

Diabetes & its Complications

Feeding and Risk to Diabetes Mellitus in the Eastern Mediterranean Region

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ABSTRACT

Background: Diabetes mellitus (DM) is a global problem and in particular in the 22 countries of the Eastern Mediterranean region (EMR).

Aim: To identify risk factors linked to nutritional indices associated with DM in the EMR.

Methods: Collection and analysis of regional data from the WHO Framework of EMR information systems for the 22 countries of EMR. Data of deaths noncommunicable disease (NCD), early discontinuation of breastfeeding and indicators of DM were correlated with raised blood sugar (RBG) and obesity, Sustainable Development Goals Index (SDGI), illiteracy rates and total fertility rates (TFR), life expectancy, low birth weight (LBW), stunting, wasting and anaemia in children under five of age (CU5), neonatal mortality, deaths from exposure to ambient air pollution (AAP) and nutritional anemia in pregnant and non-pregnant women and maternal mortality ratio (MMR).

Results: Early discontinuation of breastfeeding was influenced by income status and NCD. RBG correlated highly with obesity and overweight in adults ($r=0.8$, $p=0.0001$), NMR ($r=0.6$), $p=0.002$, MMR ($r=0.7$), $p=0.0001$, stunting in CU5 ($r=-0.5$, $p=0.02$, anemia in CU5 ($r=-0.4$), $p=0.05$ and TFR ($r=0.6$), $p=P<0.05$. Overweight and obesity correlated highly with illiteracy ($r=0.6$), $p=0.01$, TFR and SDGI $p<0.001$. They correlated highly with feeding practices especially duration of breastfeeding to 24 months, nutritional indices in mother and child including anaemia in pregnant and non-pregnant women, stunting, wasting and underweight. They also correlated significantly with NMR and MMR and deaths from exposure to AAP.

Conclusion: Early discontinuation of breastfeeding may be an underlying factor for risk factors for NCD and DM. Investing in improving early feeding practices can reduce the rising expenditure on NCD in the region.

Keywords

Breastfeeding, Diabetes mellitus, obesity, overweight, social determinants, mortality rates, Eastern Mediterranean region.

Background

Obesity is a global epidemic that predisposes to many diseases and is the underlying cause of noncommunicable diseases (NCD) particularly diabetes mellitus (DM) [1]. DM, is considered the leading cause for disability from blindness and death from cardiovascular, renal and multiple organ failure. DM prevalence is increasing globally, and particularly in low- and middle-income

countries [2]. The rise in obesity and DM are largely driven by modifiable risk factors as physical activity, tobacco, obesogenic and unhealthy diet [1-3]. Exclusive breastfeeding (EBF) for the first six months and continued breastfeeding (CBF) for two years are the optimal breastfeeding practices that are recommended by the World Health Organization (WHO) and United Nation International Children's Emergency Fund (UNICEF) [4]. There is evidence supporting the role of EBF in preventing Type II DM in mothers [5-7] and Type I DM in children [8-10]. In addition, evidence shows that breastfeeding is the most effective and non-costly intervention to prevent deaths from NCD [11].

Unfortunately, early breastfeeding practices particularly continuity for two years remains a challenge to many breastfeeding mothers globally and in the EMR. Many mothers in the EMR will not continue breastfeeding up to the end of the second year. Research about the importance of continued breastfeeding for two years is building up, and evidence shows it is linked to serious disease and handicapping states as breast and ovarian cancer [12]. Still, there is inadequate data to link breastfeeding practices that support continuity with DM and expenditure in health care (EHC), particularly out-of-pocket expenditure (OPE) that drains family resources and places constraints on socioeconomic development and achievement of sustainable development goals (SDG).

