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Determinants of inappropriate complementary feeding practices in children aged 6-23 months in Mosul city

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ABSTRACT:

Background: Proper feeding practices of children less than 2 years of age is important as it is the most critical period of life for optimal growth and development . **Aim:** This study aimed to use the newly developed World Health Organization (WHO) infant feeding indicators published in 2008, to assess determinants of complementary feeding practice in children 6-23 months of age in Mosul city, Iraq in 2013 .

Patients and methods: A cross-sectional study was conducted in six primary health care (PHC) centers in Mosul city during 3 months period from 11th of February to 11th of May 2013. The study sample consisted of 420 healthy children, aged 6–23 months who attended (PHC) centers for immunization The questionnaires data were based on the consent mother's recall of foods given to her child in the. 24 hours before the interview. Inquiry also included the sample demographic characteristics. Children's anthropometric measurements were assessed according to standard techniques.

Results: Minimum dietary diversity rate was 45.5 %, minimum meal frequency 79.1% and minimum acceptable diet 40.7%. Determinant of inadequate minimum dietary diversity were: Children aged 6-11 months [P =0.000, adjusted odds ratio (AOR) = 6.28], first born children (P =0.019, AOR =2.46) and monthly income per capita < 100,000 Iraqi Dinars (ID) (P= 0.002, AOR = 3.27 for < 50,000 ID; P= 0.010, AOR = 2.35 for 50,000 -100,000 ID). Determinant of inadequate minimum meal frequency were: Stunting (P = 0.015, AOR= 3.01) and monthly income per capita of 50,000 - 100,000 ID (P = 0.009, AOR = 4.41). Determinants of inadequate minimum acceptable diet included: Children aged 6-11 months (P = 0.000, AOR = 6.50), preceding birth intervals of 12-24 months duration (P = 0.008, AOR =2.58) and monthly income per capita < 100,000ID (P= 0.005, AOR = 3.12 for < 50,000 ID; P= 0.008, AOR = 2.48 for 50,000 - 100,000 ID). Breast milk feeding type (P = 0.001, AOR=0.25) displayed protection against inappropriate minimum acceptable diet achievement.

Conclusions: The measured minimum dietary diversity and minimum acceptable diet attainment are not at satisfactory levels among studied children in Mosul city. Attention should focus on aforementioned determinants of inadequate infants feeding practices to prevent their subsequent negative influence on growth parameters .

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Introduction

Complementary feeding practices represent one of the most ignored factors of young child malnutrition despite their essential role in growth pattern of children (1). The time between the birth of a child and two years of life is the most critical period of life for optimal growth and development (2). Early growth faltering is difficult to reverse after the first 2 years of life (3) .Adequate complementary feeding depends on correct information and expert support from the family, community and healthcare system. Inadequate mother's knowledge about feeding practices is often a greater determinant of malnutrition than shortage of food (4). Improving infant and young child nutrition must be a priority for all health personnel, not limited to the domain of nutritionists (5). Many factors associated with optimal complementary feeding practices have been recognized. These include maternal characteristics like age, education level, occupation, socio-economic status and child's characteristics such as birth weight and birth order (6.(

In order to define simple and valid indicators that are essential to asses feeding practice and hence improve nutrition and health during the first two years of life; WHO in 2008, published a document titled indicators for assessing infant and young child feeding practices (7) . Few studies and reports tackle assessment of complementary feeding in Iraq, moreover; there is no previous research in Iraq examining the new WHO indicators published at 2008 recommended for assessing complementary feeding practice. Based on these recent indicators, this current analysis was conducted to assess complementary feeding practice in children 6-23 months of age in Mosul city and to identify the determinants of inadequate complementary feeding indicators achievements of enrolled children.

Patients and methods

The study was performed in Mosul city in northern area of Iraq; that has an estimated population of 3,100,000 people. The research was conducted during the period from 11th of February to 11th of May 2013. Six primary health care (PHC) centers out of 30 (PHC) centers in the two city sides were chosen by lot drawing randomization, three (PHC) centers on each coast side of Tigris River. Those centers were Al-Sharqi which had a population size in the catchment area of (56972), Al Garbi PHC centers (36208) , Al –Noor (64529), Al–Quads (16232), Al –Hadba (46774) and Bab Al- Beidh (31882) (PHC) centers .

In order to have a representative sample of children 6–23 months living in Mosul city ,the sample size estimate was done in agreement with Gorstein et al method of sample calculation in cross sectional studies (8) , based on the following formula n = 1.962 p (1- p)(DEFF) / d2 Where n = required sample size, P = estimate of the expected proportion (p) of infants on complementary feeding practice according to recent WHO recommendations which is not known proportion ; a value of 0.5 (or 50%) is selected which produces the largest sample size (for given values of d and DEFF). DEFF= Estimated design effect, a value of 1 is selected as the study using simple PHC random sampling. d = Desired level of absolute precision which specifies the width of the confidence interval, a value of ±0.05 (i.e., +5%) is chosen in the study. Size of sample=1.962X 0.5 X 0.5 X 1/ (0.05)2=384. Accordingly, sample size of 384 children, which gives confidence level of 95%, was computed. Nevertheless, a quantity more than calculated sample size consisting of 420 eligible children was chosen to improve sample selection .

Equal number of children were enrolled from each PHC center and were selected using inclusion and exclusion criteria as follows :

Inclusion criteria:

1. Any child aged between 6 to 23 months attending health care center, labeled as healthy and eligible for vaccination after being examined by PHC doctor .
2. The child is a product of full term delivery with normal birth weight.
3. Mothers and children are available during the period of the data collection.
4. Mother's consent to participate in the study .

Exclusion criteria: To rule out the effect of other factors on the pattern of feeding practice and on the child's growth, the following were excluded from the study:

1. Children with chronic disease .
2. Children with congenital anomalies or abnormal facies .
3. Children sick on the day or night preceding the interview.
4. Children taking therapeutic milk formula.

Mothers refused to respond to some questions or could not satisfactorily recall the previous day infant feeding practice or their responses were inconsistent and contradictory were excluded from the sample size.

Data were collected by face-to-face interview with consent mothers concerning infant feeding practices (milk feeding and complementary food) and parent's socio-demographic information. Assessment of the socioeconomic status scale (SESS) of

the family is graded based on El-Gilany et al socioeconomic status scale for health research (9). This scale has a total score of 84 and it includes 7 domains: education and cultural, occupation, family, family possessions, economic, home sanitation and health care domains. Socioeconomic level is classified into very low, low, middle and high levels depending on the quartiles of the score calculated. Grading of economic level alone was assessed using approximate monthly income per capita expressed in Iraqi Dinars (ID) currency and its United States Dollar (US $) equivalent (1 US $ ≈1270 ID at the time of the study conduction) . Monthly income per capita was graded in an ordinal scale as follow: <50,000 ID, 50,000-100,000 ID and >100,000 ID.

