Prevalence and correlates of overweight and obesity among under-five children in Egypt

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Abstract

Background: Evidence suggests that Egypt, a country in North Africa, has a significant number of children at serious risk of excess body weight. Yet, there is a dearth of studies on overweight and obesity among children under 5 years in the country. This study examined the prevalence and correlates of overweight and obesity among under-five children in Egypt.

Methods: Data were retrieved from the latest (2008 and 2014) Egypt demographic and health surveys (EDHS). A total of 42,568 children under 5 years were included. The prevalence of overweight and obesity was described using proportions whereas the factors associated with the prevalence were examined using logistic regression.

Results: Of the 42,568 children under 5 years, about one in every six (17%) were overweight or obese. Those aged 19-37 months, those with birth weights greater than 4 kg, those given large portions of protein foods (eggs and meat), and those whose mothers were in the rich wealth quintile had significant risks of overweight or obesity.

Conclusion: Overweight and obesity are highly prevalent among children under five years in Egypt. Interventions developed to address these two overnutrition indicators in Egypt need to consider variations in risk factors across age, birth weight, food types and portions, and maternal wealth status.

Introduction

Overweight and obesity defined by the World Health Organization (WHO) as an abnormal or excessive build-up of body fats that might harm one's health[1], are emerging public health concerns in Africa[2]. The impact of overweight and obesity is even more significant when it occurs in children as it puts them at increased risk of both early and long-term breathing problems, musculoskeletal diseases, hypertension, diabetes, stroke, insulin resistance, some cancers, and adult obesity[3, 4]. Also, obesity in childhood is linked to a higher risk of mental health issues, impairment, and even death[5].

Globally, there are about 41 million children under five years reported to be either overweight or obese as of 2018[6]. A growing body of evidence shows that the current majority of obese or overweight children are in developing countries, where the pace of increase is more than 30 percent higher than in industrialised countries[7].

Overweight and obesity in children are on the rise, largely, due to significant changes in dietary and physical activity behaviour, partly, as a result of food globalisation and the replacement of several physical activities with machines[8]. Thus, technological advancement has made it easier to perform daily physical activities; hence increasing sedentary lifestyles and reducing physical activities[9]. In recent years, more children are also spending more time indoors and are likely to spend much time watching television or playing video games, which makes them less active and gain weight as a result[10].

Moreover, dietary patterns have changed from traditional healthy diets largely composed of fruits and vegetables to 'junk' foods which are high in calories and fats[11].

Evidence shows that genetic or family characteristics are also attributable factors associated with overweight and obesity[12]. Research indicates a possibility of a person inheriting about 40% of body type from parents[13]. Additionally, emerging evidence suggests that socio-demographic factors, such as parental wealth status and place of residence have a significant impact on the likelihood of childhood overweight or obesity [14]. Importantly, overweight or obesity resulting from socio-demographic factors are known to be modifiable compared to genetic factors[12]. This idea of modifiable and non-modifiable risk factors associated with overweight and obesity is critical to developing appropriate interventions for reducing childhood overnutrition.

One of the regions in the world facing a high risk of overnutrition is North Africa.

Reports show a rising trend in childhood overweight and obesity in North Africa, especially, in Egypt, with the prevalence higher than in most countries in the Middle East and Sub-Saharan Africa[15, 16]. A study among school-going children in Sohag, Egypt found approximately 17% of the participants were overweight and 15% were obese [3]. Behera, a suburb of Egypt found as high as 18% of overweight and obesity among primary school children in 2019 [17]. Although several community-based evidence shows a high prevalence of overweight and obesity among children under-five years in Egypt, childhood overnutrition is underexplored in Egypt with most studies focusing on adults and adolescents[3, 18]. In view of this significant gap in the empirical literature, we sought to examine the prevalence and correlates of overweight and obesity in Northern Africa by using Egypt as a case study. Findings from this study are critical to developing tailored interventions aimed at addressing overnutrition in the country and even beyond.

