

A review of the emerging pandemic of obesity in preschool children in Egypt: Exclusive breastfeeding is protective

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ABSTRACT


Introduction: Early exclusive breastfeeding (EBF) without foods or formula milk (FM) is recommended for the first six months of life, for optimum growth and development. **Aim:** This study aims to review studies in Egypt on nutritional status of preschool children by type of feeding. **Methods:** A two staged study was done: First; research was obtained from the Egyptian university libraries consortium (www.eulc.edu) on overweight, obesity stunting, and wasting in preschool children. We filtered 18 thesis fitting the criteria of the study. Next, analysis was done to compare EBF versus FM. **Results:** Comparison of nutritional status of children aged 6–59 months among formula versus EBF was as follows: Overweight 5.4% versus 3.45%, obesity 13.8% versus 5.65%, stunting 21.6% versus 1.15%, and wasting 9.7% versus 0.85%, respectively. Obesity and overweight were higher in males, whereas stunting and wasting were higher in females irrespective of mode of feeding. Early and extended formula feeding, foods before 6 months of life, packed foods, canned drinks, and low activity are risk factors for obesity. Colostrum feeding, exclusive and longer duration of breastfeeding, healthy food intake, and fruits and vegetables are protective. Studies report that deficiency of micronutrients is common with obesity. **Conclusions:** Prolonged formula feeding and unhealthy food intake are risk factors for the emerging and growing problem of obesity. Policies and legislations are needed to encourage exclusive breastfeeding and control marketing of unhealthy foods.

Key words: Anthropometry, Breastfeeding, Child development, Obesity, Overweight, Preschool children

In 2020, globally, 149.2 million children <5 years of age were stunted, 45.4 million wasted, and 38.9 million were found overweight. The number of children with stunting may be declining as United Nations Children’s Fund (UNICEF)/World Health Organization (WHO)/World Bank have reported that two-thirds of countries in all regions are making some improvements except for Africa. Furthermore, among the children who were affected by wasting, 13.6 million were severely wasted and the condition is being exacerbated by the COVID-19 crises [1]. Hence, the rising problem of overweight and obesity is of concern and is more challenging as many countries around the world have experienced no progress or are worsening. Adiposity persists throughout a lifetime and the COVID-19 lockdown has potentiated sedentary life and overeating of unhealthy foods under the effect of marketing. In one country, decrease in physical activity during the pandemic was reported in 28% of children aged 3–5 years, while increased intake of snack with high sugar, salt, and fat was reported in 19% of children in the study [2].

Early exclusive breastfeeding (EBF) for 6 months and continued breastfeeding (CBF) for 2 years or more are recommended by the UNICEF and WHO as the optimal feeding practices [3]. EBF ensures optimal development of the immune system whereas formula milk (FM) predisposes to immune diseases leading to high morbidity and mortality [4,5]. Early and prolonged industrialized FM feeding practices have been shown to play an important role in predicting or predisposing to obesity and its associated morbid medical complications [6]. Action has been taken by the WHO to limit, control, and guide the inappropriate marketing of these products [7,8]. Despite such efforts, products as follow-on milk (FOM) after 6 months and growing up formula at 1–5 years continue to be consumed as a continuum of early FM. Moreover, FM and baby foods introduced in the early months of life <6 months predispose to health and nutritional problems [9].

Egypt is a developing country situated in the African continent and is the gatekeeper to Asia and Africa, sharing with Mediterranean and African countries common lifestyles and dietary habits. The nutritional status varies across the country and is influenced by poverty as well as cultural factors. However, recent marketing of FM has been the drive to the changing patterns

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of feeding among children despite poverty. Children living in poverty is highest in rural Upper Egypt (UE) (53%) compared to rural Lower Egypt (LE) (19%), urban UE (12%), urban LE (4%), and urban governorates (9%) [10]. UE is a community of rigid traditional cultures who are not open to change and have the highest prevalence of stunting and wasting [11]. In contrast, children in LE are open to westernized lifestyles of marketed fast foods, packed snacks, and canned beverages and thereby vulnerable to overweight and obesity, but stunting and wasting remain a problem in poor areas in LE leading to the double burden of malnutrition [10,12]. The challenge in any study is that overweight and obesity are closely linked and thus it is difficult to delineate when the adiposity of overweight can be serious and mimic morbid obesity. It remains up to individual habits, susceptibility, hereditary factors, and epigenetics to determine the outcome of these conditions. Importantly, numerous recent studies demonstrate that gene regulation of adiposity is influenced by maternal and early postnatal diet [13].

