



CODEN [USA]: IAJPBB

ISSN: 2349-7750

**INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES**<http://doi.org/10.5281/zenodo.3754270>Available online at: <http://www.iajps.com>

Research Article

RISK FACTORS OF DIARRHEA IN CHILDREN YOUNGER THAN 5 YEARS IN KHYBER TEACHING HOSPITAL, PESHAWARAttiq Ur Rehman¹, Dr Ejaz Ahmad², Dr Imad Ali³¹ BS Emergency Care, Institute of Paramedical Sciences (IPMS) Khyber Medical Institute, Peshawar^{2,3} MBBS, Rehman Medical College, Peshawar**Article Received:** February 2020 **Accepted:** March 2020 **Published:** April 2020**Abstract:**

Background: Diarrhea is communicable disease caused by inflammation of gastrointestinal tract by viruses, bacteria, protozoa or toxin that lead to watery stool mostly accompanied by vomiting and fever. After pneumonia, acute diarrhea is second leading cause of death in younger children. According to world health organization (WHO) and UNICEF, worldwide there are more than two billion of diarrheal cases are reported each year. There are many factors that may risk for diarrhea in children it includes un vaccination, poor economic status, contaminated water, unhygienic food, poultry and domestic animals and lack of education.

Aim: To assess and find the major risk factors for diarrhea in children less than 5 years of age.

Material and method: An Analytical cross-sectional questionnaire-based survey was conducted on children less than five year presenting with AGE in pediatric emergency of Khyber teaching Hospital Peshawar. Risk factors associated with diarrhea such as age, gender, residency, mother's education, socio-economic status and unvaccinated were examined.

Results: A total of 150 participants were enrolled into current study, out of which 58% were male and 42% were female, out of total participant 45.3% belong to rural and 55.7% are from urban areas. Male gender, age <1 year, poor sanitary condition, urban residency, low socio-economic status, uneducated mothers, poor hygiene and unawareness were the major risk factors associated with diarrhea in children with ages <5 years.

Key words:

Children, diarrhea, risk factors, unhygienic

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Please cite this article in press Attiq Ur Rehman et al, Risk Factors Of Diarrhea In Children younger Than 5 Years In Khyber Teaching Hospital, Peshawar, Indo Am. J. P. Sci, 2020; 07(04).

INTRODUCTION:

The increase frequency of liquid or watery stool from more than 3-5 times a day is called diarrhea. There are two things to define diarrhea one is softness of stool while other is frequency of bowel. Increase of pasty stool in infant and hard stool with frequent in nature are not diarrhea.(1)Diarrhea is due to disturbance in normal function of GI tract that lead to no or poor absorption of water, food content and electrolyte that causes watery stool. When there is more than 10mg/kg/day in infant and children and 200g/day in adult are consider as diarrhea.(2)

when duration of diarrhoea is lasting than 14 days then called acute diarrhoea. It may be inflammatory when there is blood or mucus in the stool while non-inflammatory is associated with watery stool, nausea, vomiting and sometime abdominal cramps.(3) When duration of diarrhoea is longer than 14 days, called persistent or chronic diarrhoea. May because of chronic infection, malabsorption or any other abnormality.(3)

According to world health organization (WHO) and UNICEF, worldwide there are more than two billion (20000000) of diarrheal cases are reported each year, the mortality rate in children younger than 5-year account for 18% of total deaths of children. By the mean there is more than 5000 children dies from diarrhea each day. The mortality rate of diarrhea in African and south-east Asia countries has greater and reach to 78% of total death in these countries. After pneumonia, acute diarrhea is second leading cause of death in younger children.(4) World health organization carried out a study in different regions of Pakistan in 1991 shows that rotavirus are the most causative agent of diarrhea in children under 1 year of age and 20% of total presenting cases. According to two other studies carried out in Lahore and Rawalpindi rotavirus is second most causative agent after E.Coli in children.(5)

The study carried out in seven different countries on mortality rate of diarrhea suggest that more than 30 % of children are died from 2000-2012 whose age are from 1 to 11 months greater than Bangladesh and united republic of Tanzania.(6)

Diarrhea and pneumonia are leading cause of death in children in 2010.and count in five countries of highest morbidity and mortality rate because of diarrhea and pneumonia. And to find factor and decline mortality of diarrhea , study was carried out in low income communities of Karachi in 2016 suggest that strong belief to local concepts and therapies ,lack of health education and delayed treatment are leading cause of deaths.(7)According to another study conducted in Africa that there are more than 2.5 million deaths each year in children

younger than 5 years of age. The account for 17% of all the death. AIDS, malaria and measles combined mortality rate is less than that of diarrhea, and its mortality rate in African countries are 42% of the total death.(8)

Diarrhea has caused by different pathogens, including viruses, bacteria and parasites. About 70% of acute diarrhea is caused by various species of viruses, rotavirus and norovirus are most common. Rates of viral infection in children are similar in both developed and under developed countries.(9)

Bacterial infection accounts for 10% to 20% of all the acute gastroenteritis. The most common bacterial causes are Salmonella species, Campylobacter species, Shigella species and Yersinaspecies. Vibrio cholera remains a major cause of cholera, especially after a disaster where sanitation is destroyed. Giardialamblia is most active agent causes protozoal infection, although it mostly causes persistent diarrhea. Other species of protozoa include Cryptosporidium species and Entamoeba histolytica.(10)