Critical analysis of the problem of obesity shows that it is not a disease but is an underlying and preventable risk factor for many NCDs [13]. In the EMR, obesity and overweight trends are on the rise [14]. However, their link with early cessation of breastfeeding and early shift to formula feeding is possible but is not proven for this region. Obesity and DM are leading underlying causes for ischemic heart disease, which is the lead cause of death in the EMR and. At present 340 million children and adolescents are already obese and overweight and 650 million adults are obese [15,16]. These conditions create an economic burden as they increase the EHC and OPE aggravating the problem of poverty in the region where over 80% live in poverty or conflicts [17]. Hence, obesity and DM may cause an added threat to achieving the SDGs in the region.

Therefore the aim of this work was to study status of DM in the EMR and identify early feeding practices and social determinants that can influence nutritional status of children under-five years of age (CU5) [18].

Methods

Study Design

This is a review study using regional data from the WHO EMR framework for health information systems and core indicators for monitoring health situation and health system performance for 2015 and 2017 for the 22 countries of the EMR region and NCD WHO Global data bank for NCDs [18]. Missing data was completed from the UNICEF Multicenter Indicator Cluster Surveys (MICS) of UNICEF accessed on "mics.unicef.org" and the World Bank [19]. The results from the most recent MICS surveys which were carried out from 1995 are becoming progressively available online and are updated for countries every 3 to 5 years. The data for life expectancy were retrieved from the WHO World Health Statistics 2016 Monitoring Health for the Sustainable Development Goals (SDGs) [20].

Data analysis

The data that was compiled from the 22 countries of the EMR for raised blood glucose (RBG) (fasting glucose ≥ 7.0 mmol/l (126 mg/dl) or on medication for raised blood glucose or with a history of diagnosis of diabetes) as crude adjusted estimates, and age standardized death from DM (per 100,000) for males and females (<70 years) (WHO, 2014). Other data included exclusive

breastfeeding (EBF), breastfeeding at 12 and 24 months of age (BF12, BF24), nutritional status of under-fives (stunting, wasting, overweight and anemia), adult data for sociodemographic, nutritional status and behavior life styles, mortality rates for early childhood, mortality from NCDs (MNCD) and attributed to household and ambient air pollution (MAP). The data reflected the status over period from 2010 to 2015 [18,19] (WHO, 2017, UNICEF, 2016).

EBF was taken from global databases and represented the pattern of feeding only on mother's milk from birth up to 5 months of age (0-5 months) with no introduction of bottles, pacifiers, drinks or other milks or even water (except for medicine or vitamin drops). Percent not-breastfeeding at 12 and 24 months (NBF12, NBF24) was defined as mothers who were not breastfeeding at this age. This rate was chosen instead of the continued breastfeeding, as the pattern of feeding and intensity of breastfeeding is not known and this may influence the specificity if the data. The data was collected from WHO regional offices and UNICEF multicenter cluster surveys (MICS). In case of Palestine (West Bank and Ghaza strip) data was obtained from national surveys.

The countries were categorized by income level into three groups

- High income countries (HIC): Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Oman.
- Middle income countries (MIC): Egypt, Jordan, Iran, Iraq, Lebanon, Libya, Morocco, Syria, Tunisia, Palestine.
- Low income countries (LIC): Afghanistan, Djibouti, Pakistan, Somalia, Sudan, Yemen.

The data used for NCD included percent RBG for each of the 22 countries. These were obtained from the WHO database. Age specific adjusted death rate (ASDR) by sex and by disease for all NCDs was available from the World Bank statistics. EHC and OPE was also obtained from WHO data base and World Bank sources of data. Data on nutritional status of children under five (CU5) included stunting, wasting and anemia, and for adult's obesity and overweight were available from WHO database.

Ethical considerations

The work of the paper was in compliance with the ethical principles of Helsinki Declaration (1964).