Feeding types labeling in this study were based on current World Health Organization (WHO) definitions: Breastfeeding means that the infant consumes breast milk with allowance to consume any food or liquid involving non-human milk and formula (7.(

Complementary feeding indicators: each selected eligible respondents were interviewed by the researchers to describe everything the child ate based on the mother's recall of nutrients given to her child during the 24-hours before the interview .The infant and young child feeding (IYCF) practices were evaluated applying the key indicators recommended by the WHO which include minimum dietary diversity, minimum meal frequency and minimum acceptable diet calculated for the age ranges 6–11, 12–17 and 18–23 months of age. The mentioned indicators are defined by WHO (7) as follows:

Minimum dietary diversity: proportion of children 6–23 months of age who received foods from four or more food groups out of the seven-food groups. The seven foods groups used for tabulation of this indicator were grains, legumes, dairy products (milk, yogurt), flesh foods (meat, fish poultry and liver/organ meats), vitamin A-rich fruits and vegetables (according to WHO list of specific food item definitions) and other fruits and vegetables. The investigator carried a copy of WHO reference liquid and food groups consisting of a detailed description of infant and young child feeding practices (10) as guideline in case of difficulty in categorizing a food or liquid item. Consumption of any amount of food from each mentioned food groups is sufficient to "count", i.e., there is no minimum quantity. Children who consumed an item that includes more than food groups obtained a point for each included

food groups in that meal (7). For example, a child consuming "Mohallabia" (local popular infant food in Mosul) will get a point for each of the two constituent food groups (dairy products and grains) as it includes both milk and rice .

Minimum meal frequency: proportion of breastfed and non-breastfed children 6–23 months of age, who receive solid, semi-solid, or soft foods (but also including milk feeds for non-breastfed children) the minimum number of times or more. Minimum was defined as: twice for breastfed infants 6–8 months, three times for breastfed children 9–23 months and four times for non-breastfed children 6–23 months (7.(

Minimum acceptable diet: this composite indicator was calculated from the following two fractions: Breastfed children 6–23 months of age who had at least the minimum dietary diversity and the minimum meal frequency during the previous day; and non-breastfed children 6–23 months of age who received at least two milk feedings and had at least the minimum dietary diversity not including milk feeds, and the minimum meal frequency during the previous day (7 .(

Anthropometric measurements: SECA weight scales calibrated to 0.1 kilogram was used to measure weight; finding was rounded to the nearest 100 grams. The scales were calibrated daily. Recumbent length was measured with mother assistance using portable Seca/ Hamburg , Germany model 210 182 1009 Infantometer (range 10–99 centimetres), with digit counter readings precise to 1 millimetre, placed on a flat, firm and stable surface table. Length measurement is recorded in centimetres to the last completed 0.1 centimetres .The anthropometric measurements were assessed by the researcher according to standard techniques. Growth status indicators of studied sample were assessed depending on the following world health statistics (WHS), 2010 definitions of z-scores :

- Stunting: proportion of children less than 5 years of age with length or height for age < -2 z-scores of the median WHO child growth standards.
- Wasting: proportion of children less than 5 years of age with weight for length or height < -2 z-scores of the median WHO child growth standards.

A z-score is the number of standard deviations (SD) below or above the reference median value (11).

Anthropometric measurements were assessed twice for each child. If the results were identical, they were recorded as reliable results; otherwise, the child growth parameters were

rechecked again until identical results were obtained.

Statistical processing was conducted by the use of SPSS statistical package version 17. A chi-squared test was used to test the significance of associations between complementary feeding indicators achievement and the studied independent variables to determine factors associated with appropriate complementary feeding indicators. All potential confounders were assessed using stepwise backwards elimination type of multiple logistic regression to determine the factors significantly associated with not meeting the complementary feeding indicators. P value < 0.05 was considered significant.

The scientific and ethical research review committees in Nineveh health directorate approved this study. The will of enrolled child's mother was respected and her consent was taken after explaining the purpose, components of the study and clarifying that participation is completely optional. Each mother was reassured that the obtained information was confidential and would be used only for the purpose of this study.

Results

The studied children consisted of 230 male (54.8 %) and 190 female (45.2%).Mean age was 12.4 ± 4.98 months.

Table (1) shows types of food given to assessed children aged 6–23 months during the preceding 24 hours prior to interview .Majority (88.8 %) of children were given grains, 55.2 % consumed dairy products, 38.6% had egg intake whereas only 27.9 % fed meat and 21.4 % received legumes. Vitamin A-rich fruits and vegetables were eaten by only 32.4 % of children while 50.5 % of the sample ate other fruits and vegetables. The frequency of different food groups consumption during the past 24 hours were uniformly lower in the 6–11 months age group with the lowest rates reported for legumes and meat food group (11.8%,15.3%) respectively.

Table (1): Types of food groups given to children aged 6–23 months during the 24-hours before the interview, classified by age category, Mosul, Iraq 2013 (n = 420).

Child age category (months)	N*	Percentages with 95% confidence interval of proportion for children who consumed the listed food groups during the 24-hours before the interview													
		Grains		Legumes		Dairy products		Meat		Eggs		Vitamin A rich fruit and vegetables		Other vegetable and fruits	
		%	95%CI	%	95%CI	%	95%CI	%	95%CI	%	95%CI	%	95%CI	%	95%CI
6-11	203	83.7	(78.1,88.2)	11.8	(8.08,17)	50.7	(43.9,57.5)	15.3	(11,20.9)	21.7	(16.6,27.8)	20.2	(15.3,26.3)	39.4	(32.9,46.3)
12-17	121	90.1	(83.5,94.2)	33.6	(25.3,41.9)	62,0	(53.1,70.1)	38,0	(29.9,46.9)	51.2	(42.4,60)	45.5	(36.9,54.3)	56.2	(47.3,64.7)
18-23	96	97.9	(92.7,99.4)	27.1	(19.2,36.7)	57.3	(47.3,66.7)	41.7	(32.3,51.7)	58.3	(48.3,67.7)	41.7	(32.3,51.7)	66.7	(56.8,75.3)
6-23	420	88.8	(85.4,91.5)	21.4	(17.8,25.6)	55.2	(50.7,60.2)	27.9	(23.8,32.3)	38.6	(34,43.3)	32.4	(28.1,37)	50.5	(45.7,55.2)

Table (2) shows frequency of achievement of the calculated complementary feeding indicators by age for breast fed, non- breastfed and all children. Less than half (45.5 %) of children 6–23 months of age meet the minimum dietary diversity criteria whereas (79%) meet the minimum meal frequency criteria and only (40.7%) of the sample achieve the minimum acceptable diet criteria. There is increasing percentages of the acquisition of minimum dietary diversity and minimum acceptable diet complementary feeding indicators requirements with increasing age of selected children .