Methods

Overview

Since 1980, several surveys have been carried out in Egypt to obtain data from the community on the current health situation including a series of Demographic and Health Surveys (DHS) of which the 2014 Egypt Demographic and Health Survey (EDHS) is the most recent[19]. The 2014 EDHS is of special importance as it is the latest and first national health survey since 2008. The preliminary results of the 2014 EDHS show that key maternal and child health indicators, including antenatal care coverage and medical assistance at delivery, have improved. However, the survey also documents several critical challenges, particularly relating to fertility and family planning[19]. The findings of the 2014 EDHS together with the service-based data are very important for measuring the achievements of health and population programs. The 2014 EDHS was conducted under the auspices of the Ministry of Health and Population[19]. International classification of functioning, disability and Health (ICF) provided technical support for the survey through The DHS program. The DHS Program is sponsored by the United States

Agency for International Development (USAID) to assist countries worldwide to obtain information on key population and health indicators[19]. USAID/Cairo also provided funding to support the implementation of the survey. UNICEF and UNFPA also contributed funding to the survey. The 2014 EDHS survey design involves two components; a survey of ever-married women aged 15–49 years to update key health and population indicators covered in past Egypt DHS surveys and a special Health Issues survey to obtain updated information on other critical health problems facing Egypt[19]. The data are publicly available at http//: measuredhs.org. Details on the approach used in gathering the data including the sampling methods can be found in the EDHS reports[19, 20].

Data

This study was based on the latest [2014 (EGKR61DT.ZIP) and 2008 (EGKR61DT.ZIP)] children's data drawn from Egypt's demographic and health surveys (EDHS). The EDHS children's data contained information on children's nutrition and women aged 15 to 49 years. Approximately, 42,589 children under 5 were sampled to partake in the study[19, 20].

Variable Description

A total of 18 variables were included in the study, and these variables were categorized into three: i.child variables which included age (0–18 = infant, 19-37months = toddlers 38-59months = children), sex, birth weight (< 2.5kg = low birth weight, 2.5-4.0kg = Normal, 4.1 above = overweight), place of residence, access to a bicycle, access to vehicle, child given carbohydrate food, child given protein food, child given fatty food and child given fruits, ii. Maternal variables including maternal age (11–19 years = adolescent, 20-28years = young adult, 29years and above = adult), educational level, wealth index, maternal BMI (when bmi < 25kg/m^2 = Not overweight/obese, when bmi > 25kg/m^2 = Overweight/obese), marital status (married = currently married, widow + divorce + never married = not married), postnatal visit, and current work status), iii. Husband/partner's educational level (Table 1).

Body mass index (BMI) was measured and calculated using the WHO's new standard for child growth. The new standard is an international standard for assessing nutritional status, physical growth, and child development from birth to the fifth year. Overnutrition (overweight and obesity) was calculated in standard deviation using the z-score. To determine the actual child BMI value, the measure was divided by 100. Childhood overweight/obese was defined as z-scores greater than or equal to 2. Also, the mother's overweight/obese was considered a BMI greater than 25kg/m^2 (Table 1).