Statistical Analysis

The collected data were organized, tabulated and statistically analyzed first on excel sheets for initial analysis. The relevant data were further analyzed using SPSS version 20(SPSS Inc; Chicago, Illinois), running on IBM compatible computer with Microsoft Windows 7 Operating System. The qualitative data for the rates of breastfeeding and NCDs were presented as discrete data per country and presented in mean and standard deviation for the region. Student t-test (for parametric data) and Mann-Whitney U test (for non-parametric data) were used for comparison of 2 distinct groups. Whereas for comparison of between the three country groups of social (LIC versus MIC versus HIC) analysis

of variance with post hoc Bonferroni test (for parametric data) and Kruskal-Wallis test followed by Mann-Whitney U test (for non-parametric data) were used. Categorical variables were compared using Chi square and Fisher exact tests. Spearman rank correlation coefficient was used to measure the strength and direction of linear relationship between two variables. The level of significance cut off used was $P < 0.05$.

Results

Table 1 shows that overall mean percent EBF for the countries of the EMR was 34.4 ± 17.9 with no significant difference between the country income groups. Mean percent BF12 and BF24 were 59 ± 19.7 and 24.6 ± 16.8 respectively, being higher in LIC for BF12 (71.5 ± 18.5) and BF24 (39.3 ± 20.6) at $p > 0.05$. Mean percent stunting was 19.2 ± 14.9 being highest in LIC (34.7 ± 16.3) and lowest in HIC (6.3 ± 4.6) at $p < 0.01$. Mean percent RBG was significantly higher in HIC (18.9 ± 2.3) than MIC (13.9 ± 2.9) and LIC (10.1 ± 3.3) at $p < 0.05$. Mean deaths from DM (per 100,000) was significantly higher in males and females of HIC (56.9 ± 30.4 ; 57.2 ± 28.1) compared to MIC (36.39 ± 29.7 ; 36.62 ± 34.9) and LIC (35.9 ± 6 ; 37.1 ± 9.2) respectively at $p < 0.01$. Both overweight and obesity were highest in HIC (72.7 ± 3.9 ; 36.65 ± 4.02) and MIC (58.2 ± 12.6 ; 25.4 ± 7.49) compared to LIC (28.68 ± 11.8 ; 8.36 ± 5.6) respectively at $p < 0.05$.

Breastfeeding practices and NCDs

Correlative studies between percent not exclusively breastfeeding (NEBF) and breastfeeding discontinuation at 12 to 15 months of age (NBF12) and not breastfeeding at 21 to 23 months (NBF24) and indices for NCD are shown in table 2. There were no significant correlations between NEBF and RBG or death from NCDs or DM.

There were significant correlations between NBF12 and death from all NCDs ($r = -0.65$) in both males ($r = 0.51$) and females ($r = 0.59$) at $p < 0.05$ and $P < 0.01$ respectively and RBG with NBF24 months at $p < 0.05$ as shown in table 2. When analyzed in relation to sex and income group the correlations between mortality from NCDs

(MNCD) and mortality from diabetes (MDM) with EBF were evident with LIC and HIC in either sex at $P < 0.05$ and between MNCD and NBF12 at $P < 0.05$ in LIC as shown in table 2.

Correlations between indices for DM with different parameters of nutrition, survival and development

There were evident correlations between all nutritional indices in CU5 for under and overnutrition with RBG as shown in table 3 as follows: RBG correlated negatively with, MMR ($r = -0.63$) at $p = 0.002$, NMR ($r = -0.7$) $p = 0.0001$, stunting ($r = -0.5$) $p = 0.02$, anaemia in CU5 ($r = -0.43$) $p = 0.05$. Also, RBG correlated highly overweight and obesity in adults ($r = 0.8$, $r = 0.80$ respectively) at $p < 0.0001$. There were insignificant correlations with anemia during pregnancy ($p > 0.05$). RBG correlated with TFR ($r = -0.6$) at $p = 0.005$.

Overweight and obesity in adults were significantly negatively correlated with CBF ($r = -0.5$, $r = -0.5$ at $p = 0.03$, $p = 0.02$), CBF24 ($r = -0.6$ at $p = 0.002$ and $r = -0.7$ at $p = 0.001$), stunting ($r = -0.85$ $p < 0.000$, $r = -0.8$ at $p < 0.000$), wasting ($r = -0.6$ at $p = 0.003$ and $r = -0.61$ at $p = 0.003$) and anaemia ($r = -0.7$ at $p = 0.001$). Nutritional anaemia for non-pregnant and for the reproductive age group correlated negatively with obesity ($r = -0.4$ $p = 0.05$, and $r = -0.5$ at $p = 0.02$).