Diarrhea is one of the communicable diseases; it can spread from a patient to another healthy person by food and water. The symptoms observed in the patients start from a little sign to a more serious sign and patients have a risk of death at any time, because of decrease fluid in body. (Suknirun1991).(11) Loose motion, nausea and mild fever are most clinical features of acute gastroenteritis in children some time accompanied by abdominal pain .(12)but the most complaints of children with AGE has fever (84%), anorexia (68%), vomiting (54%), bloody stool (21%), dehydration (55%), lethargy (39%), and abdominal pain (20%).(9)

Management of diarrheaincludes soft easily digested food, oral rehydration solution, zinc supplements and antibiotic in case of infection. Intravenous fluid is given to severely dehydrated patients. Anti-diarrheal agent is contraindicated in children.(3)

There are many factors that may risk for diarrhea in children it includes un vaccination, poor economic status, contaminated water, unhygienic food, poultry and domestic animals and lack of education.(13) Previous studies have described different risk factors for diarrhea such as younger age, male gender, early weaning, seasonal patterns, low maternal education, lack of pure water supply, poor water-storage practices, younger maternal age, lack of hand washing with soap by caregiver, poor sanitation, indiscriminate-disposal of child faces, unsatisfactory garbage disposal, shorter boiling time and using water from unhygienic sources. In

this study, we focused how many children are affected, which source is most dominant and how to be prevented. Residence, gender of the child, type of water used, methods of baby feeding, methods and materials to wash the hands are the most important variables that responsible for occurrence of diarrhea. People in the economically poorest regions of the world and the least developed countries continue to bear the heaviest burden of child deaths. Compared to children from urban areas the rural communities children were more than eleven times more likely to report diarrheal disease.(8)A study conducted in Northern Vietnam suggest risk factors of diarrhea are irregular hand-washing by mothers after use of toilet, no hand-washing before feeding children, unsafe storage for water and food, improper kitchen cleaning, infrequent cleaning/emptying of storage container before refilling it with fresh water and irregular latrine cleaning, latrine-sharing among more people.(14)

MATREIAL AND METHODS:

Study Design:

The study was conducted through Descriptive cross sectional study, to find out the risk factors of diarrhea in children whose age are less than 5 years bring to Khyber teaching hospital Peshawar.

Study Setting:

The current study was conducted in emergency pediatric service (EPS) in Khyber teaching Hospital Peshawar.

Study population:

The current study was conducted on children who are presented to emergency with acute gastroenteritis. It includes only those patients whose is diarrhea and age is less than 5 year and greater than 1 month.

Sample Size:

A total of the one hundred and fifty samples were collected from the pediatric emergency unit of the Khyber teaching Hospital Peshawar.

Study Duration:

The study duration was four months from September to December, 2017.
(1 September to December, 2017)

Sampling Technique:

Through sample random sampling technique data was collected. In each week randomly 20 patients are selected and directly asked the question from their mother or children itself and some of the factors like hygienic condition that was observed.

Inclusion Criteria:

Those children are included in study whose age in less than 5 years presented with acute watery diarrhea (having three or more loose motion per day lasting up to 2 week) to Pediatrics Emergency of Khyber teaching hospital Peshawar.

Exclusion Criteria:

Those children whose age is greater than 5 years or less than 1 month is not included in the study. Bloody diarrhea or children with any other diseases like Chest infection, systemic disease or any other chronic illness are excluded.

Data Collection Procedure:

After permission of ethical committee and concern personnel of pediatric unit, Pre-design and preset questionnaires are used to find the most probably risk factors of diarrhea in children. In each week 20 patient data was collected randomly from children whose suffer from diarrhea. Taking care of social and culture norms and rule along with female staff data was collected from the children and the parents. No one is enforced to participate in the study. And after permission and well of parent or guardian question was asked in very easily and clearly method. Question was asked about demographic status (name, age, weight, and residency) water and diet of patient, education and vaccination. The hygienic status of baby and mother are also absorbed and asked about hand washing.

Data Analysis Technique:

Each variable is observed and each questionnaire is checked carefully. All the questionnaires are summarized and simplify and then enter in to SPSS version 16. For frequency and percentage of demographic and social characteristics descriptive statistics are used. While some of variable are analyze through cross tabulation.

RESULT:

In this study 150 of children are included. All the variables are classified into four categories which include demographic, hygienic status, infrastructure and socio-economic status. In this study eighty seven which make 58% of total population are male while sixty three which make 42% are female. The participants enrolled are all those children whose age are less than 5 year and suffer from diarrhea presented the pediatric emergency of Khyber teaching hospital Peshawar. The children whose age are from 6 month to 1 year are highest rate of 42.67% and children whose age are from 3 to 4 year are least effected.

Gender of Participant

Gender	Frequency	Percent	Cumulative Percent
Male	87	58%	58.0
Female	63	42%	100.0
Total	150	100.0	

Figure 4.1:

Figure 4.1 shows gender wise distribution of participant. In the previous research carried out in different countries the ratio of male is higher than female. In my study the ratio of male effected children are 16% greater than that of female. Total of 58% of males are suffered from diarrhea.

Figure 4.2:

Figure 4.2 shows the age of patient suffer from diarrhea. According to many articles (discuss in introduction) by increasing the age the morbidity of diarrhea decrease. In this research the children whose ages are in between 6 month to 1 year are mostly affected and the table and graph is plotted as bellow.