The aim of the present study is to perform an analytical review on the nutritional status of preschool children of Egypt over the past decades, with a focus on obesity and its association with breastfeeding and FM feeding practices to guide well-informed recommendations for controlling this pandemic.

METHODS

This was a two staged study. First, we searched for literature on overweight and obesity in children using online search engines primarily in the Egyptian university libraries consortium (www.eulc.edu). Search was done based on the key words of preschool children, obesity, and nutritional status.

We included literature that report the assessment of nutritional status of preschool children or children <5 years of age. All studies were approved by the ethical committee of the affiliated university and followed the standard anthropometric methods of interpretation of the recent WHO standards [14] and Egyptian growth standards [15]. The sample included males and females. Studies considered are those after the year 2000. Studies that consider only sick children or those who are suffering severe or debilitating conditions from early childhood or handicapped or case-control studies were excluded from our analysis.

Out of the 919 thesis that were identified by the key words, 24 thesis were initially identified. They were qualitatively evaluated and filtered so that 14 were excluded and 18 thesis and one national survey were included [11] that fit the study criteria for inclusion. The reference child standards that assess overweight and obesity include the Z-scores for weight for height (W/H Z-scores-2SD) and weight for age (W/A+2SD) and the body mass index (BMI) (overweight: 85th-95th and obesity: >95th) standard reference curves. The protocols for measuring weight and height followed the international standards for valid measurement of both height and weight in which weight is measured to the nearest gram and recumbent length is measured for children <2 year age, and standing height is measured for all other children.

In the second phase, a comparative observation analysis of the reviewed studies was made as per the type of feeding. Pooled data were reanalyzed separately for studies that included children who were fed mixed breast milk and/or FM versus studies based on children who were EBF (i.e., water or decoctions given occasionally by spoon) from 0 to 6 months of age and never introduced any bottle or FM up to the date they were examined. The first group included six studies for stunting, overweight, and obesity and five for wasting (including the national Egypt Demographic and Health Survey [EDHS]) for analysis by age group. The second group included two studies with a total of 2000 children aged 6–59 months.

Permissions to use the data in the thesis were not required as the thesis acceptability was regulated by the individual faculty libraries that allowed us to access and review them inside the library but not for public use.

Descriptive observational analysis was done using graphic presentations between two types of studies (EBF vs. non EBF) identified. The raw data were not available to conduct detailed statistical analysis.

RESULTS

The reviewed studies are presented in Table 1.

Fig. 1 presents the pooled data from the reviewed studies for prevalence rates of overweight, obesity, stunting and wasting by age. Fig. 2 presents the pooled data from the reviewed studies for the prevalence rates of overweight, obesity, stunting and wasting by gender.

Fig. 3 presents a comparison of the nutritional indices of studies with children who were on EBF with the other studies that had both breast and formula fed children in their population sample.

DISCUSSION

The reported rates of overweight and obesity in preschool children over the past decade are alarmingly high. The EDHS national survey in 2014 showed that differences were present between the National Center for Health Statistics (NCHS) system (10.2%)