Table 4 shows that mortality rates of MMR and NMR correlated negatively, very highly with both obesity ($r = -0.8$ and $r = -0.9$) and overweight ($r = -0.8$ and $r = -0.9$) at $p < 0.000$. It shows that RBG, overweight and obesity correlated with death from exposure to AAP at $p < 0.001$. SDGs were also highly correlated with obesity, overweight and RBG at $p < 0.01$. Overweight and obesity correlated with TFR at $r = -0.8$ and $r = -0.8$ at $p < 0.0001$ and $p < 0.0001$, and with illiteracy ($r = -0.6$ and $r = -0.6$) at $p = 0.003$, and $p = 0.003$ respectively.

Discussion

In this study RBG for the region was highest in HIC (18.9 ± 2.3) compared to MIC (13.9 ± 2.9) and LIC (10.1 ± 3.3). The data inventory for country data in the WHO show that 67% of deaths in the EMR are due to NCDs with an increase of 10% from 2012. The

Countries		LBW	% Exclusive BF	% Continued Breast-feeding		Under fives	Adults				
		% LBW	0-5 months	12 months	24 months	% Stunting	% RBG	% Death from DM		% Over-weight	% Obese
								M	F		
All countries in the EMR [22]	Mean	14.1	34.4	59.9	24.6	19.2	14.4	41.8	42.3	55.45	24.6
	SD	± 10.3	± 17.9	± 19.7	± 16.8	± 14.9	± 4.23	± 26.4	± 28.6	± 19.13	± 11.9
High income countries (HIC) (5 countries)	Mean	8.4	32.0	51.32	22.29	6.3*	18.9*	56.9	57.2*	72.7*	36.65*
	SD	± 1.6	± 20.4	± 21.76	± 14.6	± 4.6	± 2.3	± 30.4	± 28.1	± 3.9	± 4.02
Middle Income Countries (MIC) (11 country)	Mean	9.4	37.6	59.2	21.8	13.6	13.9	36.39	36.62	58.2	25.4
	SD	± 2.8	± 18.7	± 18.4	± 11.9	± 6.6	± 2.9	± 29.7	± 34.9	± 12.6	± 7.49
Low Income Countries (LIC) (6 countries)	Mean	24.8	35	71.5	39.3	34.7*	10.1*	35.9	37.1	28.68	8.36
	SD	± 12.8	± 17.5	± 18.5	± 20.6	± 16.3	± 3.3	± 6.0	± 9.2	± 11.8	± 5.6

Table 1: Comparison of indicators for breastfeeding, diabetes mellitus and nutritional status in the countries of the Eastern Mediterranean region (EMR) by income status.

p-value of statistical significance: * $p < 0.05$, ** $p < 0.01$. LBW: low birth-weight, RBG: raised blood glucose, DM: diabetes mellitus, MNCD: mortality per 10,000 for aged 30 – 70 years related to death from the four major noncommunicable diseases (cardiovascular disease, cancer, diabetes, chronic respiratory disease 2015) HIC: Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Oman. MIC: Egypt, Jordan, Iran, Iraq, Lebanon, Libya, Morocco, Syria, Tunisia, Palestine. LIC: Afghanistan, Djibouti, Pakistan, Somalia, Sudan, Yemen. Data from EMR-WHO, 2017.

