

Efficacy of Cleaning and Disinfecting Infant Bottle Feeding by Mothers in Raparin Teaching Hospital at Erbil City/Kurdistan Region

تأثير تنظيف وتعقيم زجاجة ارضاع الطفل من قبل الأمهات في مستشفى رابه رين التعليمي في مدينة أربيل/
إقليم كردستان

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الخلاصة:

خلفية البحث: الاستعمال الامن للحليب الاصطناعي للأطفال يمثل تحديا في تطور أعداد السكان في العالم، لأن الماء والصرف الصحي في كثير من الأحيان دون المستوى في التعقيم في هذه المجتمعات، والأطفال الرضع الذين لا يرضعون من الثدي لايزالون في خطر كبير في التعرض للأمراض والوفيات الناجمة من جرثومة الاسهال.

الأهداف: تهدف الدراسة إلى معرفة العلاقة بين طرق وأساليب التنظيف وتعقيم قنينة الرضاعة والنتائج المختبرية، وتحديد الطرق الأكثر استعمالا من قبل الامهات في التعقيم.

المنهجية: أجريت دراسة استقصائية في مستشفى رابرين التعليمي في مدينة أربيل إقليم كردستان/ العراق من 15 حزيران 2015- الى 15 ايلول 2015 تم اختبار عينة غرضية تكونت من 40 ام تستعمل زجاجة الرضاعة الاصطناعية وكانت 10 من الامهات يستعملن الماء المغلي في تعقيم قنينة الرضاعة، و10 من الامهات يستعملن ملح الطعام في تعقيم قنينة الرضاعة، و10 منهن يستعملن مادة كيميائية و10 امهات يستعملن ماء الحنفية في تنظيف قنينة الرضاعة. وتم اخذ مسحة من خط مسمار الزجاجة بعد التنظيف والغسل من قبل الام وبعدها تم إرسالها إلى المختبر للتحليلات. وقد تم تصميم استمارة استبيان التي تتألف من أربعة أجزاء (البيانات الاجتماعية والديموغرافية للأم والرضيع، وبعض الأسئلة حول الإسهال و تنظيف وتعقيم زجاجة الرضاعة، وقد تم تحليل البيانات باستخدام التكرار،النسبة المئوية ومربع كاي عن طريق برنامج SPSS (الإصدار 19).

النتائج: اظهرت النتائج ان (32,5 ٪) من الأمهات ضمن الفئة العمرية ما بين (26-30) سنة، و 37,5 ٪ منهم كانوا أميين، و 45 ٪ منهم من الحضر، و 82,5 ٪ من الأطفال لديهم تاريخ مع الإسهال. (10٪) من المسحة المختبرية كانت وجود جرثومة من الذين يستعملون الماء المغلي لتعقيم وتنظيف قنينة الرضاعة، (90 ٪) من المسحة المختبرية كانت وجود جرثومة من الذين يستعملون المنظفات، (100 ٪) من المسحة المختبرية كانت وجود جرثومة في كلا الطرفين (ماء الحنفية وملح الطعام). (35 ٪) للنمو البكتيري كانت E. Coli، و (17.5 ٪) منهم كانت Klepsela pneumonia. و (5 ٪) من المسحة المختبرية كانت (متعدد البكتيريا)، وفيما يتعلق الفطريات (15 ٪) من (Monilia) كانت موجودة، واطهرت الدراسة بوجود علاقة مؤثرة بين طريقة التنظيف والتعقيم مع نوع البكتيريا، مدة التعقيم والنوع من قنينة الرضاعة.

الاستنتاج: استنتجت الدراسة بان الوسائل المستخدمة في التعقيم من قبل الامهات غير صالحة وذلك لظهور نسب كبيرة من الجراثيم لطرق التعقيم المستعملة. وان الطريقة الماء المغلي كانت الطريقة الأكثر معقمة لدى الامهات، وأن قنينة الرضاعة لا توفر التغذية الصحية للطفل.