Table 1
Variable categorisation and description

Variables	Coding used for the analysis
Outcome	
Overweight/Obese	1 = z-score ≥ 2
Not Overweight/obese	0 = z-score < 2
Independent	
Age of Child	1 = 0–18 months, 2 = 19–37 months, 3 = 38 + months
Sex of Child	1 = Male, 2 = Female
Birth Weight	1 = < 2.5 kg, 2 = 2.5-4.0 kg, 3 = 4.1 + kg
Access to Bicycle	1 = No 2 = Yes
Access to car	1 = No 2 = Yes
Child given carbohydrate food	1 = No 2 = Yes
Child given protein food	0 = No, 1 = Yes
Child given fatty food	0 = No, 1 = Yes
Child given fruit	0 = No, 1 = Yes
Maternal Age at First Birth	1 = 11–19 years, 2 = 20–28 years, 3 = 29 + years
Education Level	0 = No formal education, 1 = Primary level education, 2 = Secondary level education, 3 = Higher level education
Place of Residence	1 = Urban, 2 = Rural
Wealth Index	1 = poor, 2 = Middle, 3 = Rich
Mother's BMI	1 = Overweight/Obese 2 = Not Overweight/Obese
Marital Status	1 = Not married, 2 = Married
Antenatal visit during pregnancy	0 = No, 1 = Yes
Postnatal Visit	0 = No, 1 = Yes
Father's education Level	0 = No formal education, 1 = Primary level education, 2 = Secondary level education, 3 = Higher level education
Current work status	1 = Not working, 2 = Working

Patient And Public Involvement Statement

Patients were not involved in this study.

Data Analysis

Descriptive statistics including frequencies and percentages were performed. Beyond descriptive statistics, bivariate and multivariate analyses (logistic regression) were computed in the final model to observe associations. Based on empirical literature [14], the logistic regression analysis was set at a 95% confidence interval and this included all the18 variables. Logistic regression was used because the outcome variable was categorised into two Overweight/obese = 1 and Not overweight/obese = 2. The analysis was performed using Stata/SE 14.

Results

Socio-demographic characteristics of participants

A total of 42,568 children under 5 years were included in the study. Of these, there was a close percentage in terms of age. A little more than one-third (34%) and (33%) were between 0-18 months and above 38 months, respectively. With regards to sex, the majority (52%) were males and the remaining 48% were females. Children who were born with low birth weights were approximately 15% whereas the majority (83%) weighed between 2.5-4.0 kg at birth, with only 2% weighing above 4.0 kg. Most (68%) of the children lived in rural areas whereas the remaining 32% were in urban areas. Less than a quarter (7%) had access to a bicycle while the majority (93%) had access to a car. In terms of food consumption, about 4 percent were commonly given carbohydrate foods whereas more than a quarter (30%) were commonly given protein foods. More than half (56.4%) were commonly consuming fatty foods whereas less than a quarter (8.8%) were commonly consuming fruits (Table 2).

For mothers' sociodemographic characteristics, more than a quarter (32%) were adolescents (11-19 years), the majority (63%) were young adults (20-28 years), and the remaining 5% were considered adults (29 years and above). Most mothers (56%) had attained secondary level education, one-fifth (20%) had no formal education, 15% had higher level education, and the least (9%) had primary education. For wealth index, there was a close percentage among poor and rich mothers, with each having approximately 38% and the remaining 24% being among those in the middle class of wealth. Mothers who were overweight or obese were 34% whereas 65% were neither overweight nor obese. The vast majority (98%) were married and most of them (68%) did not visit a postnatal clinic after birth, whereas 32% attended postnatal clinics after birth. In terms of a child's father's educational level, more than half (56%) had secondary level education, followed by higher level education (17%), primary education (14%), and no formal education (13%). Most (88%) of the fathers were not working at the time of the survey whereas 12% were gainfully employed (Table 2).

Table 2: Participant characteristics

Variable	N=42,568 (%)	Weighted % (C.I)
Child Variables		
Age of Child (months)		
0-18 months	14, 568 (34.25)	34.08 (0.33-0.35)
19-37 months	13,642 (32.01)	32.01 (0.31-0.33)
38+ months	14,358 (33.74)	33.91 (0.33-0.35)
Sex of Child		
Male	22,057 (51.82)	52.20 (0.51-0.53)
Female	20,511 (48.18)	47.80 (0.47-0.49)
Birth Weight		
< 2.5 kg	3,326 (14.08)	14.67 (0.14-0.16)
2.5-4.0 kg	19,662 (83.24)	82.90 (0.82-0.84)
>4.0 kg	633 (2.68)	2.42 (0.02-0.03)
Place of Residence		
Urban	16,771 (39.40)	32.47 (0.31-0.34)
Rural	25,797 (60.60)	67.52 (0.66-0.69)
Access to Bicycle		
No	37,299 (92.72)	92.84 (0.92-0.93)
Yes	2,927 (7.28)	7.16 (0.07-0.08)
Access to car		
No	36,500 (90.75)	92.53 (0.91-0.93)
Yes	3,719 (9.25)	7.47 (0.07-0.08)