Indices		Not exclusively breastfeeding for 0-5 months (22 countries)			Not Breastfeeding at 12 months (21 countries)			Not Breastfeeding at 24 months (21 countries)		
RBG in adults		r0.17			r0.44			r0.52*		
ASDR NCD		r-0.37			r-0.65**			r-0.36		
		LIC [6]	MIC [10]	HIC [6]	LIC [6]	MIC [10]	HIC [6]	LIC [6]	MIC [10]	HIC [6]
Raised blood glucose (RBG)	RBG	r-0.1	r-0.31	r0.07	r0.3	r0.04	r0.098	r0.35	r0.35	r0.41
	MRNCD	r0.11	r-0.14	r0.44	r0.48	r0.047	r0.56	r0.59	r0.486	r-0.06
Age-standardized death rate per 100,000 (Males)	All NCDs	r -0.67*	r -0.18	r -0.65*	r-0.81*	r-0.45	r-0.41	r-0.56	r-0.05	r-0.18
	MDM	r-0.66*	r0.30	r0.11	r -0.46	r 0.045	r -0.59	r-0.28	r0.16	r-0.79
Age-standardized death rate per 100,000 (females)	All NCDs	r-0.72*	r-0.17	r-0.61*	r-0.67*	r-0.63*	r-0.07	r -0.57*	r-0.29	0.45
	MrDM	r-0.60*	r0.22	r0.35	r -0.31	r -0.06	r -0.48	-0.31	r-0.06	r-0.48

Table 2: Correlations between breastfeeding duration and deaths from noncommunicable diseases and diabetes mellitus by income level of countries in the Eastern Mediterranean region.

p-value of statistical significance: *p<0.05, **p<0.01. NCD: Non-communicable disease, DM: Diabetes mellitus (21 countries, no data for State of Palestine), ASDR: Age-standardized death rate per 100,000. **Low income countries (LIC):** Afghanistan, Djibouti, Pakistan, Somalia, Sudan, Yemen; middle income countries (MIC): Egypt, Jordan, Iran, Iraq, Lebanon, Libya, Morocco, Syria, Tunisia, Palestine; High income countries (HIC): Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Oman. NCD: Noncommunicable disease . DM: Diabetes mellitus, MRNCD: Mortality related NCD.

NCD Indices		Range Mean ± SD	Raised Blood sugar [21]	Overweight (18± years)	Obesity (18± years)	NCD-related mortality
EBF		34.4 ± 17.9	r-0.05	r-0.1	r-0.1	
CBF12		59.9 ± 19.7	r-0.25	r-0.5*	r-0.5*	
CBF24		24.6 ± 16.8	-r0.4	r-0.6**	r-0.65**	
Nutritional Anaemia in Pregnant and Non-Pregnant and Reproductive age group	Anaemia Non Pregnant [22]	20-51 33.96 ± 9.28	r-0.2	r-0.35	r-0.4*	r-0.50*
	Percent Anaemia in.Pregnant	27- 61 40.02 ± 10.79	r-0.2	r-0.3	r-0.4	r-0.2
	Percent Anaemia in Reproductive age	23.8-69.6 36.3 ± 10.01	r-0.4*	r-0.5*	ND	ND
Nutritional indices in children under-five years of age (CU5)	% Low Birth Weight (22)	5.7-39.9 14.87 ± 8.78	r-0.4	r-0.7**	r-0.7**	r0.4
	% Stunting	0-22 8.68 ± 6.2	r-0.50*	r-0.85***	r-0.8***	r-0.2
	% Wasting	1.2-33 8.8 ± 7.26	r-0.3	r-0.6**	r-0.6**	r-0.2
	% Anemia	21.7-84.6 39.26 ± 15.55	r-0.4*	r-0.6**	r-0.7**	r0.6*
Nutritional status in adults	% Overweight	16.2-8.1 54.7 ± 19.5	r0.8***	NA	NA	r0.06
	% Obesity	2.9-42.3 24.49 ± 11.87	r0.8***	NA	NA	r-0.68**

Table 3: Correlative studies between indices of diabetes mellitus (blood sugar, obesity and overweight and death from noncommunicable diseases) with breastfeeding, nutritional status in women and children in the countries under study.

p-value of statistical significance: *p<0.05, **p<0.01 *** p<0.001. NMR: Neonatal mortality rate, IMR: Infant mortality rate, U5MR: Under-five mortality rate, MMR: Maternal mortality ratio.