التوصيات: اوصت الدراسة بوضع برنامج تعليمي وتنقيفي وإرشادات شاملة حول طريقة تنظيف وتعقيم قنينة الرضاعة للامهات وتزويد كل مراكز الرعاية الصحية في إقليم كردستان العراق به، وتشجيع الامهات لاستعمال الرضاعة الطبيعية واستخدام قنينة الرضاعة الزجاجية بدلا من البلاستيكية لأنه اسهل للتعقيم والتنظيف، كما اوصت الدراسة بان ماء الحنفية لا ينصح لتنظيف زجاجة الرضاعة بسبب سوء الصرف الصحي.

Abstract

Background: Safe use of infant formula is challenging in developing world settings. Because water and sanitation infrastructure are often suboptimal in these communities, infants who are not breastfed remain at high risk of morbidity and mortality caused by diarrheal pathogens.

Objectives: The study aimed to find out the association between methods of cleaning and disinfecting bottle feeding and culture result, determine most sterilize methods by mothers.

Methods: A survey study was carried out at Raperin Teaching hospital in Erbil City Iraq/Kurdistan Region from (15-June-2015 to 15-September-2015). A convenience sample of 40 mothers were selected who used bottle feeding, (10 Mothers of each method (boiling water, salt (NaCl), Detergent) and tap water only), Then the swape was taken from the screw line of bottle after the cleaning and washing by mother and send to laboratory for culture was taken from the screw line of bottle after the cleaning and washing by mother and send to laboratory for culture. A questionnaire was designed that composed of four parts, (Socio-demographic data of mother and their infant, some questions method

of cleaning and disinfecting bottle feeding, the data were analysis by using Frequency, percentage and Chi square (SPSS, 19).

Results: The results found (32.5%) of mothers were age (26-30) years old,(37.5%) were illiterate,(45%) of them were from Urban , (82.5%)of infant have history of previous diarrhea (10%) positive culture swap from boiling methods of cleaning and sterilizing the bottle feeding, while (90%) positive pathogen culture swap is seen in detergent method, (100%) was positive culture swap from both methods(tap water and salt).(35%) of bacterial growth was E. Coli, (17.5%) of them was Klepssela. pneumonia, while only (5%) of bacteria were(Multi bacteria), Regarding the fungi (15%) was positive (Monilia), there is highly significant association between (Culture result, Type of Bacteria, Duration of cleaning and sterilization and Type of bottle) with method of cleaning and sterilization.

Conclusions: The study concludes that method of cleaning and sterilization of bottle feeding were sterilize because there are a lot of pathogen were isolated from bottle after cleaning and sterilization by mothers and Boiling method was the most sterilize method and The study indicate that bottle feeding does not provide a safe feeding.

Recommendations: The study recommend a guideline and an educational program about method of cleaning and sterilization of bottle feeding for mothers and family must be provide to all maternal and child heath care center in Kurdistan region –Iraq, Encourage mother to use breast feeding and use glass bottle feeding instead of plastic one, because its easier to sterilize and clean. Tap water not recommended for cleaning the bottle feeding because of poor sanitation.

Key words: Efficacy, Cleaning and disinfecting, Infant bottle feeding, Mother.

INTRODUCTION

Infants who not being breastfed is associated with an increased incidence of infectious morbidity, including otitis media, gastroenteritis, and pneumonia⁽¹⁾. Nearly one in five child deaths is due to diarrhea, a loss of about 1.5 million lives each year, Diarrhea is one of the leading causes of death among children under five globally. More than one in ten child deaths about 800 000 each year is due to diarrhea. Today, only 44% of children with diarrhea in low-income countries receive the recommended treatment, and limited trend data suggest that there has been little progress since 2000⁽²⁾.

In 2015, 4.5 million (75% of all under-five deaths) occurred within the first year of life⁽³⁾.In 2009 (UNICEF) estimates that not breastfeeding (formula feeding with contaminated water) is responsible for 1.5 million child deaths per year. Infant feeding bottles can be very difficult to clean, and prepared formula can become contaminated through a number of mechanisms⁽⁴⁾.