Fig 4.2 Age of Participants

Age of children	Frequency	Percent	Cumulative Percent
1 to 6month	30	20%	20.0
6month to 1year	64	42.7%	62.7
1 to 2 years	33	22%	84.7
2 to 3years	8	5.3%	90.0
3 to 4years	5	3.3%	93.3
4 to 5years	10	6.7%	100.0
Total	150		

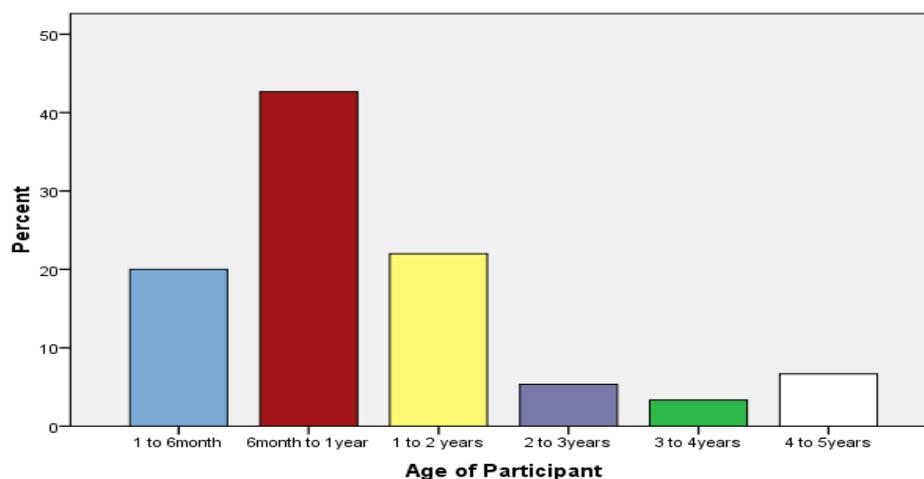
Age of Participant

Figure 4.3:

Figure 4.3 shows the residency wise distribution of children. The result shows that children from urban area are most affected as compared to rural and the ratio is increase 9.4% to that of rural patients.

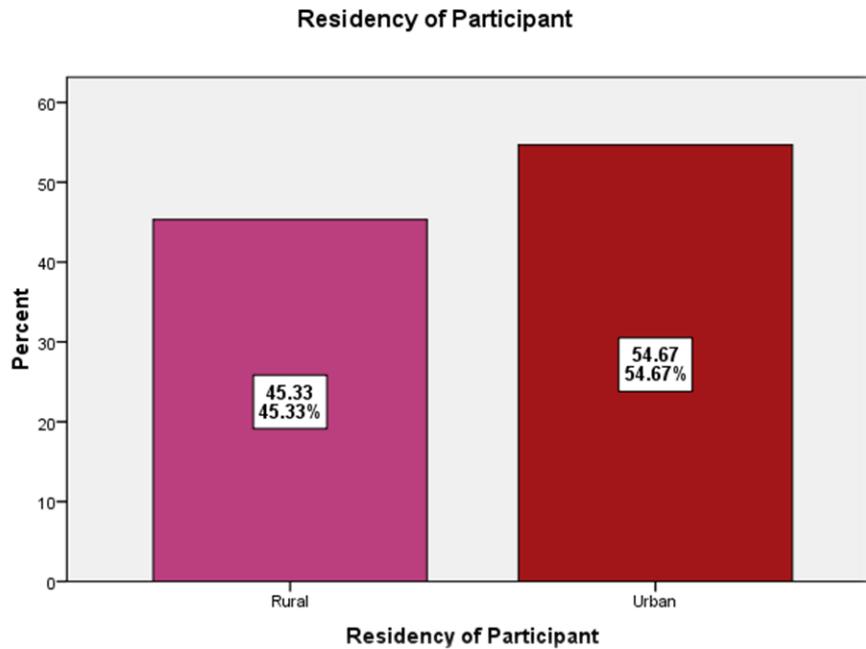


Fig 4.3

Figure 4.4:

The previous research suggests that children of poor families are more affected. This study also agreed and 58% of children who had diarrhea belong to poor families. Only 8% of children of higher family status are affected.

