PDF version

Nawal Alqaoud[1] and Abdullah Al-Taiar[2]

[1]Food and Nutrition Administration, Ministry of Health, Kuwait City, Kuwait. 2School of Community & Environmental Health, College of Health Sciences, Old Dominion University, Norfolk, Virgina, United States of America (Correspondence to: A. Al-Taiar: aaltaiar@odu.edu).

Abstract

Background: There is a paucity of data on the secular trends of stunting and overweight among children aged < 5 years in oil-rich countries in the Middle East.

Aims: To examine the secular trends of stunting, underweight and overweight in children aged < 5 years in Kuwait between 2007 and 2019.

Methods: We used large individual data records (n=48 108) from the Kuwait Nutritional Surveillance System (KNSS) to calculate height/length-for-age z score (HAZ), weight-for-age z score and body mass index (BMI)-for-age z score using World Health Organization growth references. Stunting and underweight were defined as less than -2 standard deviation (SD) and overweight (including obesity) as ≥ 2 SD. Trends of stunting, underweight and overweight were investigated using logistic regression models.

Results: The prevalence of stunting, underweight and overweight was 5.15%, 2.33% and 10.78%, respectively. Stunting increased during the study period, among children aged < 2 years. There was no increasing trend in overweight during the study period. These findings were corroborated by the distribution of HAZ and BMI-for-age z scores. Current prevalence of combined stunting and overweight was 1.53% in boys and 1.98% in girls.

Conclusion: Current prevalence of stunting and underweight is low in Kuwait indicating that undernutrition is no longer a major public health issue. There is a tendency for stunting to

increase in children aged less than 2 years, highlighting the need to investigate early causes of stunting such as maternal and pregnancy-related factors.

Keywords: children, stunting, underweight, overweight, wasting, Kuwait, Middle East, under-5

Citation: Alqaoud N; Al-Taiar A. Trends of stunting, underweight and overweight among children aged < 5 years in Kuwait: findings from Kuwait Nutritional Surveillance System (2007–2019). East Mediterr Health J. 2022;28(6):407–417. https://doi.org/10.26719/emhj.22.043
Received: 08/08/21; accepted:02/03/22

Copyright © World Health Organization (WHO) 2022. Open Access. Some rights reserved. This work is available under the CC BY-NC-SA 3.0 IGO license (https://creativecommons.org/licenses/by-nc-sa/3.0/igo)

Introduction

Malnutrition in early childhood is a significant public health problem with profound short- and long-term impacts on human health, including high morbidity and mortality, and reduced cognitive and social development (1,2). Despite progress on several health indicators for children aged < 5 years, malnutrition remains a major cause of death in several low- and middle-income countries (1). In early life, both undernutrition (manifested as stunting, underweight or wasting) and overnutrition (manifested as overweight or obesity) are of major concern worldwide. It is estimated that around 45% of deaths among children aged < 5 years are linked to undernutrition, and mostly occur in low- and middle-income countries (3). In many developing countries, the acceleration of nutrition transition has led to a decrease in stunting (low height/length for age) (4), although it remains more common than underweight (low weight for age) or wasting (low weight for height) (3). Globally, the prevalence of overweight in children aged < 5 years increased slightly from 4.8% in 1990 to 5.9% in 2018, showing heterogeneous trends (5).

Monitoring trends in malnutrition at regional and country level is needed for planning, priority setting and tracking progress towards specific goals. For example, the World Health Assembly Resolution (65.6) endorsed a comprehensive implementation plan on maternal, infant and young child nutrition (6), which includes specified global nutrition targets for 2025; 2 of which

aim at no increase in childhood obesity and 40% reduction in the number of children under 5 years with stunted growth. It has been suggested that global estimates of malnutrition cannot be used to monitor trends at the regional level (4). Regional level data cannot be extrapolated to national level, particularly in the Middle East and North Africa Region, which includes economically diverse countries such as oil-rich and low- and middle-income countries. Trends in malnutrition are difficult to ascertain in the same population due to the incomparability of data over time or from methodologically heterogeneous surveys (7). Systematic reviews of previous studies with little consistency in their methods are more likely to fail to reveal trends in malnutrition than analysis of individual data records collected by the same organization over time (8). As an example, a review showed that the prevalence of overweight and obesity in children aged < 5 years ranged from 1 to 28.6% among European countries, which was attributed to methodological variation (9).