Studies in developing countries have found home prepared infant formula feedings frequently contaminated with 10^2 – 10^6 coli forms/mL; often, multiple pathogens are isolated from a single prepared feed⁽⁵⁾.*Salmonella* species and *Escherichia coli*, particularly enteropathogenic *E. coli* , have been isolated from prepared infant formula and have cause multiple outbreaks of diarrheal disease among formula-fed infants⁽⁶⁾. Evidence of the dangers of formula feeding in non-research settings have also been documented in Botswana. Between November 2005 and February 2006 there were unusually heavy rains and flooding which led to an increase in infant diarrhea incidence and mortality, Most of the deaths were among HIV-exposed infants whose mothers were receiving free formula milk through the Prevention of Mother-to-Child Transmission PMTCT programme. Among hospitalized infants, 51% had poor growth before the illness⁽⁷⁾.

The worldwide average annual number of reported invasive *Cronobacter* infections in infants without pre-existing conditions was 1.5 in 1958 - 2003 (68 cases in 46 years) and 4.3 in 2004 - 2010 (30 cases in 7 years). In a recent study 90% of *Cronobacter* infected infants had received powdered infant formula or human milk fortifier and therefore powdered infant formula products are considered to be high-risk foods for the growth of *Cronobacter*⁽⁸⁾.

Powdered infant formula is not a sterile product, It may contain bacteria that can cause serious illness in infants, such as *Enterobacter sakazakii*. Although infections caused by *E.sakazakii* in formula are rare, they can be serious and sometimes fatal⁽⁹⁾.

OBJECTIVE OF THE STUDY:

1. Determine the most sterilize methods of cleaning and disinfecting the bottle feeding by mothers.
2. Find out the association between methods of cleaning and disinfecting the bottle feeding and culture result).
3. Find out the association between demographical characteristics of mothers and methods of cleaning and disinfecting the bottle feeding.

METHODOLOGY:

Study Design: A survey study was carry out to find out the most sterilize method of cleaning and sterilize of infant bottle feeding

Duration of the study: The study was carrying out from 15- June -2015 to 15- September -2015).

Setting of the study: The study was carrying out in Raperin Teaching hospital in Erbil City Iraq – Kurdistan Region.

Sample of the study: Purposive sample was used, as 40 mothers were selected who used bottle feeding (10) mother of each method sterilization of bottle feeding (Boiling, Detergent, Nacl and tap water) were selected.

Criteria of the sample

1. Inclusion criteria include the following:

- a. Mothers with Infant bottle feeding who suffer from diarrhea.
- b. Bottle feeding Infant.
- c. Mixed feeding Infant.

Tool of the study : A questionnaire was designed that composed of four parts, the part I consist of : Socio-demographic information of the mothers such as (age and gender, level of education ,occupation) , and part II consist demographic information of the infant such as (age and gender) part III consist of some questions about the diarrhea which as (previous diarrhea, age, treatment of diarrhea) and last part consist the cleaning and disinfecting the bottle feeing such as boiling, washing with tap water .

Equipment needed for study:

The study needs the following equipment:

- 1-Special sterilized room with facet and boiling machine for water
- 2-Tray for Boiling
- 3-Detergent
- 4-Food Salt (Nacl)
- 5-Bottle Brush
- 6-Swap Strips
- 7-Microscope
- 8-Vitec Device for bacteria detection

Laboratory Examination:

The swap was taking from screw line of infant bottle feed after cleaning and sterilization methods by mothers the researcher observe them how to clean , sterilize and record the duration of

sterilization, after cleaning the bottle then researcher educate the mother about the best method and how it done in correct way finally the specimen was send to laboratory for culture.