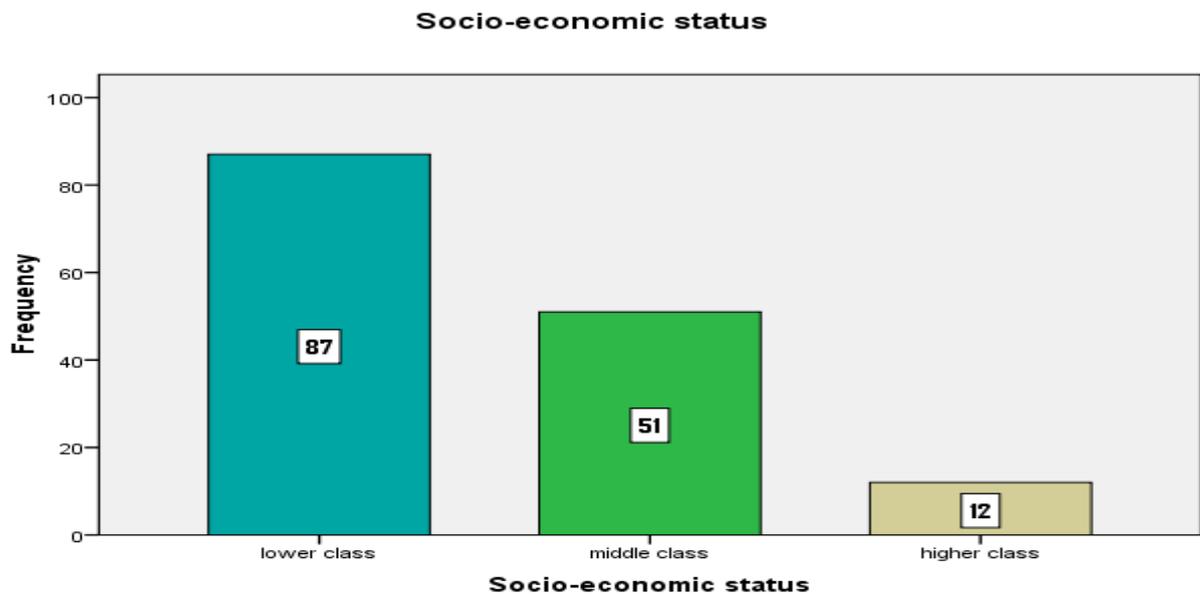


Figure4.5:

In the questionnaire are parents are also about vaccination of children because in many researches shows that morbidity of diarrhea in immunized children are decrease than unimmunized children.in my study 19.3% of children are unvaccinated. While 32.7% of vaccinated children are also affected with diarrhea.

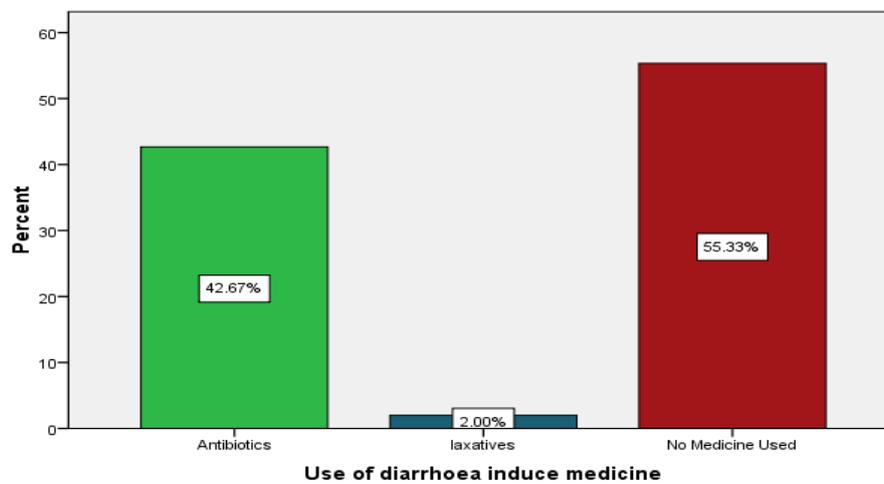
History of Vaccination

History of vaccination	Frequency	Percent	Cumulative Percent
Vaccinated	49	32.7%	32.7
Unvaccinated	29	19.3%	52.0
In Progress	72	48.0%	100.0
Total	150	100.0	

Figure 4.6:

Figure 4.6 shows the rate of patient suffer diarrhea using diarrhea induce drugs. 42.7% of people who had diarrhea used antibiotic during within 3 days of diarrhea. Mostly penicillin and clavulanic acid.

Use of diarrhoea induce medicine

**Figure 4.7:**

According to this study only 6% of people can drink filter or boil water in their home. Mostly people used tube well is source of water while 19.3% people used stored water in different countiers and then used this for drinking purpose. In rural area 14.7% used water from spring that must be probably risk factor of diarrhea.

Source of water used

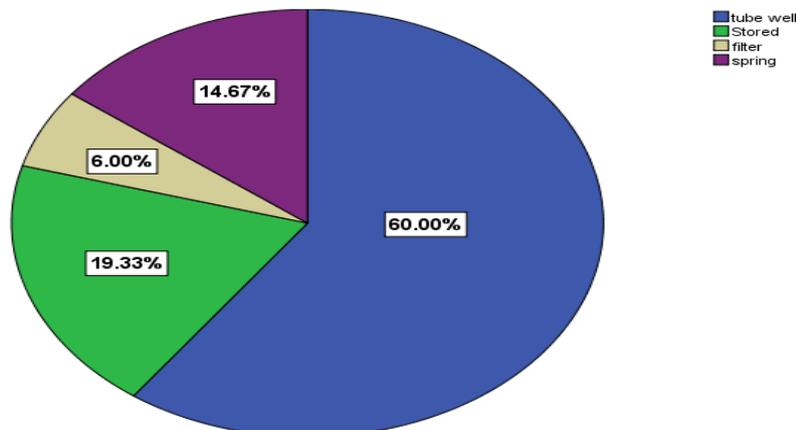


Figure 4.8:

About 70% of mother of the children have no education and 5.3% of mother have higher education (above intermediate). And educated mother know better about risk factors of diarrhea. They provide better diet, boil water and keep them clean.