Child given carbohydrate foods

No	32,448 (95.67)	95.95 (0.95-0.96)
Yes	1,469 (4.33)	4.04 (0.04-0.05)

Child given protein foods

No	23,669 (69.66)	69.50 (0.68-0.71)
Yes	10,307 (30.34)	30.49 (0.29-0.32)

Child given fatty foods

No	3,808 (44.19)	43.93 (0.42-0.46)
Yes	4,809 (55.81)	56.49 (0.54-0.58)

Child given fruits

No	31,008 (91.29)	91.12 (0.90-0.92)
Yes	2,957 (8.71)	8.88 (0.08-0.10)

Mothers' Variables

Maternal Age at First Birth	N=42,568 (%)	Weighted % (C.I)
11-19	13,246 (31.12)	31.54 (0.30-0.32)
20-28	26,916 (63.23)	63.13 (0.62-0.64)
29 +	2,406 (5.65)	5.32 (0.05-0.06)

Mother's Education Level

No education	8,440 (19.83)	19.87 (0.19-0.21)
Primary	3,804 (8.94)	9.01 (0.08-0.10)
Secondary	23,811 (55.94)	55.93 (0.55-0.57)
Higher	6,513 (15.30)	15.19 (0.14-0.16)

Wealth Index

Poor	16,637 (39.08)	38.30 (0.37-0.40)
Middle	8,844 (20.78)	24.00 (0.23-0.25)
Rich	17,087 (40.14)	37.69 (0.36-0.39)
Mother's BMI		
Not overweight/Obese	28,637 (67.79)	65.08 (0.64-0.66)
Overweight/obese	13,605 (32.21)	34.92 (0.34-0.36)
Mother's marital status		
Not marriage	684 (1.61)	1.60 (0.01-0.02)
Marriage/Cohabiting	41,884 (98.39)	98.40 (0.98-0.99)
Antenatal Visit		
No	6,115 (14.37)	13.98 (0.13-0.15)
Yes	36,435 (85.63)	86.01 (0.85-0.87)
Postnatal Visit		
No	22,673 (69.05)	67.78 (0.67-0.69)
Yes	10,164 (30.95)	32.21 (0.31-0.33)
Fathers' variables		
Father's Education Level		
No education	5,723 (13.45)	13.67 (0.13-0.14)
Primary	5,836 (13.71)	14.00 (0.13-0.15)
Secondary	23,940 (56.25)	55.58 (0.54-0.57)
Higher	7,060 (16.59)	16.74 (0.16-0.18)
Current work status		
Not working	37,240 (87.58)	87.55 (0.87-0.88)

Working	5,275 (12.41)	12.44 (0.12-0.13)

Note: C.I=Confidence interval; N= Total number of respondents

Prevalence of overweight and obesity in Egypt

As shown in Figure 1, the overall prevalence of childhood overweight and obesity was approximately 17% (CI=0.17-0.19). In 2014 alone, the prevalence rate was 16.9% (CI=0.16-0.18), and in 2008 the prevalence was 20.3% (CI=0.20-0.23). Although the prevalence of overnutrition is still high as of 2014, the findings show a slight decrease in childhood overweight and obesity between the two survey periods.