In the laboratory at First of all we added 2mL of normal saline to transport swab and leave it about 10 minutes in the incubator. Then culture it on Blood, MacConkey and Sabourand agar. Leave the culture for 24 hours in incubator for agriculture of bacteria and fungi. Vitek -2 was used for diagnoses bacteria. Put normal saline of transport swab into disposable centrifuge tube. Centrifuge it at 2000Rotationper Minute RPM for 5 minutes. After Centrifuge stopped remove tube and pour the supernatant, leaving any sediment in the bottom of the tube. Shaking the sediment then place one drop of the sediment solution on a glass slide and cover it with a cover slide. Then Microscope was used to examine the sediment for parasite, bacteria and fungi.

Statistical Methods: The data was analysis by using frequency, percentage and chi square by using (SPSS, 19).

Ethical consideration: Ethical considerations were a main principle in data collection. For the purpose of this study a written official permission was obtained from College of Nursing / Hawler Medical University, Ministry of Health and Raperin teaching hospital. Permission was taken from mother before starting interview. The answers and information raised from the study was keep confidentially and use for the purpose of this study only. In addition, Researchers was provided opportunities for participants to ask questions and finally the result of the study was give to all the participant of the sample of the study.

RESULTS:

Table (1): Socio –Demographic characteristic of the mothers

No.	Variable	Category	Frequency	Percentage%
1-	Age of mothers	16-20Years	5	12.5
		21-25 Years	11	27.5
		26-30 Years	13	32.5
		31-35 Years	7	17.5
		36-40 Years	4	10.0
2-	Mothers level of education	Illiterate	15	37.5
		Can read and write	6	15.0
		Primary school graduate	8	20.0
		Secondary school graduate	4	10.0
		Institute graduate	2	5.0
		University and higher education graduate	5	12.5
3-	Mothers occupation	Employed	3	7.5
		Non employed	37	92.5
4-	Residential area	Urban	18	45.0
		Suburban	12	30.0
		Rural	10	25.0
5-	No. of children	≤3	25	67.5
		>3	15	32.5
6-	Socio economical status	High	1	2.5
		Middle	24	60.0
		Low	15	37.5
		Total	40	100.0

Table (1) Show that 32.5% of mothers at age 26-30 years old, 37.5% of them were illiterate, 92.5% of them were unemployed, 45% of them from Urban, 67.5% of them have equal or less than 3 children, regarding socio economical states 60% of them at middle level income.

Table (2): Demographic data of infant with diarrhea.

No.	Variable	Category	Frequency	Percentage%
1-	Infant age	1-3Month	5	12.5
		4-6 Month	13	32.5
		7-9 Month	6	15.0
		10-12 Month	16	40.0
		Total	40	100.0
2-	Infant gender	Male	25	62.5
		Female	15	37.5
		Total	40	100.0
3-	Weight classification	Under weight	8	20.0
		Normal	32	80.0
		Total	40	100.0
4-	Mode of feeding	Bottle feeding	28	70.0
		Mixed feeding	12	30.0
		Total	40	100.0
5-	Child history of previous diarrhea	Yes	33	82.5
		No	7	17.5
		Total	40	100.0
6-	Age of previous diarrhea	No diarrhea	7	17.5
		1-3Month	6	15.0
		4-6 Month	16	40.0
		7-9 Month	7	17.5
		10-12 Month	4	10.0
		Total	40	100.0
7-	Setting of treatment	No diarrhea	7	17.5
		Home	1	2.5
		Hospital	22	55.0
		Clinic	10	25.0
		Total	40	100.0
8-	Type of treatment	No diarrhea	7	17.5
		medication	22	55.0
		changing of formula	11	27.5
		Total	40	100.0
9-	Duration of diarrhea	No diarrhea	7	17.5
		acute diarrhea	25	62.5
		chronic diarrhea	10	25.0
		Total	40	100.0

Table (2) Show that 32.5% of infant have diarrhea were age (4-6) months, 62.5% of them were males, 20% of them were under weight, 70.0% of them from bottle feeding, 82.5% of infant have history of previous diarrhea, more than half of infant treated in hospital with medication, finally about 62.5% have acute diarrhea.

Table (3): Method of cleaning and sterilizing of infant bottle.