Minimum dietary diversity achievement among enrolled children 6-23 months of age is not significantly different between breast-feeding and non-breast feeding children. Minimum meal frequency is significantly (P=0.002, OR=7.52, 95% CI: 1.74-32.45) higher among 6–11 months non-breast feeding group likewise among 6–23 months aged non-breast feeding group (P=0.000, OR= 6.34, 95% CI: 2.25-17.85) in comparison to age matched breast-feeding type feeders. Minimum acceptable diet was more significantly higher among 18-23 months as well as among 6-23 months aged breast feeding category versus the compared non breast feeders (P= 0.047 ,P= 0.024) respectively.

Table (2): Complementary feeding indicators achievement among 420 children aged 6–23 months, classified by age categories in relation to types of milk feeding, Mosul, Iraq 2013.

Indicators	N*	n**	(%)	95%CI	P value	OR	95%CI
Minimum dietary diversity rate							
Minimum dietary diversity rate, breastfed (6-11 months)	161	41	25.5	(19.4,32.7)	0.589	0 .80	(0.35,1.81)
Minimum dietary diversity rate, non-breastfed (6-11 months)	42	9	21.4	(11.7,36)			
Minimum dietary diversity rate, all (6-11 months)	203	50	24.6	(19.2,31)			
Minimum dietary diversity rate, breastfed (12-17 months)	100	60	60	(50.2,69.1)	0.808	0.89	(0.34,2.30)
Minimum dietary diversity rate, non-breastfed (12-17 months)	21	12	57.1	(36.6,75.5)			
Minimum dietary diversity rate, all (12-17 months)	121	72	59.5	(50.6,67.8)			
Minimum dietary diversity rate, breastfed (18-23 months)	78	57	73.1	(62.3,81.7)	0.586	0.74	(0.25,2.21)
Minimum dietary diversity rate, non-breastfed (18-23 months)	18	12	66.7	(43.8,83.7)			
Minimum dietary diversity rate, all (18-23 months)	96	69	71.9	(61.6,80.3)			
Minimum dietary diversity rate, breastfed (6-23 months)	339	158	46.6	(41.4,51.90	0.341	0.79	(0.48,1.29)
Minimum dietary diversity rate, non-breastfed (6-23 months)	81	33	40.7	(30.7,51.6)			
Minimum dietary diversity rate, all (6-23 months)	420	191	45.5	(40.8,50.3)			
Minimum meal frequency rate							
Minimum meal frequency rate, breastfed (6-11 months)	161	117	72.7	(65.3,79)	0.002§	7.52	(1.74,32.45)
Minimum meal frequency rate, non-breastfed (6-11 months)	42	40	95.2	(84.2,98.6)			
Minimum meal frequency rate, all (6-11 months)	203	157	77.3	(71.1,82.6)			
Minimum meal frequency rate, breastfed (12-17 months)	100	71	71	(61.5,79)	0.063	3.88	(0.85,17.74)
Minimum meal frequency rate, non-breastfed (12-17 months)	21	19	90.5	(71.1,97.4)			
Minimum meal frequency rate, all (12-17 months)	121	90	74.3	(65.9,81.3)			
Minimum meal frequency rate, breastfed (18-23 months)	78	67	85.9	(75.7,92.4)	0.090	1.27	(1.14,1.42)
Minimum meal frequency rate, non-breastfed (18-23 months)	18	18	100	(78.1,100)			
Minimum meal frequency rate, all (18-23 months)	96	85	88.5	(80.6,93.4)			
Minimum meal frequency rate, breastfed (6-23 months)	339	255	75.2	(70.4,79.5)	0.000§	6.34	(2.25,17.85)
Minimum meal frequency rate, non-breastfed (6-23 months)	81	77	95.1	(87.2,98.1)			
Minimum meal frequency rate, all (6-23 months)	420	332	79	(74.9,82.7)			
Minimum acceptable diet rate							
Minimum acceptable diet rate, breastfed (6-11 months)	161	39	24.2	(18.3,31.4)	0.167	0.52	(0.20,1.33)
Minimum acceptable diet rate, non-breastfed (6-11 months)	42	6	14.3	(6.7,27.8)			
Minimum acceptable diet rate, all (6-11 months)	203	45	22.2	(17,28.4)			
Minimum acceptable diet rate, breastfed (12-17 months)	100	54	54	(44.3,63.4)	0.594	0.77	(0.30,1.99)
Minimum acceptable diet rate, non-breastfed (12-17 months)	21	10	47.6	(28.3,67.6)			
Minimum acceptable diet rate, all (12-17 months)	121	64	52.9	(44.1,61.6)			
Minimum acceptable diet rate, breastfed (18-23 months)	78	54	69.2	(58.3,78.4)	0.047§	0.36	(0.13,1.01)
Minimum acceptable diet rate, non-breastfed (18-23 months)	18	8	44.4	(24.6,66.3)			
Minimum acceptable diet rate, all (18-23 months)	96	62	64.6	(54.6,73.4)			
Minimum acceptable diet rate, breastfed (6-23 months)	339	147	43.4	(38.2,48.7)	0.024§	0.55	(0.33,0.93)
Minimum acceptable diet rate, non-breastfed (6-23 months)	81	24	29.6	(20.8,40.3)			
Minimum acceptable diet rate, all (6-23 months)	420	171	40.7	(36.1,45.5)			

Table (3) demonstrates that all complementary feeding indicators were significantly higher in children of 18-23 months of age compared to younger age groups. Wasting had a significant association with lower minimum dietary diversity (p= 0.017) and minimum acceptable diet (p= 0.041). In contrast to breast feeding children; non breast feeding ones was a significant frequent meal consumer (p= 0.000). Achievement of all complementary feeding indicators is significantly improved with increasing duration of complementary feeding. The table also displays that children of mothers married at age of ≥30 years or more,

have more frequent success concerning minimum acceptable diet rate (P= 0.037) than younger aged mothers. Offspring of working mothers have more minimum acceptable diet achievements (P = 0.042) than workless mothers. Institute level and university educated mothers have a more minimum dietary diversity (P=0.019) and minimum acceptable diet achievements (P=0.004) than mothers with lower levels of education. All complementary feeding indicators were significantly lower in offspring of fathers with unskilled occupation. About 3/4 (71.2%) of mothers received information from their families about complementary feeding practice. Minimum acceptable diet achievement is significantly higher among children of university and postgraduate fathers (P= 0.048). Children belonged to families with monthly income per capita < 50,000 ID and those with lower socio-economic status had significantly lower complementary feeding indicators achievements. Bab al beidh PHC center had significantly less breast feeders (p= 0.000) compared to other centers which is not tabulated result. Minimum meal frequency indicator attainments was significantly higher in Al –Hadba, Al Garbi and Bab al Al- Beidh PHC centers.

