.8	2.8	2.8
	No	621	97.2	97.2	100.0
	Total	639	100.0	100.0	
10. Food allergy types					
Valid	Wheat	5	0.9	0.9	0.9
	Eggs	3	0.5	0.5	0.5
	Some fruits	2	0.3	0.3	0.3
	Milk	4	0.6	0.6	0.6
	others	4	0.6	0.6	0.6
	Not allergies	621	97.2	97.2	100.0
	Total	639	100.0	100.0	

Table 2 shows the extent of mothers' knowledge, as most of them (63.8%) did not take advice about children's nutrition, and (49.8%) of them did not have knowledge about treating dehydration, and the causes of gastroenteritis (46.9) %, and the importance of breastfeeding (46.9%).

Table 3 shows breastfeeding and food intake practices, as (15.8%) were weaned before 6 months, and 23.6% were weaned due to pregnancy, and most of them (26.8%) were weaned by placing a foreign substance on the breast, and the majority of them (24.9%) used a bottle feeding. 30.7% of them started eating foreign foods before 4 months, most of them

(26.9%) started their weaning food with home-made, The majority of the foods used were dairy products (26.8%) and (58.1%) used tab water.

Table 4 shows the health condition that the child experienced, according to the mother's statement, which is that (53.4%) suffer or had suffered from Gastroenteritis (vomiting & diarrhea). 39.1% suffered from it between 3 and 5 times, and 21.4% suffered from it repeatedly, about 33.9% of them have abnormal weights, 38.5% of the participating children had previously been seen by a doctor due to illness, 13.3% of them had been admitted to the hospital before, 2.8% of them suffer from some types of foods.

**Table 5.** Cross-tabulation of mother occupation and breastfeeding

Mother occupation	Breastfeeding duration		Total
	Breastfeeding	Weaned	
Mother has job	51 (20.4%)	199 (79.6%)	250 (100.0%)
Mother has no job	142 (36.5%)	247 (63.5%)	389 (100.0%)
Total	193 (30.2%)	446 (69.8%)	639 (100.0%)

**Table 6.** Cross-tabulation of suffered disease and breastfeeding duration

Suffered disease	Breastfeeding duration time				Total
	< 6 months	One year	> year	Breastfeeding	
Gastroenteritis (vomiting & diarrhoea)	75 (53.4%)	111 (53.3%)	20 (60.6%)	135 (60.6%)	341 (341.0%)
Not suffered	14 (40.4%)	70 (33.7%)	12 (36.4%)	162 (36.4%)	258 (258.0%)
Other diseases	12 (11.9%)	27 (13%)	1 (3.03%)	0 (0.0%)	40 (40.0%)
Total count	100 (15.6%)	209 (32.7%)	33 (5.2%)	297 (46.5%)	639 (100.0%)

**Table 7.** Cross-tabulation of mother get nutritional advice and knowledge of the importance of breastfeeding

Mother get nutritional advice	Knowledge of the importance of breastfeeding		Total
	Yes	No	
Yes	231 (100.0%)	0 (0.0%)	231 (100.0%)
No	90 (22.1%)	318 (77.9%)	408 (100.0%)
Total count	321 (50.2%)	318 (49.8%)	639 (100.0%)

**Table 8.** Cross-tabulation of mother get advice and know rehydration

Mother get advices	Rehydration knowledge		Total
	Yes	No	
Yes	201 (87.0%)	30 (13.0%)	231 (100.0%)
No	121 (29.7%)	287 (70.3%)	408 (100.0%)
Total count	322 (50.4%)	317 (49.6%)	639 (100.0%)

**Table 9.** Cross-tabulation of suffered diseases and child weight

Suffered diseases	Child Weight			Total
	Under weight	Over weight	Normal weight	
Gastroenteritis	101(29.%)	16 (4.7%)	224 (65.7%)	14 (100.0%)
Food allergy	9(64.3%)	3 (21.4%)	2 (14.3%)	26 (100.0%)
Other diseases	12(46.2%)	10(38.5%)	4 (15.4%)	258(100.0%)
Not suffered	8(3.1%)	48(18.6%)	202(78.3%)	639(100.0%)
Total count	130(20.3%)	77(12.1%)	432(67.6%)	341 (100.0%)

**Table 10.** Cross-tabulation of gastroenteritis and types of food started

Gastroenteritis	Types of food started with				Total
	Soft diet	Home made	Milk products	Other food	
Yes	62 (18.2%)	151 (44.3%)	98 (28.7%)	30 (8.8%)	341 (100.0%)
No	94 (55.3%)	15 (8.8%)	57 (33.5%)	4 (2.4%)	170 (100.0%)
Total count	156 (30.5%)	166 (32.5%)	155 (30.3%)	34 (6.7%)	511 (100.0%)

Statistically significant variable at  $p = < 0.001$

Cross-tabulation, also known as contingency table or crosstab, is a statistical technique used to summarize the relationship between two categorical variables. Cross-tabulation of mother occupation and breastfeeding, suffered disease and breastfeeding duration, mother get nutritional advice and knowledge of the importance of breastfeeding, mother get advice and know rehydration, suffered diseases and child weight, and gastroenteritis and types of food started are presented in Table 5-10.

**Discussion**

Through analysis of mothers' reports, there is a large number of children (53.4%) suffering from gastroenteritis. There is also a strong association between the types of food for children, especially homemade food, (26.9%) and gastroenteritis, as well as early weaning of children (15.6%), which was mostly among working mothers, (statistically significant variable at  $p = < 0.001$ ), some wrong

feeding practices, such as the exclusive use of bottle feeding (24.9%) which may be used in the wrong way. which also appears in the high percentage of nutritional disorders at the beginning of the use of complementary foods (47%) All of this requires providing health education to mothers, as the percentage of mothers who received nutritional advice was only (36.2%), There is also a high percentage of parents who are low in income, which negatively affects the health of children. There is also a high percentage of parents with low income, which negatively affects the health of children, as (36%) of parents have low income, which requires to support for these families, Likewise, all of these factors that come into the analysis of the questions can lead to a number of health problems and complications, of which gastrointestinal diseases are a part, especially in terms of mothers' level of knowledge about suitable foods for their blindness and some other health practices.

## Conclusion

This study, which was conducted in 7 health care centres and included groups varying in income, areas of residence, educational level, and other variables, revealed that the prevalence of the disease Gastroenteritis among children under the age of five is still a problem in Sudan due to the high percentage of children included in the study who had suffered from the disease or are suffering from it. There is also a clear association, between gastroenteritis diseases and the foods used, especially those were eaten at the beginning of using complementary foods for the child, early weaning. The study also revealed the a association between child food intake disorders and early weaning, which leads to eating weaning foods early, which also requires the mother to choose the appropriate food for the child in terms of quantity and quality, according to the child's age. There are also inclusion of other causes associated between children under 5 years food intake and gastroenteritis in the questionnaire analysis tables. Most of this can be overcome through health education for mothers of children.

## Recommendations

This study recommends the following in order to reduce complications or reduce the incidence of the disease.

1. Returning the health education system to what it was, as there were specialists to give health education to mothers of children who frequent health centers in the field of child nutrition and the importance of breastfeeding and everything related to healthy practices while feeding the child.
2. Due to the high percentage of low- and middle-income people, the Ministry of Health should try and distribute some small meals to children in need.
3. Seek help from some organizations to support poor families
4. Small booklets should be made that contain all the necessary instructions for mothers, the importance of seeing a doctor when necessary, and the method of making a rehydration solution at home for the child.

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