No.	Variable	Category	Frequency	Percentage%
1-	Method of cleaning and sterilizing of infant bottle	Boiling	10	25.0
		Detergent	10	25.0
		Nacl (Salt)	10	25.0
		Tap water	10	25.0
		Total	40	100.0
2-	Duration of cleaning and sterilizing for all type	1 Minute	8	20.0
		2 Minute	11	27.5
		3 Minute	7	17.5
		4 Minute	2	5.0
		5 Minute	4	10.0
		6 Minute	5	12.5
		7 Minute	1	2.5
		10 Minute	2	5.0
		Total	40	100.0
3-	Number of bottle	1	14	35.0
		2	14	35.0
		3	10	25.0
		4	1	2.5
		10	1	2.5
		Total	40	100.0
4-	Type of water for preparing the milk	Boiled water	38	95.0
		Tap water	2	5.0
		Total	40	100.0
5-	Exposure the bottle to sun light to dry	Yes	0	00.0
		No	40	100.0
		Total	40	100.0
6-	Type of bottle	Plastic	38	95.0
		Glass	2	5.0
		Total	40	100.0
7-	Duration of changing the teat	Week	23	57.5
		Month	17	42.5
		Total	40	100.0

Table (3) Show 27.5% of mother cleans and sterilizes the bottle feeding for (2) minute, while only 5% of them cleaned for (10) minute, regarding number of bottle of feeding about 35% of mother have only (1) bottle, while 2.5% of them have 10% bottles,5% of mothers use tap water for preparing milk formula, all of mother not dry the bottle by exposure to sun light, about 95.0% of them use plastic bottles and 42.5% of mothers change the teat monthly.

Table (4) Culture result of bottle swap

No.	Variable	Method of cleaning and sterilizing	Category	Frequency	Percentage%
1-	Culture result	A-Boiling	Positive	1	10.0
			Negative	9	90.0
			Total	10	100.0
		B-Detergent	Positive	9	90.0
			Negative	1	10.0
			Total	10	100.0
		C-NaCl (salt)	Positive	10	100.0
			Negative	0	00.0
			Total	10	100.0
		D-Tap water	Positive	10	100.0
			Negative	0	00.0
			Total	10	100.0
2-	Type of Bacteria	Negative		10	25.0
		<i>Escherichia coli</i>		14	35.0
		<i>Klebsiella pneumoniae</i>		7	17.5
		<i>Enterobacter cabeca</i>		1	2.5
		<i>Proteus mirabilis</i>		1	2.5
		<i>Enterococcus faecalis</i>		2	5.0
		<i>Cedecea lapagei</i>		1	2.5
		<i>Serratia ficara</i>		1	2.5
		<i>Morganella morganii</i>		2	5.0
		<u>Multi bacteria</u>			
		<i>Yersinia pestis</i>		1	2.5
Total		40	100.0		
3-	Type of Fungi	Negative		34	85.0
		Monilia		6	15.0
		Total		40	100.0
4-	Type of Parasite	Negative		40	100.0
		Total		40	100.0

Table(4) Show about (10%) positive culture swap from boiling methods of cleaning and sterilizing the bottle feeding, while (90%) positive culture swap is seen in detergent method, but (100%) was positive culture swap from both methods(tap water and salt).(35%) of bacterial growth was *Escherichia coli*,(17.5%) of them was *Klebsiella pneumoniae*, while only (5%) of bacteria were (*Enterococcus faecalis* and *Morganella morganii* Multi bacteria) ,while only (2.5%) of bacteria were(*Enterobacter cabeca*, *Proteus mirabilis*, *Cedecea lapagei*, *Serratia ficara*, *Yersinia pestis*. Regarding the fungi about(15%) was positive (Monilia).and No parasite was growing in culture swap.