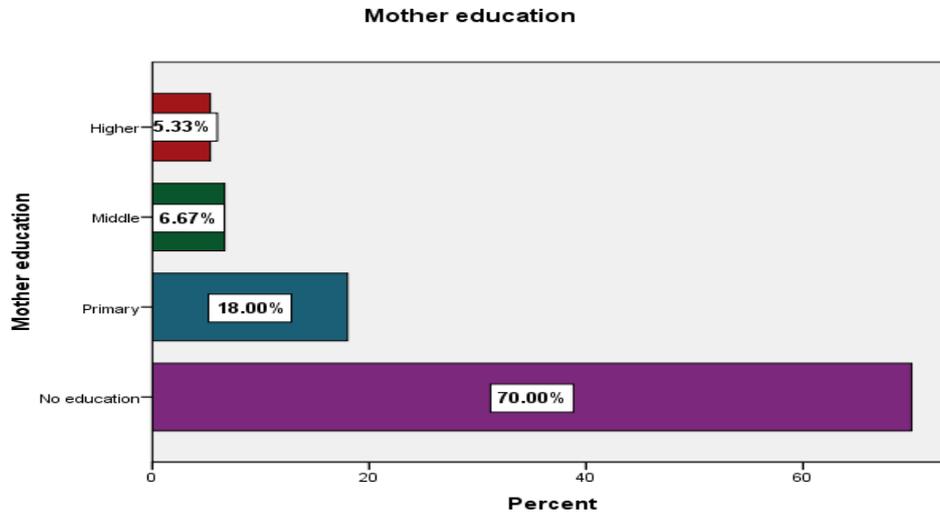


Figure 4.9:

10.7% of people have no proper storage and disposal of general waste in their home. And they collect the general waste beside the home.

Disposal of waste

Disposal of waste	Frequency	Percent	Cumulative Percent
Open	16	10.7%	10.7
Safe	134	89.3%	100.0
Total	150	100.0	

Figure 4.10

10.7% peoples have no proper washroom in their home. While 86% of people used traditional washroom not proper swage system and soap and warm water for washing their hand. Only 3.3% of people used flush washroom.

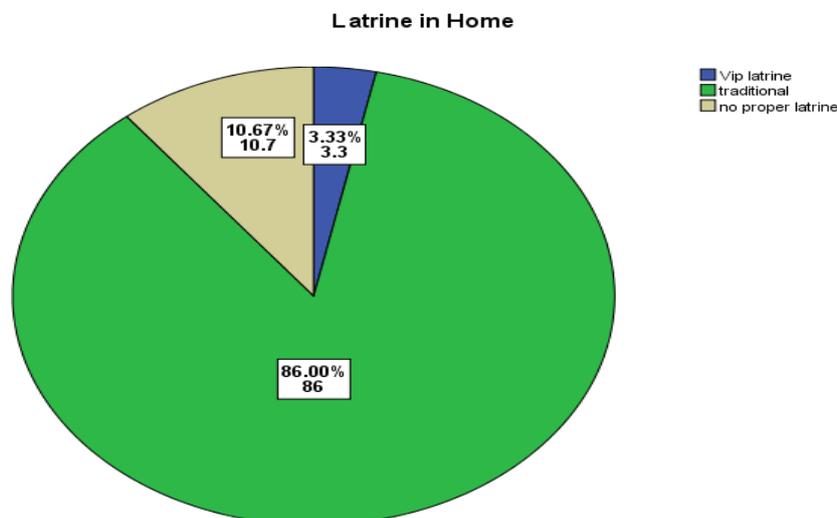
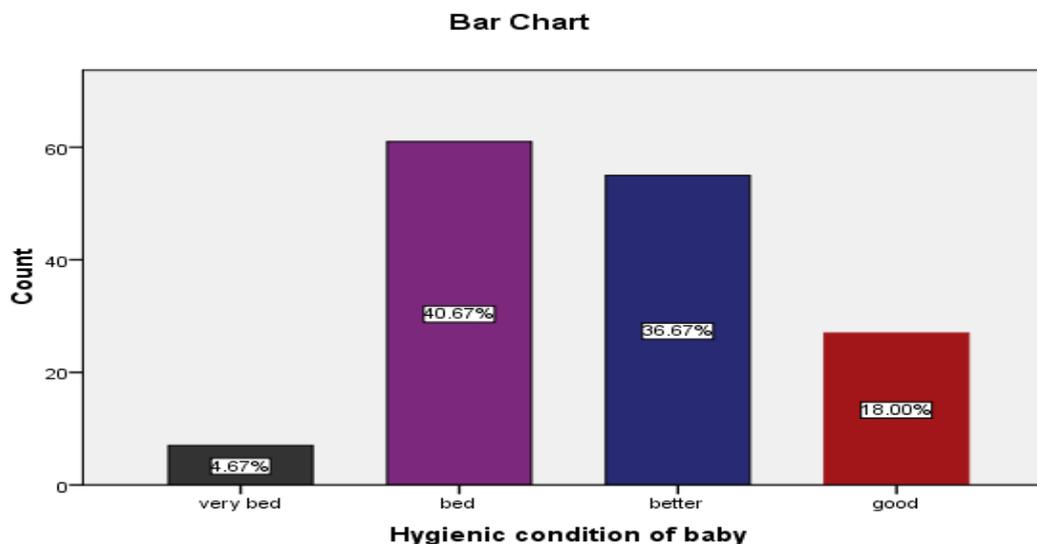
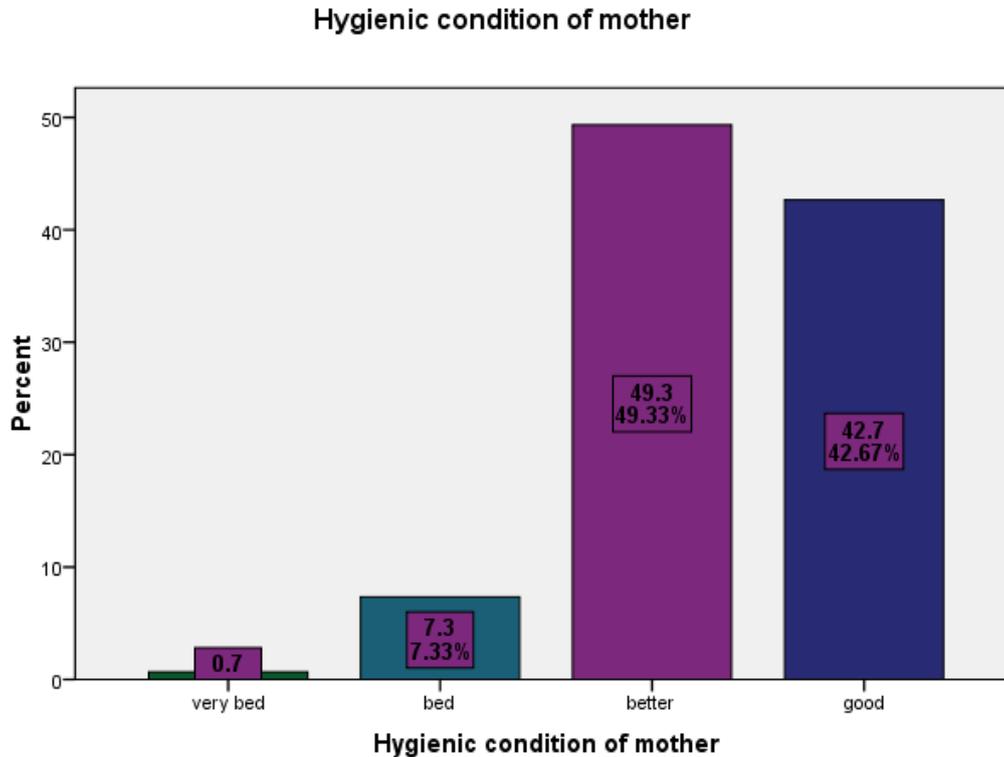