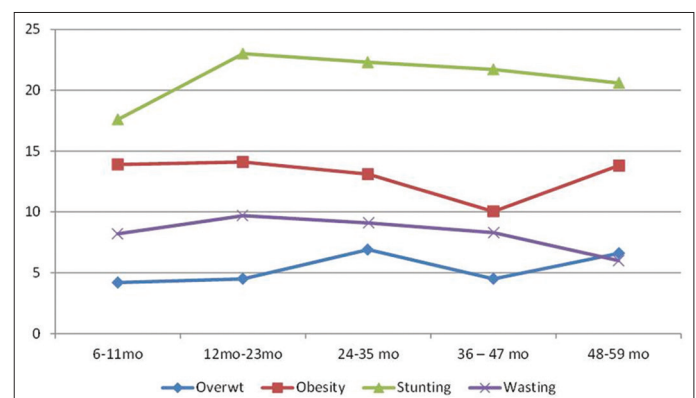


Figure 1: Diagrammatic representation of pooled data analysis from review studies for assessing children 0–72 months for overweight, obesity, stunting, and wasting by age in Egypt (2002–2021)

Table 1: Presentation of reviewed articles by authors, year, region, title, source, and main findings

Authors	Year	Region	Feeding	Title of study	Source	Main findings
Studies reviewed for nutritional status and factors affecting obesity						
Seliman <i>et al.</i>	2002	Gharbia governorate <5 years	Mixed feeding	Determinants of nutritional status of preschool children in a rural areas in Gharbia governorate.	MSc. PH thesis. HIPH Alexandria Un	Sedentary life, TV watching, lack of exercise increased risk of Ob.
Mohamed <i>et al.</i> ,	2008	Cairo governorate (3–5 years)	Mixed feeding	Assessment of nutritional status among Egyptian preschool children.	MSc. Thesis, Ped., FoM, Ain Shams Un.	Ovwt: 10.9% (> males) Ob: 6.6% (> females).
Metwally <i>et al.</i>	2009	Gharbia (rural areas) <5 years	Mixed feeding	Determinants of nutritional status of preschool children in rural areas in Gharbia.	MSc. PH Nutrition. Thesis. HIPH, Alexandria Un.	Not feeding Colostrum increased risk of stunting (OR: 2.1), Wstg (OR 1.4) and Underweight (OR 3.45)
Dyab <i>et al.</i>	2009	Alexandria (slum) (500) (3–5 years)	Mixed feeding	Assessment of preschool children health status in Alexandria squatter areas.	MSc. PHN thesis FoN, Alexandria Un.	St: 30.8% mild, 3% moderate, 6.2% severe. Males: 36%, Females: 15.8% Highest in high and very low WQ.
Darwish <i>et al.</i> ,	2011	Menoufia (LE, mid-delta) 6–60 months	EBF	An evaluation of the Global WHO child growth standards of under-five in Menoufia Governorate	MSc. Ped. thesis FoM, Benha Un	Ovwt: 4.8%; Ob: 3.6%. St: 0.6%; Wstg: 0.6%
El-Sheekh <i>et al.</i>	2011	Gharbia (LE, mid-delta) 6–60 months	EBF	An evaluation of the Global WHO child growth standards of under-five in Gharbia Governorate.	MSc. Ped. FoM, Benha Un	Ovwt: 2.2%; Ob: 7.7%; St: 1.7%; Wstg: 1.1%.
Elsayed	2012	Suez city <5 years	Mixed feeding	Assessment of risk factors of obesity among preschool children in Suez City.	MSc. thesis Ped., FoM, Suez Canal Un.	Early weaning foods <3 months and high carbohydrate diet was associated with Ob.
Mohamed	2012	Ismailia city (24–71 months)	Mixed feeding	Correlation between body mass index and severe early childhood caries in a group of preschool children in Ismailia city.	MSc. PD. Thesis. FoD, Suez Canal Un	Ob: 10.6%, ovwt: 19.8%
Khalifa <i>et al.</i>	2012	Port said <5 years	Mixed feeding	Risk factors of obesity among preschool children in nursery schools in Port Said.	MSc. Ped. Thesis FOM, Suez Canal Un	More Ob in MF fed. Starting MF before 20 days of age increased the risk of obesity
Khalaf-Allah	2014	Cairo city (3–6 years)	Mixed feeding	Assessment of Nutritional Status For Preschool Children (from 3–6 years)	MSc. CM, Thesis. FoM, Menoufia	Ob: 15%, linked to higher class and higher maternal education
Ismail <i>et al.</i>	2014	Ismailia (LE) 2–5 years	Mixed feeding	Prevalence of obesity in preschool children in Elkantara East City.	MSc. Ped. Thesis FoM, Suez Canal Un	Ob: 4.8% (M=7.1%, F=2.6%), ovwt: 7% (M=6%, F=8%). Eating Junk food 77%.
Ministry of Health and Population [Egypt], El-Zanaty and Associates	2014	EDHS, National* 0–59 months	Mixed feeding	EDHS 2014	National survey	Ob highest in urban LE 17.3% and rural LE 16.3% and WQ5: 17.7%. St highest in UE (29.4%)
Hassan <i>et al.</i>	2015	Sohag (UE) 3–6 years	Mixed feeding	Health status assessment of preschool children in Sohag city.	MSc. CHN Thesis, FoN, Alexandria Un	Ovwt: 6.9%, Ob: 5.4%. St: Males: 25.6%, Females: 15.3%.
Mahfouz <i>et al.</i>	2016	Port said 2–6 years	Mixed feeding	Risk factors of obesity in preschool children in Port Fouad	MSc. Ped. Thesis FoM, Suez Canal Un	Short duration of breastfeeding and MF before 20 days increased risk of Ob.