Table (5) Association between mother’s socio demographical characteristic and method of sterilizing

No.	Mother’s socio demographical/ method of sterilizing	Degree of free	P.value	Decision
1-	Age	12	0.89	Non Significant
2-	level of education	15	0.04	Significant
3-	Occupation	3	0.78	Non Significant
4-	Residential area	6	0.05	Significant
5-	Number of children	18	0.83	Non Significant
6-	Socio economical status	6	0.57	Non Significant

P.value at ≤ 0.05

Table 5 Show that there is nonsignificant association between mother’s socio demographical characteristics and method cleaning of sterilization of infant bottle feeding. While only there is significant association between (Mothers occupation and Residential area) and method cleaning of sterilization of infant bottle feeding.

Table (6) Association between Method of cleaning and sterilizing, Duration of cleaning and sterilization and Type of bottle with culture result:

No.	Method of sterilizing/culture results	Degree of freedom	P.value	Decision
1-	Culture result	3	0.000	Highly Significant
2-	Type of Bacteria	30	0.000	Highly Significant
3-	Type of Fungi	3	0.07	Non Significant
4-	Duration of cleaning and sterilization	7	0.000	Highly Significant
5-	Type of bottle	1	0.007	Highly Significant

P.value at ≤ 0.05

Table 6 show that there is highly significant association between (Culture result, Type of Bacteria, Duration of cleaning and sterilization and Type of bottle) and method cleaning of sterilization of infant bottle feeding. While only there is nonsignificant association between (Type of Fungi) and method cleaning of sterilization of infant bottle feeding.

DISCUSSION:

The results of present study revealed the most of mother clean and sterilize their infant bottle feeding by most common methods such as (Boiling, Detergent, Salt, Tap water) that used in Erbil Kurdistan Region in Iraq. (82.5%) of infant has previous history of diarrhea ,Our finding is agree with study done in France, They found in their study that *Salmonella* species and *Escherichia coli*, particularly enteropathogenic *E. coli*, have been isolated from prepared infant formula and have caused multiple outbreaks of diarrheal disease among formula-fed infants⁶.Regarding the duration of cleaning and sterilization about 70% of mothers clean and sterilize the bottle less than 5 minute, this is not accepted with United Kingdom National Health Services Guideline that reveal boil the feeding equipment in water for at least 10 minute this is may be due to low education of mothers⁽¹⁰⁾.

About 95% of mothers use plastic bottle, this is also increase another risk factor for diarrhea, because most of them complain about breaking risk injury for baby or its high price. Our findings agree with study when they clarify that modern plastic bottles are difficult to sterilize in boiling water because they tend to float⁽¹¹⁾. And also plastic bottle have another risk that the Polycarbonate plastic is now known to leach a compound called bisphenol A, or BPA, a chemical that mimics estrogen in the body and thus may cause developmental hormonal disruptions in young children.

Newer baby bottles are made from BPA-free plastics, such as polypropylene⁽¹²⁾. 42.5% of mothers change the teat monthly. This is lead to higher rate of diarrhea ,because boiling method lead to change the teats color and easier to damage old teats can house bacteria, and pieces of the teat may dislodge and can be inhaled or swallowed⁽¹³⁾.Regarding the best method of cleaning and sterilization of infant bottle feeding the researchers found the boiling method is the most sterilize than other, because we found microscopically 90% negative culture swap from boiling methods of cleaning and sterilizing of the bottle feeding this study is strongly agree with guideline that clarify boiling is the preferred option for sterilizing bottles and other infant feeding equipment, boiling gives consistent and reliable results if all steps are followed¹³ ,While 90% positive culture swap for pathogen were detected in detergent method , Our finding is agree when they state disinfectant detergents are not good cleaners or magic germ killers⁽¹⁴⁾.