Table (3): Complementary feeding indicators achievement in relation to child, parental, family's socio-economic status and primary health care centers characteristics of children 6–23 months of age. Mosul, Iraq 2013 (n = 420)

Characteristics	n	Percentage	Minimum dietary diversity achievement			Minimum meal frequency achievement			Minimum acceptable diet rate achievement		
			%	95%CI	*P*	%	95%CI	*P*	%	95%CI	*P*
Child characteristics											
Sex of baby											
Male	230	54.8	44.3	(38.1,50.8)	0.609	77.4	(71.6,82.3)	0.359	39.1	(33.1,45.6)	0.467
Female	190	45.2	46.8	(39.9, 54)		81.1	(74.9,860)		42.6	(35.8,49.7)	
Age of child (months)											
6–11	203	48.3	24.6	(19.2,31)	0.000*	77.3	(71.1,82.6)	0.028*	22.2	(17,28.4)	0.000*
12–17	121	28.8	59.5	(50.6,67.8)		74.4	(65.9,81.3)		52.9	(44.1,61.6)	
18–23	96	22.9	71.9	(62.2,79.9)		88.5	(80.6,93.5)		64.6	(54.7,73.4)	
Birth order											
First-born	105	25	43.8	(34.7,53.4)	0.277	81.9	(73.5,88.1)	0.192	40	(31.1,49.6)	0.135
Second	97	23.1	54.6	(44.7,64.1)		81.4	(72.6,87.9)		51.5	(41.7,61.2)	
Third	105	25	43.8	(34.7,53.4)		78.1	(69.3,84.9)		36.2	(27.6,45.7)	
Fourth	64	15.2	43.8	(32.3,55.9)		76.6	(64.9,85.3)		39.1	(28.1,51.3)	
Five or more	49	11.7	36.7	(24.7,50.7)		73.5	(59.7,83.8)		32.7	(21.2,46.6)	
Preceding birth interval											
No previous birth	105	25	43.8	(34.7,53.4)	0.114	81.9	(73.5,88.1)	0.192	40	(31.1,49.6)	0.169
< 12 months	69	16.4	40.6	(29.8,52.3)		82.6	(72.0,89.8)		36.2	(25.9,48)	
12- 24 months	106	25.2	39.6	(30.8,49.1)		71.7	(62.5,79.4)		34.9	(26.5,44.4)	
>24 months	140	33.3	53.6	(45.3,61.6)		80.7	(73.4,86.4)		47.9	(39.8,56.1)	
Stunting											
No	370	88.1	46.2	(41.2,51.3)	0.407	81.1	(76.8,84.7)	0.005	41.9	(37,47)	0.181
Yes	50	11.9	40	(27.6,53.8)		64	(50.1,75.9)		32	(20.8,45.8)	
Wasting											
No	406	96.7	46.6	(41.8,51.4)	0.017*	79.1	(74.8,82.7)	0.964	41.6	(36.9,46.5)	0.041*
Yes	14	3.3	14.3	(4,39.9)		78.6	(52.4,92.4)		14.3	(4,39.9)	
Type of feeding											
Breast feeding	339	80.7	46.6	(30.7,51.6)	0.385	75.2	(70.4,79.5)	0.000*	43.4	(8.2,48.7)	0.024*
Non breast feeding	81	19.3	40.7	(30.7,51.6)		95.1	(88,98.10)		29.6	(0.8,40.3)	
Onset of complimentary feeding											