NCD Indices		Range Mean ±SD	Raised Blood sugar (21)	Overweight (18± years)	Obesity (18± years)	NCD-related mortality
Exclusive and continued breastfeeding	EBF	34.4 ± 17.9	r-0.05	r-0.1	r-0.1	
	CBF12	59.9 ± 19.7	r-0.25	r-0.5*	r-0.5*	
	CBF24	24.6 ± 16.8	-r0.4	r-0.6**	r-0.65**	
Nutritional Anaemia in Pregnant and Non-Pregnant and Reproductive age group	Anaemia Non Pregnant (22)	5.7-39.9 14.87 ± 8.78	r-0.2	r-0.35	r-0.4*	r-0.50*
	Percent Anaemia in.Pregnant	0-22 8.68 ± 6.2	r-0.2	r-0.3	r-0.4	r-0.2
	Percent Anaemia in Reproductive age	1.2-33 8.8 ± 7.26	r-0.4*	r-0.5*	ND	ND

Nutritional indices in children under-five years of age (CU5)	% Low Birth Weight [22]	5.7-39.9 14.87 ± 8.78	r-0.4	r-0.7**	r-0.7**	r0.4
	% Stunting	0-22 8.68 ± 6.2	r-0.50*	r-0.85***	r-0.8***	r-0.2
	% Wasting	1.2-33 8.8 ± 7.26	r-0.3	r-0.6**	r-0.6**	r-0.2
	% Anemia	21.7-84.6 39.26 ± 15.55	r-0.4*	r-0.6**	r-0.7**	r0.6*
Nutritional status in adults	% Overweight	16.2-8.1 54.7 ± 19.5	r0.8***	NA	NA	r0.06
	% Obesity	2.9-42.3 24.49 ± 11.87	r0.8***	NA	NA	r-0.68**

Table 4: Correlative studies between indices of diabetes mellitus (blood sugar, obesity and overweight and death from noncommunicable diseases) with breastfeeding, nutritional status in women and children in the countries under study.

p-value of statistical significance: *p<0.05, **p<0.01 *** p<0.001. NMR: Neonatal mortality rate, IMR: Infant mortality rate, U5MR: Under-five mortality rate, MMR: Maternal mortality ratio.

Region has the second-highest age-standardized NCDs death rates of all WHO regions [2,17]. The leading causes of NCD deaths in 2015 were cardiovascular diseases (17.7 million deaths, or 45% of all NCD deaths), cancers (8.8 million, or 22% of all NCD deaths), and respiratory diseases, including asthma and chronic obstructive pulmonary disease (3.9 million deaths) [2]. Diabetes caused another 1.6 million deaths [2]. The EMR is bearing one of the heaviest burdens in the world, whereby, according to the global health observatory in 2015, it ranked second after Africa for the age-standardized NCD mortality, exceeding the global rate by 11% [14].

When analyzed in relation to income group the correlations between RBG with BF12 were evident with MIC and HIC (r-0.6 and r-0.44 respectively at P<0.05). RBP was also showed borderline correlations with BF12 in HIC (r-0.4). These relationships were lost at BF24 months for MIC and HIC but were evident in LIC for RBG (r-0.5) at p<0.05.

The study demonstrates that RBG, overweight and obesity are predictors of maternal and neonatal deaths associated with stunting, wasting, anemia in the childhood and in women thereafter. The patterns of these indices are more prevalent with illiteracy and high parity which is reflected in the strong associations with the SDGs. Overweight and obesity are not only a burden on the EHC and OPE, but also threaten the achievement of SDGs. While encouraging healthy feeding practices in early infancy can nurture and proclaim the efforts of countries to achieve these goals. The study gives a snapshot on the situation in the EMR where the high prevalence of undernutrition with concurrent overnutrition are leading to the increasing burden of NCD, expenditure in health and mortality rates.