(Figure 1 here)

Factors associated with overweight and obesity among under-five children in Egypt

There was a significant association between childhood overweight and obesity and the following factors: children aged 19 and 37 months (OR = 1.39, C.I = 1.25-1.55, p= 0.001), children in rural residence (OR = 0.83, C.I = 0.73-0.94, p 0.003), children given protein foods (OR = 1.22, C.I = 1.10-1.36, p= 0.001), children given fatty foods (OR = 1.45, C.I = 1.26-1.67, p=0.001), children given fruits (OR = 1.27, C.I = 1.09-1.49, p= 0.001), children belonging to mothers aged 29 years or more (OR = 1.22, C.I = 1.01-1.49, p= 0.04), children belonging to rich mothers (OR = 1.29, C.I = 1.14-1.46 p= 0.001), children belonging to mothers who attended postnatal healthcare (OR = 1.12, C.I = 1.02-1.24 p= 0.020), and children belonging to fathers who were gainfully employed (OR = 1.21, C.I = 1.07-1.37 p= 0.002) (Table 3).

The data was then adjusted to confirm the associations between the identified explanatory variables and the childhood undernutrition indicators (overweight and obesity). We found that overweight and obesity were significantly associated with children aged 19 and 37 months **(AOR =**1.32, C.I =1.05-1.65, p 0.015**), children with a** birthweight of 4.1kg and above (AOR =2.45, C.I =1.25-4.81, p= 0.010), children given protein foods (AOR =1.29, C.I =1.02-1.63, p 0.029), and rich mothers (AOR =2.19, C.I=1.54-3.11, p 0.001) (Table 3).

These results imply that children aged 19-37 months had 1.32 higher odds of becoming overweight or obese compared to those younger and older (<19 months and >37 months). Those who weighed more than 4.1 kg had 2.45 times higher odds of being overweight or obese compared to those who weighed lesser. Children who significantly consumed protein foods had 1.29 higher odds of becoming overweight or obese relative to those who consumed other food types. With regards to maternal factors, those belonging to rich mothers had 2.19 higher odds of becoming overweight or obese compared to those belonging to poor mothers and mothers with an average level of wealth (Table 3).

Table 3: Logistic regression of associations between explanatory variables and overnutrition

Variable	Unadjusted		Adjusted	
Child Variables				
Age of Child (months)	OR (95% C.I)	P-value	OR (95% C.I)	P-value
0-18 months	Ref.		Ref.	
19-37 months	1.39 (1.25-1.55)	**0.000**	1.32 (1.05-1.65)	**0.015**
38+ months	1.01 (0.89-1.14)	0.904	0.99 (0.74-1.31)	0.925
Sex of Child				
Male	Ref.		Ref.	
Female	0.96 (0.88-1.04)	0.364	1.04 (0.85-1.28)	0.705
Birth Weight				
< 2.5 kg	Ref.		Ref.	
2.5-4.0 kg	0.99 (0.83-1.18)	0.951	1.19 (0.82-1.71)	0.360
4.1 + kg	1.20 (0.8-1.75)	0.336	2.45 (1.25-4.81)	**0.010**
Place of Residence				
Urban	Ref.		Ref.	
Rural	0.83 (0.73-0.94)	**0.003**	0.97 (0.75-1.25)	0.801
Access to Bicycle				
No	Ref.		Ref.	
Yes	0.86 (0.72-1.03)	0.103	0.88 (0.59-1.30)	0.514
Access to car				
No	Ref.		Ref.	
Yes	0.99 (0.84-1.17)	0.932	1.23 (0.97-1.58)	0.087
Child given carbohydrate foods				
No	Ref.		Ref.	