less or equal 3 months	62	14.8	43.5	(31.9,55.9)	0.932	82.3	(71.3,90.3)	0.160	38.7	(27.6,51.2)	0.823
4-5 months	134	31.9	47.8	(39.5,56.2)		82.1	(74.7,87.7)		44.0	(5.9,52.5)	
6-7 months	152	36.2	44.7	(7.1,52.7)		79.6	(72.5,85.2)		39.5	(2.1,47.4)	
8 months or more	72	17.1	44.4	(33.5,55.9)		69.4	(58.1,78.9)		38.9	(8.5,50.4)	
Duration of complimentary feeding											
less than 3 months	96	22.9	13.5	(8.1,21.8)	0.000*	68.8	(58.9,77.2)	0.036*	11.5	(6.5,19.4)	0.000*
3-6 months	125	29.8	40.8	(32.6,49.6)		80.0	(72.1,86.1)		36.0	(28.1,44.7)	
7-12 months	141	33.6	62.4	(54.2,70)		83.7	(76.7,88.9)		55.3	(47.1,63.3)	
more than 12 months	58	13.8	67.2	(54.4,77.9)		82.8	(71.1,90.4)		63.8	(50.9,74.9)	
Parental characteristics											
Mother's age											
≤18 years	25	6	40	(23.4,59.3)	0.616	88	(70.1,95.8)	0,200	32	(17.2,51.6)	0.435
19-29 years	241	57.4	47.3	(41.1,53.6)		80.1	(74.6,84.6)		42.3	(36.3,48.6)	
30-39 years	141	33.6	44.7	(36.7,52.9)		78.7	(70.6,82.1)		41.1	(33.4,49.4)	
≥40 years	13	3.1	30.8	(12.7,57.6)		46.2	(23.2,70.9)		23.1	(8.2,50.3)	
Maternal age at marriage											
≤18 years	171	40.7	38.6	(31.6,46.1)	0.064	76.7	(69.9,82.4)	0.260	33.3	(26.7,40.7)	0.037*
19-29 years	241	57.4	50.2	(43.9,56.5)		81.3	(75.9,85.7)		45.6	(39.5,52)	
≥30 years	8	1.9	50	(21.5,78.5)		62.5	(30.6,86.3)		50.0	(21.5,78.5)	
Mother's working status											
Non-working	391	93.1	44.2	(39.4,49.2)	0.063	78.5	(74.2,82.3)	0.326	39.4	(34.7,44.4)	0.042*
Working	29	6.9	62.1	(44,77.3)		86.2	(69.4,94.5)		58.6	(40.7,74.5)	
Mother' education											
No education	42	10.0	40.5	(27,55.5)	0.019*	71.4	(56.4,82.8)	0.142	33.3	(21,48.4)	0.004*
Primary	203	48.3	39.9	(33.4,46.8)		76.8	(70.7,82.2)		36	(29.7,42.8)	
Intermediate school	85	20.2	47.1	(36.8,57.6)		76.5	(66.4,84.2)		37.6	(28.1,48.3)	
Secondary school	27	6.4	44.4	(27.6,62.7)		88.9	(71.9,96.2)		44.4	(27.6,62.7)	
Institute	9	2.1	77.8	(45.3,93.7)		100	(70.1,100)		77.8	(45.3,93.7)	
University	53	12.6	64.2	(50.7,75.7)		88.7	(77.4,94.7)		62.3	(48.8,74.1)	
Post graduate	1	0.2	0	(0,79.34)		100	(20.7,100)		0	(0,79.3)	
Marital status											
Currently married	419	99.8	45.6	(40.9,50.4)	0.361	79	(74.8,82.6)	0,606	40.8	(36.2,45.6)	0.407
Formerly married (divorced/separated/widow)	1	0.2	0	(0,79.3)		100	(20.7,100)		0	(0,79.3)	
Father' age											
≤18 years	1	0.2	100	(20.7,100)	0.605	100	(20.7,100)	0.409	100	(20.7,100)	0.616
19-29 years	148	35.2	47.3	(39.4,55.3)		83.1	(76.3,88.3)		41.9	(34.3,50)	
30-39 years	192	45.7	43.2	(36.4,50.3)		77.6	(71.2,83)		39.1	(32.4,46.1)	
≥40 years	79	18.8	46.8	(36.,57.7)		74.7	(64.1,83)		41.8	(31.5,52.8)	
Father's occupation											
Not working	4	1	0	(0,49)	0.050	100	(51,100)	0.050	0	(0,49)	0.034*
Free work	318	75.7	43.1	(37.8,48.6)		77.7	(72.9,82)		38.1	(32.9,43.5)	
Employees	90	21.4	55.6	(45.3,65.4)		85.6	(76.8,91.4)		52.2	(42,62.2)	
Retired	8	1.9	50	(17.5,82.6)		50	(17.5,82.6)		37.5	(13.7,69.4)	
Type of Father's occupation (416)											
Unskilled manual worker	72	17.1	31.9	(22.3,43.4)	0.018*	58.3	(33.4,57.5)	0.000*	29.2	(19.9,40.5)	0.037*
Skilled manual worker/farmer	61	14.5	45.2	(40.2,53.2)		87.1	(76.693.3)		38.7	(27.6,51.2)	
Trades/business	87	20.7	44.8	(34.8,55.3)		63.2	(52.7,72.6)		37.9	(28.5,48.4)	
Semi-professional/clerk	134	31.9	48.5	(40.2,56.9)		92.5	(86.8,95.9)		45.5	(37.3,54)	
Professional	62	14.8	59.0	(46.5,70.5)		86.9	(76.2,93.2)		52.5	(40.2,64.5)	
Father's education											
No education	26	6.2	42.3	(25.6,61.1)	0.177	69.2	(50.0,83.5)	0.189	38.5	(22.4,57.5)	0.048*
Primary school	178	42.4	41	(34.1,48.4)		74,7	(67.9,80.5)		34.3	(27.7,41.5)	
Intermediate school	82	19.5	43.9	(33.7,54.7)		80.5	(70.6,87.6)		41.5	(31.4,52.3)	
Secondary school	38	9.0	42.1	(27.9,57.8)		81.6	(66.6,90.8)		36.8	(23.4,52.7)	
Institute	24	5.7	45.8	(27.9,64.9)		87.5	(69,95.7)		41.7	(24.5,61.2)	
University	69	16.4	60.9	(49.1,71.5)		88.4	(78.8,94)		58	(46.2,68.9)	
Postgraduate	3	0.7	66.7	(20.8,93.9)		66.7	(20.8,93.9)		66.7	(20.8,93.9)	
Source of complementary feeding nutritional advice											
Doctor	17	4.0	35.3	(17.3,58.7)	0.119	76.5	(52.7,90.4)	0.334	29.4	(13.3,53.1)	0.060
PHC	3	0.7	0	(0,56.1)		66.7	(20.8,93.9)		0	(0,56.1)	
Audiovisual message on television &/or radio	5	1.2	60	(23.1,88.2)		80	(37.6,96.4)		60	(23.1,88.2)	
Family	299	71.2	43.5	(38,49.2)		76.9	(71.8,81.3)		37.8	(32.5,43.4)	
Printed materials, e.g. books, posters, booklets	11	2.6	72.7	(43.4,90.3)		100	(74.1,100)		63.6	(35.4,84.8)	

More than one source	85	20.2	51.8	(41.3,62.1)		84.7	(75.6,90.8)		50.6	(40.2,61)	
Family characteristics											
Family type											
nuclear	149	35.5	47	(39.1,55)	0.646	78.5	(71.3,84.4)	0.845	42.3	(34.6,50.3)	0.628
Extended	271	64.5	44.6	(38.9,50.6)		79.3%	(74.1,83.7)		39.9	(34.2,45.8)	
Number of families in home											
one family	149	35.5	47	(39.1,55)	0.506	78.5	(71.3,84.4)	0.433	42.3	(34.6,50.3)	0.307
2 families	156	37.1	47.4	(39.8,55.2)		82.1	(75.3,87.3)		43.6	(36.1,51.4)	
more than 2 families	115	27.4	40.9	(32.3,50)		75.7	(67.1,82.6)		34.8	(26.7,43.9)	
Number of children in the studied family											
1-2 child	189	45.0	49.7	(42.7,56.8)	0.273	83.1	(77.1,87.7)	0.142	46	(39.1,53.2)	0.101
3-4 child	169	40.2	41.4	(34.3,49)		74.6	(67.5,80.5)		34.9	(28.1,42.4)	
5 child or more	62	14.8	43.5	(31.9,55.9)		79	(67.4,87.3)		40.3	(29,52.6)	
Socio-economic status characteristics of the family											
Socio-economic classifications of the family											
Very low	52	12.4	23.1	(13.7,36.1)	0.000*	53.8	(40.5,66.7)	0.000*	19.2	(10.8,31.9)	0.001*
Low	84	20.0	48.8	(38.4,59.3)		84.5	(75.3,90.7)		44.0	((33.9,54.7))	
Middle	214	51	43.9	(37.4,50.6)		80.4	(74.5,85.1)		39.7	(33.4,46.4)	
High	70	16.6	62.9	(51.2,73.2)		87.1	(77.3,93.1)		55.7	(44.1,66.8)	
Monthly income per capita (Iraqi dinars)											
< 50,000	123	29.3	35.8	(27.9,44.6)	0.002*	71.5	(63.0,78.8)	0.001*	30.9	(23.4,39.5)	0.000*
50,000 - 100,000	223	53.1	45.3	(38.9,51.9)		78.5	(72.6,83.4)		39.9	(33.7,46.5)	
> 100,000	74	17.6	62.2	(50.8,72.4)		93.2	(85.1,97.1)		59.5	(48.1.69.9)	
Primary health care centers											
Al -Noor	70	16.7	45.7	(34.6,57.3)	0.144	65.7	(54,75.8)	0,000*	40	(45.5,68.1)	0.068
Al-Quads	70	16.7	42.9	(31.9,54.5)		60	(48.3,70.7)		38.6	(28.1,50.3)	
Al-Sharqi	70	16.7	32.9	(23,44.5)		64.3	(52.6,74.5)		28.6	(19.32,40.1)	
Al -Hadba	70	16.7	55.7	(44.1,66.8)		90	(80.8,95.1)		54.3	(42.7,65.4)	
Al Garbi	70	16.7	50	(38.6,61.4)		95.7	(88.1,98.5)		44.3	(33.3,55.9)	
Bab al Al- Beidh	70	16.7	45.7	(34.6,57.3)		98.6	(92.4,99.8)		38.6	(28.1,50.3)	