(Contd...)

Table 1: (Continued)

Authors	Year	Region	Feeding	Title of study	Source	Main findings
Amusha <i>et al.</i>	2016	Alexandria AlAmrawy district (rural) <5 years	Mixed feeding	The nutritional status of preschool children at Al-Amrawy Family Health Center in Alexandria Governorate.	MSc. FM thesis. FoM, Alexandria Un	Ovwt and Ob: 8%, severe Ob (> 97th Centile): 4.3%. St: 12%. Wstg: 12%. Ob on wastg > males.
Emtair <i>et al.</i>	2016	Alexandria in Sidi Bishr district<5 years	Mixed feeding	The nutritional status of preschool children at Sidi- Beshr Bahary Family Health unit in Alexandria Governorate.	MSc. FM thesis. FoM, Alexandria Un	Ob: 17.4%, severe obesity >97th centile was 13.7%. St: 19.3%, Wstg: 14.3%. Males more stunted.
Abdel <i>et al.</i>	2016	Kafr-ElSheikh governorate (LE) <5 years	Mixed feeding	The nutritional status of preschool children at Bani- Bakr Family Health Unit in Kafr-ElSheikh Governorate.	MSc. FM thesis., FoM, Alexandria Un.	Ob: 23.65%. St: 28% peaked at 24–35 months), Males more stunted than females. Severe wstg: 18.6% > males.
Abdelgawad <i>et al.</i>	2017.	Mansoura city <5 years	Mixed feeding	Problem of obesity and the predisposing factors among preschool children at Mansoura City.	MSc. CHN. Thesis, FoN, Zagazig Un	Ovwt and Ob 33%. Mother's knowledge and feeding habits
El-Sherbiny <i>et al.</i>	2018	Gamasa –Dakahlia 1–5 years	Mixed feeding	Assessment of growth & development of preschool children in Gamasa –Dakahlia, Egypt	MSc. Forensic medicine, FoM, Mansoura – Un	MF feeding, daily and unlimited access to snacks and canned juices were significantly higher in the obese
Mostafa and ElSaiedy	2018	Sharkia governorate 4–6 years	Mixed feeding	Evaluation of the Nutritional status for preschool children in Sharkia governorate.	MSc.AFS Thesis, FoA, Zagazig Un	One out of five children were obese or overweight in rural vs. one of four in urban
Rakha <i>et al.</i>	2019	Alexandria city (3–5 years)	Mixed feeding	Assessment of overweight and obesity among preschool children in day care centers in Alexandria.	MSc. CHN. Thesis. FoN, Alexandria Un	BF rate was higher in normal non-obese (44% vs. 14.6%) and non-ovwt 38.9% vs. 26.2%
Megahed <i>et al.</i>	2020	Tala district, Menoufia governorate <5 years	Mixed feeding	Overweight and obesity among preschool children attending a family health unit. in Tala district, Menoufia governorate	MSc FM. Thesis. FOM, Menoufia Un,	Ovwt: 13.3%, Ob: 6%, Ovwt & Ob was more prevalent in males.
Harraz <i>et al.</i>	2020	Idku, Beheira. 0–12 months	Mixed feeding	The relation between KAP of mothers about initiation and exclusiveness of Breastfeeding and infant nutritional status in Idku, Beheira.	MSc. FM. Thesis. FoM, Alexandria Un	Ovwt in MF: 20%vs. 10% in EBF and 5.9% in mixed fed. 9.8% & 9.1% of ovwt had poor knowledge and attitude to EBF.
Hammoda <i>et al.</i> ,	2021	Itay Albarud (Elbeheira <6 years	Mixed feeding	The Double Burden of Stunting and Excess Body Weight Among Preschool Children in Itay Albarud City, Elbeheira Governorate	MSc. PH. Thesis. FoM, Tanta Un.	Ovwt & Ob: 11.5%; St: 8.1% >males. Two thirds in rural areas had the double burden of Ovwt/Ob and Stunting