Figure 4.11:

Hygienic condition of baby and mother was absorbed by looking their head, hand and feet. 40.76% of children and 7.33% of mother have bed hygienic condition. Only 18% children has consider as good hygienic condition. While 7% of mother has bed hygienic condition.

**Figure 4.12:**

Only 25.3% of mother wash their own and baby hand with soap after using washroom. And 2% of mothers have no idea about importance of hand after use of washroom. 73.3% of people wash their hand with simple water.

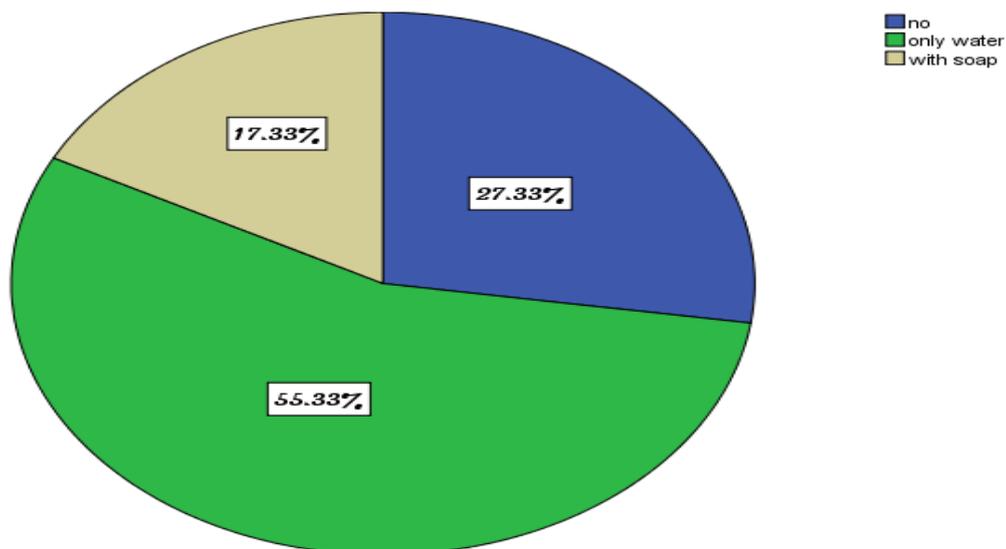
Hand washing after washroom use

Hand washing	Frequency	Percent	Cumulative Percent
Not washing	2	1.3%	1.3
Only water	110	73.3%	74.7
With soap	38	25.3%	100.0
Total	150	100.0	

Figure 4.13:

Questions are asked about washing of hand before feeding the children, 27.33% of mother do not wash their hand while giving food to their children. And only 17.33% of mothers wash their hand with soap and remaining 55.33% use only water.