Table (4) reveals that children aged 6-11 months are at higher risks (P =0.000, AOR = 6.28; 95% CI: 2.68 – 14.71) of not meeting the minimum dietary diversity criteria compared to children aged 18-23 months group. Wasting was significantly (P=0.017.OR:5.23; 95% CI: 1.16, 23.65) associated with inappropriate meal diversity. Increased risk of inappropriate minimum dietary diversity was observed in first born children (P =0.019, AOR =2.46; 95% CI: 1.16 – 5.23) and in offspring of mothers with preceding birth intervals of less than 24 months duration. Children of mother aged <18 year (P =0.027 ,AOR = 0.13; 95% CI: 0.02 – 0.79) and of mother aged 19 – 29 year (P = 0.037, A OR= 0.21; 95% CI: 0.05-0.91) were significantly more protected against not meeting minimum dietary diversity as compared to children of mother aged ≥40 year. Higher risks for not meeting minimum meal diversity were significantly found among children belong to families having monthly income per capita < 50,000 ID (P = 0.002, AOR = 3.27; 95% CI: 1.56–6.88) and 50,000 - 100,000 ID (P = 0.010, AOR = 2.35; 95% CI: 1.23–4.51) compared to families with more income. Failure of achieving minimum meal diversity was significantly associated with short duration of complementary feeding of less than 3 months (P = 0.024, AOR=3.58; 95% CI: 1.19–10.83.

Table (4): Determinants of inappropriate minimum dietary diversity among children aged 6–23 months: unadjusted and adjusted odds ratio, Mosul, Iraq 2013 (n = 420).

Characteristic	Risk of inappropriate meal diversity					
	Unadjusted			Adjusted		
	OR	95% CI	*P*	OR	95% CI	*P*
Child characteristics						

Age of child (months)						
6–11	5.68	(3.72,8.67)	0.000*	6.28	(2.68,14.71)	0.000*
12–17	0.45	(0.29,0.69)	0.000*	1.79	(0.85,3.76)	0.123
18–23	1.00			1.00		
Wasting						
yes	5.23	(1.16,23.65)	0.017*	4.51	(0.77,26.42)	0.095
no	1.00			1.00		
Preceding birth interval						
No previous birth	1.09	(0.70,1.70)	0.692	2.46	(1.16,5.23)	0.019*
< 12 months	1.27	(0.75,2.15)	0.372	2.17	(1.05,4.49)	0.037*
12- 24 months	1.38	(0.88,2.15)	0.162	2.74	(1.46,5.15)	0.002*
>24 months	1.00			1.00		
Parental characteristics						
Mother's age						
≤18 years	1.27	(0.56,2.89)	0.571	0.13	(0.02,0.79)	0.027*
19-29 years	0.84	(0.57,1.24)	0.383	0.21	(0.05,0.91)	0.037*
30-39 years	1.05	(0.7,1.58)	0.816	0.45	(0.11,1.86)	0.271
≥40 years	1.00			1.00		
Maternal age at marriage						
≤18 years	1.60	(1.08,2.38)	0.019*	3.24	(0.56,18.91)	0.191
19-29 years	0.64	(0.43,0.94)	0.024*	1.40	(0.25,7.85)	0.705
≥30 years	1.00			1.00		
Monthly income per capita (Iraqi dinars)						
< 50,000	1.76	(1.14,2.71)	0.010*	3.27	(1.56,6.88)	0.002*
50,000 - 100,000	1.02	(0.69,1.49)	0.936	2.35	(1.23,4.51)	0.010*
> 100,000	1.00			1.00		
Duration of complementary feeding						
Less than 3months	7.78	(4.17,14.53)	0.000*	3.58	(1.19,10.83)	0.024*
3-6	1.31	(0.86,2.0)	0.210	0.86	(0.32,2.28)	0.757
7-12	0.35	(0.23,0.54)	0.000*	0.83	(0.36,1.94)	0.670
>12 months	1.00			1.00		

Table 5 illustrates that children aged 6-17 months were more susceptible (AOR for 6- 11 months=2.81; for 12-17 months = 5.10) for inadequate meal frequency compared to older children. Stunted children were significantly (P = 0.015, AOR= 3.01; 95% CI: 1.23 – 7.32) more likely to have inappropriate minimum meal frequency compared to not stunted children; Other determinant of inadequate minimum meal frequency was the monthly income per capita of 50,000 - 100,000 ID (P = 0.009, AOR = 4.41; 95% CI: 1.45–13.42), Contrasting to Bab Al –Beidh PHC center, all other studied PHC centers were at risk poor minimum meal frequency.

Table (5): Determinants of inappropriate minimum meal frequency among children aged 6–23 months: unadjusted and adjusted odds ratio, Mosul, Iraq 2013 (n = 420)

Characteristic	Risk of inappropriate meal frequency					
	Unadjusted			Adjusted		
	OR	95% CI	*P*	OR	95% CI	*P*
Child characteristics						
Age of child (months)						
6–11	1.22	(0.76,1.95)	0.406	2.81	(0.78,10.09)	0.113
12–17	1.46	(0.89,2.41)	0.135	5.10	(1.65,15.71)	0.005
18–23	1.00			1.00		
wasting						
yes	1.03	(0.28,3.78)	0.964	0.21	(0.04,1.16)	0.073
no	1.00			1.00		
stunting						
yes	2.41	(1.28,4.54)	0.005	3.01	(1.23,7.32)	0.015*
no	1.00			1.00		
Preceding birth interval						
No previous birth	0.79	(0.45,1.39)	0.406	1.88	(0.73,4.81)	0.188
< 12 months	0.76	(0.39,1.49)	0.427	0.87	(0.35,2.20)	0.771
12- 24 months	1.74	(1.05,2.90)	0.032*	3.33	(1.45,7.69)	0.005
>24 months	1.00			1.00		
Parental characteristics						
Mother's age						
≤18 years	0.50	(0.15,1.70)	0.257	0.11	(0.01,1.07)	0.057
19-29 years	0.86	(0.54,1.39)	0.545	0.13	(0.03,0.65)	0.013
30-39 years	1.03	(0.63,1.69)	0.908	0.16	(0.04,0.77)	0.021*
≥40 years	1.00			1.00		
Maternal age at marriage						
≤18 years	1.28	(0.80,2.05)	0.309	1.06	(0.11,9.65)	0.958
19-29 years	0.73	(0.45,1.16)	0.183	0.43	(0.05,3.76)	0.444
≥30 years	1.00			1.00		
Monthly income per capita (Iraqi dinars)						
< 50,000	1.83	(1.12,2.99)	0.015*	3.15	(0.99,10.06)	0.043
50,000 - 100,000	1.08	(0.67,1.73)	0.759	4.41	(1.45,13.42)	0.009*
> 100,000	1.00			1.00		
PHC centers						
Al –Noor	2.33	(1.33,4.09)	0.003*	76.09	(8.92,648.81)	0.000*
Al-Quds	3.22	(1.85,5.60)	0.000*	106.71	(12.58,905.55)	0.000*
Al-Sharqi	2.53	(1.45,4.43)	0.001*	61.42	(7.38,511.50)	0.000*
Al –Hadba	0.37	(0.16,0.84)	0.014*	17.08	(1.90,153.39)	0.011*
Al Garbi	0.14	(0.04,0.46)	0.000*	7.45	(0.69,80.05)	0.097
Al- Beidh	1.00			1.00		
Duration of complementary feeding						
Less than 3months	2.09	(1.24,3.50)	0.005	2.08	(0.49,8.85)	0.324
3-6	0.92	(0.55,1.55)	0.755	0.56	(0.14,2.24)	0.413
7-12	0.64	(0.38,1.09)	0.097	0.64	(0.19,2.17)	0.468
>12 months	1.00			1.00		