*National: All governorates except North and South Sinia excluded. Mixed fed: Included both EBF and formula fed; MSc: Master degree thesis; FoM: Faculty of Medicine, FoN: Faculty of Nursing, FoD: Faculty of Dentistry, FoA: Faculty of Agriculture; Pediatrics: Ped.; CHN: Community Health Nursing, PH: Public Health; CM: Community Medicine; AFS: Agricultural Food Science, PD: Pediatric Dentistry, Un: University; Ovwt: Overweight, Ob: Obese, BMI: Body mass index, St: Stunting; Wstg: Wasting; WQ: Wealth Quintile. EBF: Early exclusive breastfeeding

and WHO (15%), 2006 meaning that the NCHS system, that was used in the previous decades, may have been underestimating the problem. In 2017, a study in Gharbia (Table 1) reported that the prevalence of stunting, wasting, and underweight were 31.9%, 2.2%, and 9.1%, respectively, with severely stunted children (<-3SD) being 11.8%, indicating a horrendous rise in stunting probably attributed to the epidemics of the influenza virus, and

severe acute respiratory syndrome over this period that deprived children from eating poultry and eggs together with the political upraise in 2011 and the economic demise that followed. The indices for wasting and underweight were higher in preschoolers <36 months of age. Stunting was highest at 36–47 months (36.3%). Stunting was higher in males (33.3%) compared to females (30.3%) while wasting and underweight were much

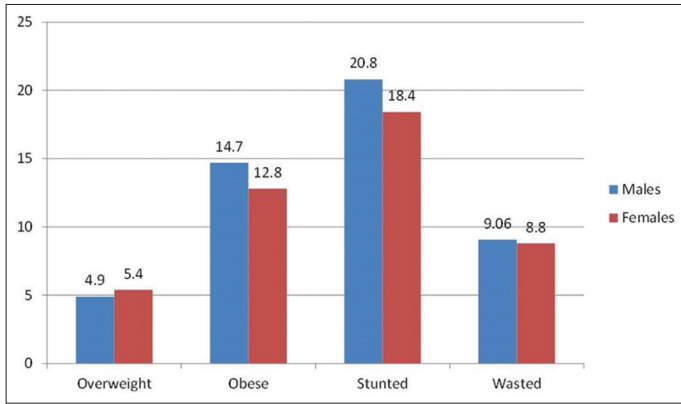


Figure 2: Diagrammatic representation of pooled data analysis from review studies for assessing children under-five for overweight, obesity, stunting, and wasting by sex in Egypt (2002–2021)