Hand washing before feeding baby

**DISCUSSION:**

This study was conducted in pediatric emergency of Khyber teaching hospital Peshawar on assessment of risk factors of diarrhea in children less than five year. Total 150 data was collected randomly. Preset question was asked from parent of children, through the study was affective and mother are counsel the relative risk factors of diarrhea. The staff nurse lubna and sumbal help me in collecting of data. Then collected data was classify into demography, diet, hygienic condition and other related risk factors and then analyzed through SPSS and every aspect is observed carefully.

In this study overall 150 participants, 58% are male and 42% are female. Another study carried out in Pakistan at Karachi suggests that male boys are more affected. And in Bangladesh the ratio of male

is 52% in 2017. According to different studies the children whose age are in between 6 to 11 month are more affected, while in this study the children whose age is 6 to 12 months are 42.7% of total population and children with age 3 to 4 year are least suffer (3.3%). In many other research the morbidity are high in rural area, but in this study the rate is high in urban area and 54.7% of total population.

The morbidity of children who are unvaccinated or vaccinations are in progress is 67.3%. According to research (carried out by UNICEF conduct in develop countries) suggest that children whose are immunized with measles vaccine are less affected. Mostly in rural area people used spring water which is exposed to external environment and out of 45% effected population 14% used spring water. Only six percent of people used filter water in their homes.

Tube well is main source of water of 60% of total population. 70% of mother are uneducated and 42% have good hygienic status.

Those children who take only breast-feed are less exposed to diarrheal diseases, but when age is 6 month are they start food like goat milk, cow milk and other soft diet they start diarrhea. More than 90% of mother use single feeder and they cannot wash their bottle properly, some of them give tea and juices to their children which consist of chemical that can cause diarrhea in children. And only 25.3% of mothers wash their hands with soap and 27.3% of mother did not wash their hand before feeding their children. According to world health organization more than 1.1 billion of people have no access to safe water. In this study only 22.7% of mothers give boils water to their children. According to who-2006 we can decrease 1.5 million diarrheal diseases by using safe water. According to one study more than 1.1 billion people in the world have no proper latrine (WHO/UNICEF, 2000) and this study the rate is 10.7% of total population. While have no proper latrine availability and drainage system, that can lead to contamination of water and food. Only 25.3% of people wash their hand with soap. While rest of people wash their hands only with sample water.

A study carried out in 2014-2015, Shahid Bahonar Hospital, Kerman, Iran suggest that 10-25% of diarrhea are associated with antibiotic. While in this study 42.7% of children start diarrhea while using antibiotic like penicillin and cephalosporin. And 2% of diarrhea is because of using laxative drugs while the mothers are unaware of iteffect. Mostly the children suffer from throat infection while without doctor consultation they use Augmentin (amoxicillin and clavulanic acid) that can cause watery stool in underdeveloped immune children.

CONCLUSION:

Diarrhea is hug burden of economic and has high morbidity and mortality rate. In this study many risk factors are observed and monitored. Boys and children at the age of 6 to 12 months are more affected. Urban are suffer than rural because of unhygienic environment. Mostly people are unaware about vaccination. The children and mother have dirty hand with soil and dirt in their nails, not wishing their hand proper after using latrine or before feeding their children. Juices and black tea in unsterilized bottle with no cap are common and family member are unaware about that it consist of chemicals that cause diarrhea. Cow milk or goat milk with added salt and large amount of water are also absorbed during the study. A mostly congested and poor family's child has

high morbidity. There is no proper disposal of general waste of baby stool that can lead to contamination of body food and water. Very rare people use boil or chlorinated water in their home. Antibiotics is one most probably cause of diarrhea. Tube well is water source mostly used and high morbidity in those homes using tube well water. And hand of mother and children are main cause of diarrhea because children put their dirty finger in to mouth cause diarrhea.

Recommendation:

- Use of boil or chlorinated water in their home.
- Cut their nails and wash their hand with soap after using washroom.
- Not using unhygienic juices, tea and other weaning foods.
- Vaccination is very important for every patient to strengthen and develop their immunity.
- Before feeding their child washing of hand with soap is very necessary for mothers.
- Give education about antibiotic induce diarrhea.
- Proper and safe disposal of general waste and stool of babies.

REFERENCES:

1. World-health-organization. Diarrhoeal disease [Internet]. Diarrhoeal disease world health organization. 2017 [cited 2017 Sep 1]. p. 1. Available from: <http://www.who.int/mediacentre/factsheets/fs330/en/>
2. Stefano Guandalini, MD; Chief Editor: Carmen Cuffari M more. . . Essential practice in diarrhoea [Internet]. JUNE,2017. 2017 [cited 2009 Jul 20], p. 1. Available from: <https://emedicine.medscape.com/article/928598-overview>
3. Danish I. Gastroenterology://__diarrhea [Internet]. ELEVENTH. DANISH I, editor. karachi: Paramount books; 2015. 795 p. Available from: www.paramountbooks.com.pk
4. Farthing M, Salam M. Acute diarrhea in adults and children: a global perspective. World Gastroenterol Organ [Internet]. 2012;(February):1–24. Available from: http://journals.lww.com/jcge/Abstract/2013/01000/Acute_Diarrhea_in_Adults_and_Children__A_Global.7.aspx
5. Ali NK1 BZ. A review of rotavirus diarrhea in Pakistan: how much do we know? J Coll Physicians Surg Pak [Internet]. 2003;297–301:1. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/12757686>
6. World-health-organization. Diarrhoea [Internet]. volume 92__number 9. 2014 [cited