Yes	0.96 (0.76-1.21)	0.753	0.92 (0.72-1.18)	0.601
Child given protein foods (eggs and meats)				
No	Ref.		Ref.	
Yes	1.22 (1.10-1.36)	**0.000**	1.29 (1.02-1.63)	**0.029**
Child given fatty foods				
No	Ref.		Ref.	
Yes	1.45 (1.26-1.67)	**0.000**	0.92 (0.73-1.17)	0.524
Child given fruits				
No	Ref.		Ref.	
Yes	1.27 (1.09-1.49)	**0.003**	1.22 (0.88-1.69)	0.23
Mothers' variables				
Maternal Age at First Birth				
11-19	Ref.		Ref.	
20-28	1.01 (0.91-1.13)	0.80	1.15 (0.89-1.49)	0.28
29 +	1.22 (1.01-1.49)	**0.04**	1.53 (0.92-2.54)	0.10
Mother's Education Level				
No education	Ref.		Ref.	
Primary	1.22 (1.03-1.46)	**0.021**	1.42 (0.87-2.31)	0.16
Secondary	1.24 (1.10-1.39)	**0.000**	1.31 (0.88-1.93)	0.18
Higher	1.33 (1.14-1.57)	**0.000**	1.14 (0.66-2.00)	0.63
Wealth Index				
Poor	Ref.		Ref.	
Middle	1.02 (0.89-1.16)	0.810	2.02 (1.43-2.85)	**0.000**
Rich	1.29 (1.14-	**0.000**	2.19 (1.54-	**0.000**

	1.46)		3.11)	
Mother's BMI				
Not overweight/Obese	Ref.		Ref.	
Overweight/obese	1.03 (0.94-1.15)	0.464	0.98 (0.75-1.26)	0.851
Marital status				
Not marriage	Ref.		Ref.	
Marriage	1.12 (0.74-1.67)	0.593	1.50 (0.52-4.33)	0.448
Antenatal Visit				
No	Ref.		Ref.	
Yes	1.03 (0.91-1.16)	0.609	1.24 (0.91-1.69)	0.175
Postnatal Visit				
No	Ref.		Ref.	
Yes	1.12 (1.02-1.24)	**0.020**	0.87 (0.67-1.12)	0.052
Fathers' variables				
Father's Education Level				
No education	Ref.		Ref.	
Primary	1.18 (0.99-1.42)	0.478	1.19 (0.74-1.92)	0.474
Secondary	1.05 (0.91-1.21)	0.481	1.13 (0.76-1.79)	0.482
Higher	1.23 (1.03-1.46)	0.479	1.06 (0.63-1.80)	0.813
Current work status				
Not working	Ref.		Ref.	
Working	1.21 (1.07-1.37)	**0.002**	1.08 (0.78-1.50)	0.630

Note: C.I=Confidence interval; Ref=reference; OR=Odds Ratio

Discussion

This study aimed to examine the prevalence and correlates of overweight and obesity among children under five years in Egypt. The findings revealed that the overall prevalence of overweight and obesity was approximately 17% which corresponds with previous community-based studies in Egypt which found an overnutrition prevalence ranging from 15–18%[3, 17]. Compared to the prevalence value of other African countries and the world at large, this prevalence rate for Egypt is significantly higher than the world average, which is 8.6%, indicating a serious childhood overnutrition problem in Egypt and the need for prompt actions to reduce this burden[8].

The study also found several socio-demographic factors significantly associated with overweight and obesity among children under five years in Egypt. Notably, the childhood overnutrition indicators were significantly associated with children aged 19 and 37 months, children with birthweights of 4.1kg and above, children given large amounts of protein foods, and children belonging to rich mothers. The findings that children within the age bracket of 19–37 months had higher odds of developing childhood overweight or obesity is quite difficult to explain. However, evidence shows that toddlers around that age bracket often engage in emotional eating behaviour and find it difficult to eat according to feelings of hunger and fullness and rather prefer eating as a soothing intervention which may put them at risk of overweight or obesity[21]. Therefore, when toddlers learn to eat according to their feelings of hunger and fullness and learn to soothe themselves without eating, they are likely to have a healthy body weight[21].