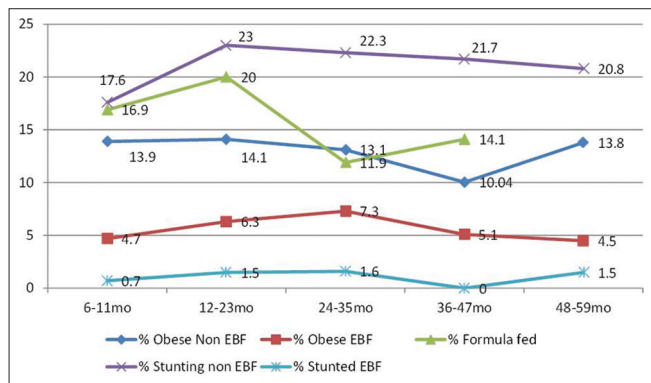


Figure 3: Comparing mean obesity and stunting rates by age group in the subsets of the reviewed local studies with varying percentage of formula fed versus those with exclusively breastfed children aged 6–59 months in relation to the national rates of formula feeding in Egypt

lower in males (2.4% and 9.9%) than in females (2.1% and 8.2%, respectively). By the end of the second decade, a new alarming trend in obesity emerged in rural areas of the mid-delta which showed that obesity rose to 40% in those aged 4–5 years (Table 1). This indicated that obesity was creeping to rise in older ages. Prevalence was again higher among males (80%) versus females (20%) and linked with high levels of education (86.7%) $p=0.003$ and middle or low socioeconomic status ($p=0.05$) [16].

A study in 2008 conducted in Cairo governorate (Table 1) for 513 preschool children aged (3–5 years) reported that the prevalence of overweight by W/H was higher than obesity (11.9% vs. 5.5%). Overweight was higher in males than in females and obesity higher in females than males (12.8% in boys and 10.8% in girls for overweight and 3.5% in boys and 7.8% in girls for obesity). Prevalence of overweight, by BMI, was 10.9% (11% in boys and 10.8% in girls) and prevalence of obesity was 6.6% (4.3% in boys and 9.5% in girls), respectively. Underweight was 0.6% (0% in boys and 1.3% in girls), wasting was 1.9% (2.5% in boys and 1.3% in girls), and stunting was 4.3% (2.8% in boys and 6.1% in girls), respectively. Overweight and obesity were clearly an emerging problem that had been in the dark for the past two decades [17,18] and had shown a sudden surge paralleling the steep rise in digital technology that grounded and invaded the

minds and lives of these children with digital games and toys that interfered with their childhood development and made their bodies and mind captive to this technology [19,20]. Moreover, it was linked with social class that could afford to purchase this technology as it was highest in the children of from families with highest quintiles of wealth (WQ4=15.0% and WQ5=17.7%) and lowest in WQ2 (12.8%). There was no difference in the prevalence of obesity by the level of education of the mothers of these children [11].

The EDHS national survey [11] also showed that stunting was strikingly higher in males (22.8%) than females (19.9%) in their survey. Stunting was highest in UE (29.8%) versus urban LE and urban governorates (19.0%). Wasting was highest in frontier and rural LE governorates versus LE and urban governorates. Low-protein intake because of the avian flu pandemic may have encouraged reliance on dairy products increasing the stunting linked to obesity in this period [10].

Obesity was clearly more prevalent in urban areas as 1/5 children exhibited overweight or obesity in rural areas, while 1/4 children exhibited overweight or obesity in urban areas [21]. In 2014, among the 3–6 years of age, obesity was 15% in Cairo, 10.6% in Sharkia, 33% in Mansoura, and 17.4% in Alexandria with severe obesity (>97th centile 13.7%; Table 1). Overweight was prevalent in males (66.1%) at 24–35 months. The phenotype of the stunted and stout child and adult became a common finding in the fast food outlets in the urbanized communities. Obesity was linked to higher class and higher maternal education [22]. Mother’s knowledge and feeding habits played an important role in this problem (Table 1).

In addition, obesity started manifesting and rising even in rural areas, later in the second decade of the 2000s. This was an alarming sign as it signaled the spread of the epidemic of obesity throughout the country doubling the burden of under- and over-nutrition in these underprivileged areas. Prevalence of obesity in rural areas ranged from 8-23.65% and stunting from 12%-28%, thus typifying the stunted stout child phenotype in these poor areas. Stunting peaked at 12–35 months, with a male predominance (Table 1). Stunting was more in large sized family (over 3), child order and family history of short stature, maternal anemia during pregnancy and no iron supplementation, cesarean section, and incubator care [23]. Wasting is also an ongoing problem in rural areas and this potentiates the rebound stunting evident in pre-puberty due to the underlying micronutrient deficiency states which become accentuated with obesity resulting in the short and stout adolescent and adult [13].