Our study re-emphasizes the UNICEF and WHO recommendation for using the global strategy for infant and young child feeding as a road map for the region to achieve the SDGs. If a randomized trial were to find similar effect sizes when comparing women who breastfed more than 1 year to those who never breastfed, then the rough estimate for the number needed to prevent a case of hyperlipidemia would be 40 and to prevent a woman from developing DM would be 100. These findings build on a growing

body of literature that demonstrates that lactation has beneficial effects on the risk of developing diabetes [12] and on abnormal lipid metabolism [13].

Our study showed that continued breastfeeding for a longer duration of up to 12 and 24 months were highly correlated with a reduction of blood sugar and also death rates from diabetes. This could be related to increased insulin sensitivity induced by lactation, thereby enhancing its role in the control of glucose metabolism [21]. Other workers found that the cumulative duration of breastfeeding influences cortisol levels in premenopausal women [5]. Such findings can also explain the associations we found with other social determinants as illiteracy, high parity and even with exposure to AAP.

It is important to highlight the importance of social indices that influence breastfeeding practices, maternal and child nutritional status as well as mortality rates in early life. Illiteracy rates and population growth are important underlying factors that influence health and development. The SDGs particularly focus on these indices as an entry point for reducing the burden of malnutrition, poverty and achieve women empowerment [20].

Our study showed that exposure to AAP is associated with increased risk factors leading to DM. Exposure to AAP is linked with the burden from NCDs [21]. Several explanations can be put forward of which exposure to AAP may reduce sensitivity to insulin and may therefore increase the predisposition to DM [22]. Also, early infant feeding practices that support early exclusive breastfeeding and continued breastfeeding for two years may have a protective role in enhancing the maturation of tissues to be resistant to the ill effects of pollution. Increasing the duration of breastfeeding can reduce obesity in both mothers and children and thereby decrease the predilection to fat cell growth that is the storage site for such pollutants. Moreover, obesity is linked with sedentary life and physical inactivity which decreases body's ability to clear away pollutants. Moreover, obesity and not breastfeeding have psychological consequences which lead to poor mental health increasing the risk to poor life styles and their complications.

In the cultural context, continued breastfeeding for two years is

mentioned in many Holy Books as in The Quran, which many of the countries in this region follow. This is a window of opportunity which should be seized by communication strategies that use traditional concepts and beliefs to change behaviour. The EMR countries of the gulf region and North Africa continue to suffer from high rates of obesity that predispose to diabetes. Improving breastfeeding rates in these countries can be pivotal in reducing obesity and also protecting mothers [23,24] and children [25] from obesity, diabetes and risk of cardiovascular disease.

Until recently breastfeeding rates for continuity were measured by continued breastfeeding for 12 months only [26,27]. It is recommended that EMR countries should be encouraged to include continued breastfeeding for 12 and 24 months in its monitoring and surveillance systems, and encourage research that can support such findings, especially that it is difficult to find such evidence in Western communities, because of the low continuity rates to two years in these countries [28,29].

Although countries of the EMR have lower rates of breastfeeding continuity for 24 months, and only one half of the countries of the EMR have data reported for these rates [30]. Still this study showed significant relationships that should be taken into consideration when drafting strategies and policies on infant feeding that positively impact maternal and child health and nutritional status. Moreover, it is essential to consider some of the common barriers that intervene with continuation of breastfeeding. Improving health providers' skills and practices in managing and supporting women to breastfeed exclusively for the first six months of life and continue breastfeeding for two years is required through the Baby Friendly hospital initiative and community-based initiatives [31]. Whilst supporting working women to combine lactation with work through Breastfeeding friendly workplaces is another strategy that needs to be placed within the scope of promoting, supporting and protecting rights of women and children to optimal support in breastfeeding [32]. Finally, it is essential to enact and implement the strategies proposed by the WHO-EMR for preventing obesity and diabetes in the region [33].

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