Also agree with study done in United Kingdom on *E. coli*, they found detergents that increase susceptibility to benzalkonium chloride (BAC) increase membrane permeability. In *L. monocytogenes*, detergents that reduce susceptibility to BAC lower cell surface hydrophobicity⁽¹⁵⁾. Unfortunately (100%) positive culture swap were found from both methods (salt and tap water) this is agree with National Health and Medical Research Council guideline that clarify the chemical sterilization is not as effective as boiling unless bottles and other utensils are meticulously cleaned⁽¹³⁾. Also our finding is come inline with study done in Georgia about efficacy of protocols for cleaning and disinfecting infant feeding bottles in Georgia, they found the disinfection of bottle feeding equipment by submerging in chlorine solution was not able to consistently sterilize bottles so tap water is not recommended because poor sanitation of water but Ideally should be done by, rinse bottle equipment with soapy tap water and then submerge it in chlorine solution; such steps would reduce the residual pathogen load as well as organic material that may interfere with chlorine's antimicrobial activity, this positive due to the mothers use only tap water without soap or detergent and also not immersing in chlorine or sodium chloride solution salt⁽¹⁵⁾.Regarding the bacterial growth the study fined that 35% of bacterial growth was *E.Coli*, only 5% of bacteria were (*Enterococci*, *Fecalis* and Multi bacteria), Our result strongly agree with study done in South Africa their study on infant feeding knowledge and the practices of mothers they found from total of 84.5% (n = 160) of all the collected feeds was contaminated with *E coli*⁽¹⁷⁾. and also agree with study done in South Africa about bacterial contamination and over-dilution of commercial infant formula prepared by HIV-infected mothers, they find Out of 94, 58 (62%) of the clinic samples containing *E. coli*⁽⁵⁾. Also agree with another study in United Kingdom that found after use commonly used cleaning and disinfection procedures (one chemical .and two thermal), considerable microbial and organic soil remained in the cumulative bottles⁽¹⁸⁾. Regarding the fungi about 15% was positive (*Monilia*) this is due to mother low knowledge and practice regarding bottle feeding sterilization but no parasite was growing in culture swap, In our study we found significant association between (Mothers level of education and Residential area) and method cleaning of sterilization of infant bottle feeding at P value ≤ 0.05 , this finding is completely agree with study about infant-feeding knowledge and the practices of mothers they found the associations between

total coliform count and level of education of the mother or caregiver were significant p-value < 0.05⁽¹⁷⁾.

Regarding method of sterilization we found that there is highly significant association between culture result, Type of Bacteria, duration of cleaning and sterilization and Type of bottle and method cleaning of sterilization of infant bottle feeding at P value ≤ 0.05 . Our finding is supported by guideline which mentions that chemical sterilization is not as effective as boiling unless bottles and other utensils are meticulously cleaned⁽¹³⁾. Also agree with study done in Georgia they found that rinsing bottle equipment with soapy water followed by tap water was the most effective cleaning method and reduced pathogen load by 3.7 and 3.1 log 10 s at the low and high inoculum levels, respectively. Submersion in 50 parts per million (ppm) hypochlorite solutions for 30 minutes produced a 3.7-log 10, because the mother use only tap water without detergent or use salt only. Regarding the association of type of bottle feeding with method of sterilization⁽¹⁶⁾. Our finding is agree with study that clarify glass is easy to clean, and glass bottles can be easily sterilized in boiling water but the plastic bottle is changed by boiling method¹².

CONCLUSION:

The study concluded the following:

1. Boiling method was the most sterilize method among (Detergent, Salt and Tap water) methods.
2. Majority of mother use different amount of detergent, salt, duration, brushing or without brush for cleaning and sterilization of infant bottle feeding.
3. Different type of bacteria and Monilia was isolated for bottles swap after cleaning and sterilization by mother.
4. The mother's educational level has positive effect on culture result.

RECOMMENDATIONS:

The Researchers recommend the following

1. Mass media for mothers and an educational program about method of cleaning and sterilization of infant bottle feeding must be providing by ministry of heath to all maternal and child heath care center in Kurdistan region –Iraq.
2. Encourage mother to use breast feeding to decrease risk for diarrhea
3. Instruct the mother to avoid use tap water for cleaning the bottle feeding because of poor sanitation.
4. Encourage mother to use glass bottle feeding instead of plastic one because its easier to sterilize and clean.
5. Including nursing, Mass media, TV and radio, lectures in different community associations or in health centers regarding the best method of cleaning and sterilization of bottle feeding.
6. Health education through the group in Maternal and Child Health center.