The higher rates of obesity among males are documented in other middle-income countries in our region, where in Iran, prevalence in preschool children was reported as 9.6% in males and 6.3% in males which are close to many of our studies in this period [24].

In 2021, a study in the delta region of LE in Gharbia and Beheira illustrated the pattern of the short stout child and showed that overweight and obese were 11.5%, and 8.1% and had also stunted growth, while 2% had double burden of stunted growth

Table 2: Comparison of pooled data for studies with formula fed (FF) children versus studies comprised children who were exclusively breastfed (0–6 months)

Age (months)/gender	6–11	12–23	24–35	36–47	48–59	Males	Females	Population
Type of study	Pooled population estimates by age and sex							Total
EBF studies	574	718	247	196	265	996	1004	2000
Percentage overweight	5.4	2.4	2.4	1.5	4.5	5.5	4.3	3.45
Percentage obese	4.7	6.3	7.3	5.1	4.5	4.8	3.9	5.6
Percentage stunting	0.7	1.5	1.6	0.0	1.5	1.6	2.1	1.15
Percentage wasting	0	1.5	1.2	0.005	0.01	0.9	0.8	0.85
	Pooled population estimates and ranges by age and sex							
Non EBF	1556	3125	3087	3199	2679			13,646
Percentage overweight	4.2	4.5	6.9	4.5	6.6	5.7	6.06	5.4
Percentage obese	13.9	14.1	13.1	10.04	13.8	14.7	12.8	13.8
Percentage stunting	17.6	23.0	22.3	21.7	20.6	20.8	18.4	21.6
Percentage wasting	8.2	9.7	9.1	8.3	6.0	9.06	8.8	9.7

Percentage overweight: Weight for recumbent length or standing height (W/H) Z-score +2SDS, percentage obese: Body mass index (BMI) Z-score +2SDS, percentage stunting: height forage H/A Z-score-2SDS, percentage wasting: W/H Z-score -2SDS according to the WHO Child Growth standards, 2006. EDHS used W/H Z-score +2 SDS for obesity as BMI was not estimated. All other studies after 2009 used WHO BMI standards >95th centile for estimating obesity. EBF: Early exclusive breastfeeding, EDHS: Egypt Demographic and Health Survey

and obesity, that is, stoutness (Table 1). In these studies, girls were heavier and males were shorter. Approximately, 2/3rd (66.7%) of children who were suffering from stunted growth or the double burden were living in rural areas, but 70.6% of overweight and obese children were from urban areas. This illustrates the trends of migration of obesity. From urban into rural areas increasing the burden of malnutrition and chronic diseases as diabetes mellitus in India [25] and bronchial asthma in Ismailia [26].

These patterns brought the attention of research workers in Alexandria later in 2019 to study this pattern in relation to formula feeding (Table 1). They studied 796 children (age: 3–5 years) attending day care centers in Alexandria and reported that 14% of children were wasted and 10% were obese and less than one-quarter (22%) were overweight. Less than 1/5th (17.1%) of them were bottle-fed with a mean duration of 17.08±7.70 months. They concluded that the prolonged formula feeding was linked to the emerging problem of obesity. Thus, increasing use of formula beyond the first and even the 2nd year of life indicates the active marketing of another “formula” the so-called “growing up milks” (GUM) as a continuum of infant milk formula leading to obesity from overconsumption of whole milk [27].

The two studies conducted in Gharbia and Menoufia in 2011 were based on children who were exclusively breastfed (EBF) (Table 1). They showed less alarming findings of obesity and stunting. The studies were conducted in the mid-delta in Gharbia and in Menoufia for a total of 2000 children. The prevalence rates of obesity were 5.6% in EBF versus 13.8% in studies based on formula fed children. Stunting ranged from 0.6% to 1.7% and wasting from 0.6% to 1.1%. The malnutrition rates in the other studies were closely paralleling the rates of milk formula intake, as shown in Table 2 and Figure 3.