- 2017 Sep 1]. p. 1. Available from: <http://www.who.int/bulletin/volumes/92/9/13-134809/en/>
7. Qamar FN, Zaman , Quadri F1, Khan A1, Shaikh BT2, Azam I3, Nasrin D4, Kotloff K4, Levine M4, Brown N5 ZA. Predictors of diarrheal mortality and patterns of caregiver health seeking behavior in in Karachi, Pakistan. *J Glob Heal* [Internet]. 2016;020406. doi(2016). Available from: <https://www.ncbi.nlm.nih.gov/pubmed/27606059>
 8. Anteneh ZA, Andargie K, Tarekegn M. Prevalence and determinants of acute diarrhea among children younger than five years old in Jabithennan District , Northwest. *BMC Public Health* [Internet]. 2017;1–8. Available from: <http://dx.doi.org/10.1186/s12889-017-4021-5>
 9. Chung N, Wang SM, Shen CF, Kuo FC, Ho TS, Hsiung CA, et al. Clinical and epidemiological characteristics in hospitalized young children with acute gastroenteritis in southern Taiwan: According to major pathogens. *J Microbiol Immunol Infect*. 2017;1–8.
 10. Chow CM, Leung AK, Hon KL. CEG-6554-gastroenteritis--from-guidelines-to-real-life-and-then-back-. *Clin Exp Gastroenterol*. 2010;3:97–112.
 11. Health P, Control CD. Chapter 1 Introduction. 2000;1–9.
 12. WebMD. symptoms of diarrhea [Internet]. *Drugs & Diseases*. [cited 2018 Sep 10]. p. 2. Available from: <https://emedicine.medscape.com/article/928598-overview>
 13. Cohen A, Colford JM. Effects of Boiling Drinking Water on Diarrhea and Pathogen-Specific Infections in Low- and Middle-Income Countries: A Systematic Review and Meta-Analysis. *Am J Trop Med Hyg* [Internet]. 2017;97(5):48. Available from: <http://www.ajtmh.org/content/journals/10.4269/ajtmh.17-0190>
 14. Bjune G, Minh NB. Section for International Health The most common causes of a risk factors for diarrhea among children less than five years of age admitted to Dong Anh Hospital, Hanoi. 2006;(May).
 15. Arif GM, Ibrahim S. Diarrhoea morbidity differentials among children in Pakistan. *Pak Dev Rev*. 1998;37(3):205–30.
 16. Pinto JM, Petrova A. Detection of Acute Gastroenteritis Etiology in Hospitalized Young Children: Associated Factors and Outcomes. *Hosp Pediatr* [Internet]. 2017; Available from: <http://www.ncbi.nlm.nih.gov/pubmed/2879013>
 17. Unicef. A global review of diarrhoeal disease control. 1997.
 18. WHO-Biological behavioural and contextual rationale. Water, sanitation and hygiene interventions and the prevention of diarrhoea [Internet]. [cited 2017 Sep 1]. p. 1. Available from: http://www.who.int/elena/titles/bbc/wsh_diarrhoea/en/
 19. Alelign T, Asegidew W, Abera A, Carvajal-vélez L, Amouzou A, Perin J, et al. Assessment of Diarrhoeal Disease Attributable To Water, Sanitation and Hygiene Among Under Five in Kasarani, Nairobi County. *BMC Public Health* [Internet]. 2016;2015(May):1–6. Available from: <http://etd.aau.edu.et/handle/123456789/6566>. Accessed on September 5, 2016%0Ahttp://dx.doi.org/10.1186/s12889-016-3475-1
 20. Clasen TF, Bostoen K, Schmidt W-P, Boisson S, Fung IC-H, Jenkins MW, et al. Interventions to improve disposal of human excreta for preventing diarrhoea. *Cochrane Database Syst Rev* [Internet]. 2010;(6). Available from: <http://doi.wiley.com/10.1002/14651858.CD007180.pub2>
 21. Motarjemi Y, Kaferstein F, Moy G, Quevedo F. Reviews / Analyses Contaminated weaning food: a major risk factor for diarrhoea and associated malnutrition *. 1993;71(1):79–92.
 22. Ejemot-Nwadiaro RI, Ehiri JE, Arikpo D, Meremikwu MM, Critchley JA. Hand washing promotion for preventing diarrhoea. *Cochrane database Syst Rev*. 2015;(9):CD004265.
 23. Riddle MS, DuPont HL, Connor BA. ACG Clinical Guideline: Diagnosis, Treatment, and Prevention of Acute Diarrheal Infections in Adults [Internet]. Vol. 111, *The American Journal of Gastroenterology*. Nature Publishing Group; 2016. 602–622 p. Available from: <http://www.nature.com/doifinder/10.1038/ajg.2016.126>
 24. WebMD. Diarrhea Caused by Antibiotics [Internet]. National Library of Medicine's. Available from: <https://www.webmd.com/digestive-disorders/diarrhea-caused-by-antibiotics>
 25. Zarandi ER, Mansouri S, Nakhaee N, Sara. Frequency of antibiotic associated diarrhea caused by *Clostridium difficile* among hospitalized patients Kerman, Iran. *Gastroenterol Hepatol from Bed to Bench*. 2017;10(3):229–34.