REFERENCES:

1. Alison S. The Risks of Not Breastfeeding for Mothers and Infants. USA. *Rev Obstet Gynecol*. 2009 .2(4).
2. United Nations Children's Fund (UNICEF)/World Health Organization (WHO), Diarrhoea: Why children are still dying and what can be done. Final_Diarrhoea Report.2009.978-92-806-4462-3.

3. United Nations Children's Fund (UNICEF)/World Health Organization (WHO) World Bank, UN DESA/Population Division. Levels and Trends in Child Mortality 2015.
4. Leroy V, Sakarovitch C et al. Acceptability of formula-feeding to prevent HIV postnatal transmission, Abidjan, Cote d'Ivoire: ANRS 1201/1202 Ditrane Plus Study. *J Acquir Immune Defic Syndr.* 2007;44: 77–86.
5. Andresen E, Rollins NC, Sturm AW, Conana N, Greiner T. et al.;. Bacterial contamination and over-dilution of commercial infant formula prepared by HIV-infected mothers in a Prevention of Mother-to-Child Transmission (PMTCT) Programme, South Africa. *J Trop Pediatr*, 2007, 53: 409–414.
6. Brouard C, Espie E, *etal.* Two consecutive large outbreaks of Salmonella enterica serotype Agona infections in infants linked to the consumption of powdered infant formula. France. *Pediatr Infect Dis J* . 2007;26: 148–152.
7. Creek TL, Kim A, Lu L, Bowen A, Masunge J, Arvelo W, et al. Hospitalization and mortality among primarily non-breastfed children during a large outbreak of diarrhea and malnutrition in Botswana, *J Acquir Immune Defic Syndr* .2010; 53: 14-9.
8. Jason J. Prevention of invasive Cronobacter infections in young infants fed powdered infant formulas. USA. *AAP.* 2012;130(5):e1076-84.
9. World Health Organization WHO. Organization of the United Nations (FAO). How to Prepare Powdered Infant Formula in Care Settings. 2007.
10. National Health Services United Kingdom .Guide to bottle feeding how to prepare infant formula and sterilize feeding equipment to minimize the risks to your baby. 2012.
11. Jess Miller. "How To Sterilize Baby Bottles And Nipples". Parent Guide Retrieved 4 May 2015.
12. Lori A. Selke. Plastic vs. Glass Baby Bottles. Live strong. 2015.
13. National Health and Medical Research Council. Infant Feeding Guidelines. Canberra: National Health and Medical Research Council; Canberra: NHMRC; 2012.
14. Gabe Zanche, Trying To Kill Germs Can Backfire. FFSr.-Co-Founder of Gabriel First Corp. Niagara .USA. 2006.
15. Walton J.T., Hill D.J., Protheroe .R.G., Nevill A. and Gibson H. Investigation into the effect of detergents on disinfectant susceptibility of attached Escherichia coli and Listeria monocytogenes. United Kingdom. *J of Appl Microbiology.* 2008. 105(1) 309–315.
16. Li Ma , Guodong Zhang , Balasubr Swaminathan , Michael Doyle , and Anna Bowen.. Efficacy of Protocols for Cleaning and Disinfecting Infant Feeding Bottles in Less Developed Communities. Center for Food Safety, University of Georgia, Griffin, Georgia; *Am. J. Trop. Med. Hyg.* 2009. 81(1),. 132–139.
17. Kassier SM, Veldman FJ Cry, the beloved bottle: infant-feeding knowledge and the practices of mothers and caregivers in an urban township outside Bloemfontein, Free State province. South Africa. *S Afr J Clin Nutr* .2013;26(1): 17-22.
18. Redmond EC, Griffith CJ, Riley S.;. Disinfection methods used in decontamination of bottles used for feeding powdered infant formula. Food Research and Consultancy Unit Cardiff School of Health Sciences University of Wales Institute, Cardiff, UK. *J Fam Health Care.*; 2009.19 (1):26-31.