Studies in Ismailia by Suez Canal University teams of researchers showed that early initiation of breastfeeding and colostrum feeding was shown to be protective against obesity and was significantly associated with decreased prevalence of

stunting and underweight. Children not receiving colostrum had 3.45 times risk of underweight relative to those receiving colostrum (Table 1). Furthermore, longer duration of breastfeeding was protective against obesity. Obesity was associated with longer periods of MF feeding beyond 2 years, early introduction of foods from 3 months of age and early abrupt weaning off the breast. Several other of the reviewed studies in LE and UE showed that all the obese children had received FM, especially early in life (<20 days) and continued FM feeding till 18 months of age were obese. They also highlighted in their research that early age of weaning (<3 months) and carbohydrates as a main type of weaning food were significantly associated with overweight and obesity in preschool children and that EBF protects against obesity (p<0.03). This was substantiated by other studies [28].

The Tanta University team of researchers in Gharbia (Table 1) reported that less than half of children in the double burden group (44.4%) and more than one-third of overweight and obese children were bottle-fed, compared to one-third (33.3%) of those who were breastfed and initiated breastfeeding early. Furthermore, early introduction of weaning foods and early termination of breastfeeding were linked to the double burden group and overweight and obese children.

Our study showed that MF took the upper hand in the 2nd year and beyond probably under the effect of GUM. Hence, much of the obesity is linked to the extended milk feeding for over 2 years that encourage consumption of large amounts of high-fat milk. This could be attributed to the aggressive marketing for the GUM. Furthermore, a high percentage of children were fed packed potato chips (71.1%) and canned sugary drinks on daily or weekly basis 57.9% [21,22]. These were significantly associated with overweight and obesity. Sedentary life with less physical and outdoor activities was more common in the obese group. Familial obesity was linked to obesity among children [28].

Obesity was shown by several studies to be associated with micronutrient deficiency states as anemia, Vitamin A deficiency

and Vitamin D deficiency, Vitamin B complex deficiencies as angular stomatitis in 21.1%, and atrophied glazed tongue in 29.6%. A number of studies examined the health status of preschool children and showed that there was a positive link between early feeding status and health status and that MF feeding, daily and unlimited access to snacks, and canned juices were significantly higher in the obese children. Studies showed poor parental knowledge of optimal dietary practices which had a negative effect on nutritional indices. Sedentary life and inactivity were shown by most of the reviewed studies in all regions in UE and LE. Unfortunately, poor attitudes of caretakers in nursery day care centers toward optimal nutritional needs of these children were described in some studies [28-30].

Limitations

Raw data were not accessible to conduct a detailed meta-analysis hence we relied on systemic reviews. Studies on prevalence of obesity in the preschool age group were limited in Egypt.

CONCLUSIONS

The problem of overweight and obese children in early childhood has emerged over the past decade and is extending from urban to rural areas probably under the effect of marketing. Children who were EBF in the first 6 months showed significantly lower rates of obesity and negligible rates of stunting and wasting. Early initiation of breastfeeding, colostrum feeding, and longer duration of breastfeeding is associated with less obesity. Obesity is linked to stunting and micronutrient deficiency states. Risk factors include unhealthy foods as fast foods high in fat and sugary beverages, confounded by restricted outdoor activities, exposure to marketing of these unhealthy foods, and high milk intake in these years [31].

Controlling the aggressive marketing and commercialization of breast milk substitutes, FM, GUM, baby foods, and beverages for young children [32] as per the WHO are recommended. Member states should implement policies that promote early and CBF and control marketing of infant FM [33], especially in public areas, shopping outlets, on television, and digital marketing and cross-border marketing [6,7]. The control measures should be supported by education about the importance of healthy foods and dietary habits, and dangers of responding to marketing, that is, raise their media literacy, as well as encourage exercise, healthy lifestyles of activity, exercise, sleep, and play [34]. Health and medical staff needs to be advocates and becomes engaged in pressuring policies.

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