Consistent with poor minimum dietary diversity, determinants of inadequate minimum acceptable diet included: Children aged 6-11 months (P = 0.000, AOR = 6.50; 95% CI: 2.65– 15.97), preceding birth intervals of 12-24 months duration(P = 0.008 , AOR =2.58; 95% CI: 1.28-5.17), monthly income per capita < 100,000ID (P= 0.005,AOR = 3.12 for < 50,000 ID; P= 0.008 , AOR = 2.48 for 50,000 - 100,000 ID), short duration of complementary feeding of less than 3 months (P = 0.014 , AOR=4.36; 95% CI: 1.35–14.08). In accordance with poor minimum meal frequency, determinants of inadequate minimum acceptable diet were: all studied PHC centers apart from Bab Al -Beidh

PHC center were at risk poor minimum acceptable diet. Breast milk feeding type (P = 0.001, AOR=0.25; 95% CI: 0.11–0.59) and maternal age of 19- 29 years old (P = 0.048, AOR=0.19; 95% CI: 0.04-0.99) displayed superior minimum acceptable diet achievement in comparison to their reference groups (Table 6).

Table (6): Determinants of inappropriate minimum acceptable diet among children aged 6–23 months: unadjusted and adjusted odds ratio, Mosul, Iraq 2013 (n = 420)

Characteristic	Risk of inappropriate acceptable diet					
	Unadjusted			Adjusted		
	OR	95% CI	*P*	OR	95% CI	*P*
Child characteristics						
Age of child (months)						
6–11	4.93	(3.22,7.56)	0.000*	6.50	(2.65, 15.97)	0.000*
12–17	0.49	(0.32,0.76)	0.001*	1.55	(0.74, 3.25)	0.247
18–23	1.00			1.00		
Preceding birth interval						
No previous birth	1.07	(0.68,1.67)	0.78	2.23	(1.00, 4.98)	0.050
< 12 months	1.20	(0.71,2.04)	0.50	2.09	(0.96, 4.51)	0.06
12- 24 months	1.39	(0.88,2.20)	0.16	2.58	(1.28, 5.17)	0.008*
>24 months	1.00			1.00		
Parental characteristics						
Mother's age						
≤18 years	1.49	(0.63,3.54)	0.360	0.14	(0.02,1.14)	0.066
19-29 years	0.62	(0.41,0.92)	0.017*	0.19	(0.04,0.99)	0.048*
30-39 years	0.68	(0.17,2.76)	0.589	0.36	(0.07,1.80)	0.215
≥40 years	1.00			1.00		
Maternal age at marriage						
≤18 years	1.69	(1.13,2.53)	0.011*	3.56	(0.56,22.55)	0.178
19-29 years	0.62	(0.41,0.92)	0.017*	1.48	(0.25,8.88)	0.667
≥30 years	1.00			1.00		
Type of milk						
Breast milk	1.82	(1.08,3.07)	0.024*	0.25	(0.11,0.59)	0.001*
Formula milk	1.00			1.00		
Monthly income per capita (Iraqi dinars)						
< 50,000	1.81	(1.16,2.83)	0.008*	3.12	(1.42,6.86)	0.005*
50,000 - 100,000	1.07	(0.73,1.59)	0.721	2.48	(1.27,4.84)	0.008*
> 100,000	1.00			1.00		
PHC centers						
Al –Noor	1.04	(0.61,1.75)	0.894	4.37	(1.5,12.76)	0.007*
Al-Quds	1.11	(0.66,1.88)	0.689	3.63	(1.25,10.5)	0.018*
Al-Sharqi	1.9	(1.08,3.32)	0.023*	4.69	(1.64,13.45)	0.004*
Al –Hadba	0.52	(0.31,0.87)	0.011*	1.29	(0.49,3.42)	0.610
Al Garbi	0.84	(0.50,1.41)	0.505	2.78	(1.07,7.18)	0.035*
Al- Beidh	1.00			1.00		
Duration of complementary feeding						
Less than 3 months	7.54	(3.88,14.66)	0.000*	4.36	(1.35,14.08)	0.014*
3-6	1.33	(0.86, 2.042)	0.201	0.85	(0.31,2.33)	0.754
7-12	0.40	(0.27,0.61)	0.000*	1.04	(0.44,2.46)	0.922
>12 months	1.00			1.00		

DISCUSSION:

In our study, less than half (45.5 %) of analyzed children aged 6–23 months meet the minimum dietary diversity criteria, this indicates that more than half of studied children 6–23months of age fail to receive foods from four out of seven classified food groups. Like our finding, the rate of minimum dietary diversity In Bangladesh was (41.9%) and in Nepal, it was (34.2%) (12, 13). In Egypt (69%) of breast -fed children age 6-23 months had an adequate diverse diet (14), likewise the minimum dietary

diversity rate In Indonesia was (68.4%) (15). Higher rates are observed in other countries like Jordan (75.1%) (16) and Sri Lanka (71.1%) (17), while in India the minimum dietary diversity rate is low (15.2%) (18). Overall differences in the dietary schedules during the complementary feeding in most countries originate from cultural reasons (19).