Consistent with a previous study[22], we found that children who weighed 4.1 kg or higher at birth were more likely to experience childhood overweight or obesity. This finding is not surprising and may be attributed to biological causes needing urgent early intervention[13]. However, a previous study has argued otherwise and indicated that low birth weights in rural areas in Indonesia were associated with higher BMI z-scores and higher odds of obesity[23]. The variations in findings may be attributed to differences in samples and confounding variables, such as variations in residence. With regards to food consumption, children who consumed protein foods such as meat and eggs had a greater risk of overweight and obesity. This finding is in line with several previous studies[3, 24]. A plausible reason for this outcome is that a high intake of protein foods is likely to lead to excess storage of body fats which eventually leads to a higher risk of overweight or obesity[25, 27]. Consistent with previous studies[28, 29], we found that children belonging to wealthy mothers had a higher risk of overweight and obesity. This is probably because children in rich households may be exposed to high-calorie foods and sedentary lifestyles which puts them at risk of overweight and obesity[30].

While taking due caution in making policy suggestions based on findings from this cross-sectional data, our findings which are based on over 40,000 under-five children provide a comprehensive and important "wake-up" call to policymakers and health advocates about the need to pay close attention to childhood overnutrition in Egypt and North Africa. Particularly, interventions aiming to reduce childhood undernutrition need to be cautious of the possibilities of overnutrition after the implementation of food uptake interventions. Additionally, our findings indicate that the growing overnutrition problem in Egypt (North Africa) can be effectively reduced if attention is paid to modifiable risk factors, such as sedentariness and overfeeding of toddlers with high protein foods, especially, by wealthy mothers.

Supportive interventions are important in shaping people's choices, especially, in choosing healthier foods for their children and engaging in regular physical activity. At the individual level, parents can limit the provision of foods high in proteins to toddlers and increase the consumption of fruit and vegetables. We believe that these factors are critical in promoting optimal health for children aged under five years in Egypt and beyond.

Limitation

Recent studies on overweight and obesity in Africa have indicated a potential double burden of undernutrition and overnutrition in the continent. However, the previous studies have been largely focused on adult populations in Sub-Saharan Africa with limited studies focusing on children in North Africa, although anecdotal evidence shows that many North African countries have a potentially high prevalence of childhood overnutrition.

Using Egypt as a case study, we report the prevalence of overweight and obesity among children under-five years in Egypt and the risk factors associated with these overnutrition indicators. By examining the prevalence and factors associated with childhood overnutrition in Egypt, this study provides a timely empirical contribution to the literature examining whether childhood overnutrition is indeed a growing problem in North Africa.

The potential burden of childhood overnutrition in Africa has received much attention in recent years. Modifiable risk factors may be important contributors to overnutrition and this study is one of the early researches examining this emerging problem for early interventions. Findings from this study provide useful 'wake-up' calls for researchers, health promoters, and policymakers to consider seriously the emerging problem of childhood overnutrition in North Africa.

Although this study makes a noteworthy contribution to the literature on childhood overnutrition including the pooling of large samples of children under-five years from two standard EDHS, and therefore increasing the statistical power, some limitations can be observed. First, the data is limited to ever-married women with children under 5 years which may limit the generalisability of the findings. The study is cross-sectional and therefore we were unable to make causal inferences. Also, some variables were self-reported which may be subject to recall and social desirability biases. There was evidence of missing responses for some variables which made data cleaning and validation complicated. Also, almost all the variables were used in the regression analysis, and this is likely to contribute to over-adjustment bias. However, all the variables were important possible risk factors for childhood overweight or obesity in Egypt. Although we used the latest EDHS data, the available data were gathered in 2008 and 2014 which are quite old and may lack some currency. Therefore, the prevalence rates should be taken cautiously.

Conclusions

We conclude that childhood overnutrition (overweight and obesity) is high in Egypt. This is a worry for public health due to the risk of maintaining overnutrition status in adulthood together with the several negative consequences. The study also found that a child's age (19-37), birth weight (greater than 4 kg), consumption of protein foods, and mothers' wealth status are significantly associated with the risk of overweight and obesity among children under-five years in Egypt. These findings indicate the need for early and urgent strategies to mitigate childhood overnutrition in Egypt.

Abbreviations

- **EDHS -** Egypt Demographic and health survey
- **ICF –** International classification of functioning, disability and Health
- **USAID -** United States Agency for International Development
- **WHO –** World health Organization

Declarations

Ethics approval and consent to participate

Ethical approval was not sought for this study since our analysis was based on publicly available data. However, the DHS reports that both written and verbal informed consent were obtained from all participants. Before the commencement of the survey, ethical clearance was sought and all ethical guidelines governing the use of human subjects were strictly adhered to and methods were carried out in accordance with the relevant guidelines and regulations by the Declaration of Helsinki.

Competing interests

The authors of this manuscript have no competing interests

Authors' contributions

IYA conceived the study. EOB conducted the multilevel analysis. IYA reviewed the analyses. EOB and IYA drafted and critically reviewed the manuscript. All authors read and approved the final manuscript.

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Availability of data and materials

Dataset for this study is freely available for download at: http://dhsprogram.com/data/available-datasets.cf

Acknowledgements

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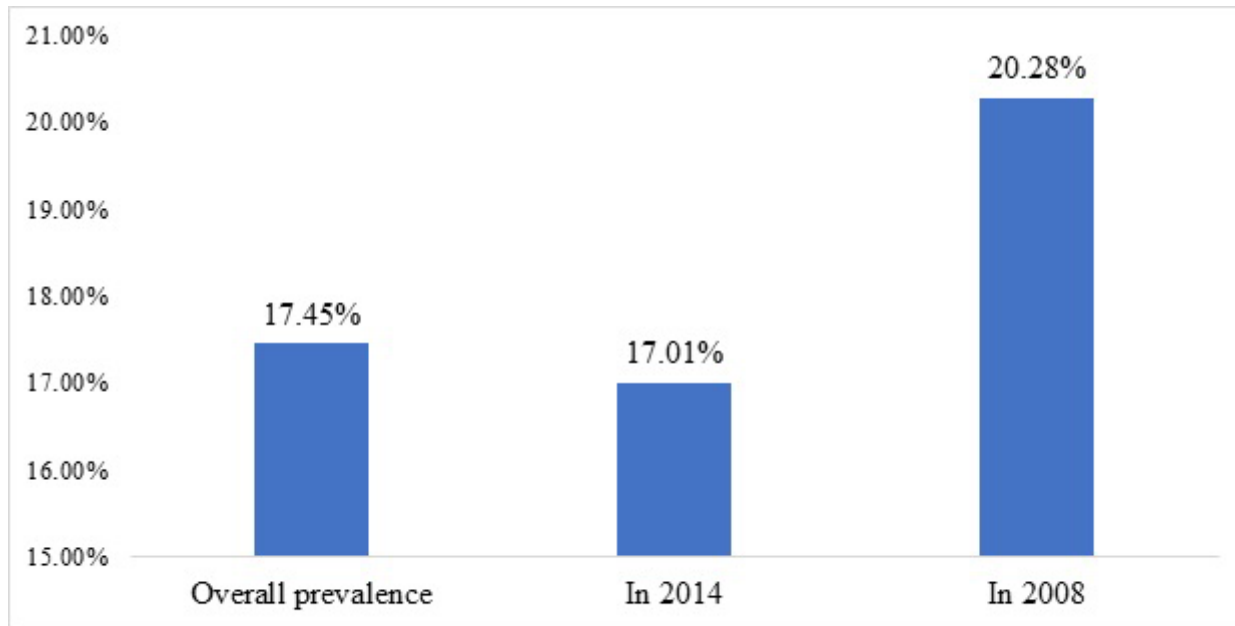
Figures

Figure 1

Prevalence of coexistence of overweight and obesity in Egypt, 2008 and 2014