Factors that affect inappropriate diversity practices in Mosul city had been determined, it is revealed that children aged 6-11 months was a risk factor (AOR = 6.28) for food diversity failure, other investigators; in other locations, reached to a same conclusions (12, 18). Short duration of complementary feeding of less than 3 months (AOR=3.58) is another determined risk factor for food diversity failure. By virtue of their young age group of 6-11 months, they are also susceptible to short duration of complementary feeding, implying that these two variables are closely interrelated. knowing that studied children in this age group of 6–11 months predominantly consumed grains (83.7%) and dairy products (50.7%) with the lowest rates reported for legumes and meat food group (11.8%,15.3%) respectively. Hence, in order to increase diversity rate, we recommend that the later food groups should be advised to be consumed daily started with initiation of complementary feeding practice.

Children of mothers with preceding birth intervals of less than 24 months duration and children belong to families having monthly income per capita (Iraqi dinars) < 100,000 ID are other determinants of food diversity failure that necessitate appropriate counteractive recommendations. Economic constraints were the main reason for the low frequency of animal protein consumption stated by some researchers (20, 21). Institute level and university educated mothers have better minimum dietary diversity (P=0.019) and minimum acceptable diet achievements (P=0.004) than mothers with lower levels of education, emphasizes that education of parents is important as it makes better decision to promote their children's growth and health (22) furthermore all complementary feeding indicators were significantly lower in offspring of fathers with unskilled occupation. Children with acute malnutrition were more likely than controls have a father with no or a low-paying job (23).Whether it had a cause or a consequence role, wasting was significantly ($P = 0.017$) associated with lower minimum dietary diversity in this study.

The minimum meal frequency criterion was achieved by (79%) of the enrolled sample. In Egypt, Jordan and Morocco, rates of meal frequency were (58%), (62%) and (62%) respectively (18). In Bangladesh (12) and in Sri Lanka (17) the rates of minimum meal frequency were (81.1%),(88%) respectively, which is similar to our findings, whereas in India rates of meal

frequency are low (41.5%) (18), this difference is probably due to cultural or economic reasons. Stunted children (AOR= 3.01) were more likely to have inappropriate minimum meal frequency. It is possible that mothers perceive stunted children as too small (18), hence offer them infrequent foods. Short duration of complementary feeding of less than 3 months (AOR=2.08) and a mother being less than 18 years of age are another hazards indicating the need for educating vulnerable mothers to feed their infants frequently and as soon as they start the complementary feeding. Poverty is the major cause of inadequate food intake (24). Income is one of the important factors providing the access to health care, education, and nutrition facilities as enough income can improve the nutritional status of the family (25). Financial support for low income Iraqi families is essential as poor monthly income per capita of less than 100,000 ID (AOR = 4.41) was a barrier for frequent diet. Low socio-economic status is associated with sub-optimal complementary feeding practices (6). Non breast feeding children was a significant (p= 0.000) frequent meal eaters. Bab al beidh PHC center had significantly more non breast feeders (p= 0.000) as opposed to other centers, this may explain that all other studied PHC centers were at risk poor minimum meal frequency.

Because children aged 6-11 months and children with short duration of complementary feeding of less than 3 months possess poor food diversity as well as poor food frequency ,consequently they expected to have poor minimum acceptable diet (AOR =6.50 , AOR=4.36) respectively. First born children were at risk of inappropriate minimum dietary diversity (P =0.019, AOR =2.46; 95% CI: 1.16 - 5.23) probably due to lack of previous experience with complementary feeding practice. Preceding birth intervals of less than 24 months duration presumably giving inadequate time for child feeding practice causing unacceptable diet rate achievement. Poor monthly income per capita of less than 100,000 ID (Iraqi dinars) was consistently identified obstacle for achieving all studied complementary feeding indicators.

Feeding with adequate quantity and quality of food as well as healthy feeding practices is a right for each infants; it is the responsibility of health professionals to pass on the updated information about proper infant feeding, convey them to community; with the aim of promoting the optimal growth and development of infant. Nevertheless, majority of enrolled mothers (71.2%) depended on the family as the source of complementary feeding nutritional advice (Table 3). In Brazil, Caetano et al found that about (67.6%) of mothers depended on their own and their family's life experience for the feeding practice (26). Likewise, in Ireland, maternal grandmother was the principal source of advice on infant feeding (27). Inappropriate infant

feeding practices were strongly influenced by traditional beliefs of the mothers and paternal grandmothers (28).

The finding of this research highlights the important role of breast-feeding in the consequent successful complementary feeding practice. Breast-feeding has a protective effective (p = 0.001, AOR=0.25 ;) against failure of acceptable diet. Thus, it provides an additional advantage of breast-feeding to the already known ones; it may reflect the value of maternal knowledge that leads to proper type of infant milk feeding as well as appropriate complementary feeding practice. Supporting the conclusion of other investigators, that breastfeeding improved complementary feeding (29).

Minimum meal frequency rate is significantly (OR=6.34) better among non-breastfed 6–23 months of age children, while minimum acceptable diet rate, is significantly (p=0.024) better among breastfed 6–23 months aged children. This discrepancy might be due to the different equation formulas set for the calculation of "Minimum acceptable diet" for non-breastfed children , as milk feeds are excluded from the diversity score for those children compared to breastfed children.

Table (3) demonstrates a significant frequency of wasting in relation to improper minimum dietary diversity (P < 0.017) and inappropriate minimum acceptable diet (P < 0.041) which is consistent with Marriott et al finding (30). There was a significant association between meal frequencies per day and stunting (P < 0.005). Ramli et al showed that the stunted children were 26% lower in families that provided a minimum of three meals per day (31). This imply that achievement of the recommended WHO complementary feeding indicators is vital for optimizing childhood growth.

Similar studies in other world regions were a strong stimulus for us, to compare them with our complimentary feeding practice attainment. An important strength point of this study being the first paper that describe complementary feeding patterns in Iraq based on the newly developed WHO infant feeding indicators. It determines factors that affect inappropriate feeding practices in this region and can serve as baseline data to monitor future changes in complementary feeding indicators rate after eliminating negative factors associated with poor feeding indicators scoring. Weak points in the study is that it is across sectional which impede cause and effect analysis.

Conclusion:

Grain is the predominant type of food consumed by 6-23 months aged children in Mosul, followed by dairy products, fruits and vegetables, egg, vitamin A-rich fruits and vegetables, meat and finally legumes in decreasing frequency. The measured minimum dietary diversity (45.5%) and minimum acceptable diet attainment (40.7%) are not at appropriate levels. Institute level and university educated mothers have

better minimum dietary diversity (P=0.019). Breast milk feeding type and maternal age of 19- 29 years offered a protection against inappropriate minimum acceptable diet achievement in comparison to their reference groups. Family was the principal source of advice on infant feeding practice. Children of 6-11 months of age, short duration of complementary feeding of less than 3 months and poor monthly income per capita of less than 100,000 ID were an identified risks of not meeting complementary feeding indicators. Early childhood malnutrition is associated with poor feeding practices manifested by significant frequency of wasting (Weight for age <2 Z scores) in relation to inappropriate minimum dietary diversity and minimum acceptable diet achievement rates.

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