Most studies of long-term trends of overweight and obesity in children have focused on school-age children (5–19 years) (10) with limited data on those aged < 5 years. Kuwait and other oil-rich countries in the Middle East have undergone rapid economic development and obvious transition of lifestyle in the last few decades. The high oil revenues have resulted in significant improvement in socioeconomic status, with citizens enjoying high standards of living that include highly subsidized food, free education, and free healthcare services. The prevalence of overweight and obesity has significantly increased with the most recent estimates in adults of 40.6%, and 42.1%, respectively (11), and 20.19% and 28.39% in schoolchildren (12). Previously, we have demonstrated that obesity and overweight increased in schoolchildren in Kuwait between 2007 and 2019 but started to stabilize in girls (12). There is limited data on the trends in stunting, underweight and overweight among children aged < 5 years in Kuwait and other oil-rich countries in the Middle East. The present study aimed to examine trends in stunting, wasting, underweight and overweight in children aged < 5 years in Kuwait between 2007 and 2019, using individual data records from the Kuwait Nutritional Surveillance System (KNSS).

Methods

Study setting and participants

KNSS is funded by the Government of Kuwait to monitor nutritional status of the population over time. The system consists of a repeated cross-sectional study that collects data on children aged ≤ 2 years and > 2 to < 5 years, schoolchildren aged 5–19 years, and adults. KNSS recruits children aged < 5 years from vaccination centres at primary healthcare centres in all provinces of Kuwait. These healthcare centres are designated sentinel sites for surveillance. KNSS also recruits children aged < 5 years who are enrolled in kindergartens in all provinces of Kuwait. No sampling strategy is used because all parents attending vaccination centres are invited to participate and usually < 2% refuse to participate. For several logistic reasons (13), KNSS includes data only on Kuwaiti nationals. In 2015, data collection forms were reviewed and updated and later approved by the Ethics Committee at the Ministry of Health (No. 98:262/2015). Details of KNSS have been published previously (12,13). In this study, we

conducted a secondary data analysis for anthropometric measurements of children aged < 5 years from 2007 to 2019.

Data collection and anthropometric measurements

Permanently employed data collectors with KNSS measured height and weight of children aged < 5 years at vaccination centres and kindergartens using a standard written protocol. The length of children aged 0–2 years was measured to the nearest 0.1 cm using a length board, with children's knees fully extended and shoes off. The height of children > 2 but < 5 years was measured to the nearest 0.1 cm using a stadiometer, with knees fully extended and shoes off. The weight of children was measured using a digital scale to the nearest 100 g. To maintain accuracy, weighing scales are calibrated regularly using a well-known weight set. Starting from 2015, mothers were asked to report the birth weight of their children if they were < 2 years. This was conducted only for children recruited at the vaccination centres. Data were entered into a database at the Food and Nutrition Administration, which is part of the Kuwait Ministry of Health.

Statistical methods

We calculated age- and sex-specific z scores relative to the WHO growth reference median using the STATA zanthro package (Stata Corp., College Station, TX, USA). We defined obesity as BMI-for-age z score ≥ 3.0 SD, and overweight (including obesity) as BMI-for-age z score ≥ 2.0 SD (14). Height/length-for-age z scores (HAZs) were calculated, and stunting was defined as < –2 SD. Similarly, weight-for-age z scores were calculated, and underweight was defined as < –2 SD. Weight-for-length/height z scores were calculated, and wasting was defined as < –SD.

Logistic regression analysis was used to examined trends over time while stratifying by sex and adjusting for age. The regression analysis was performed with stunting, underweight, overweight or obesity (all coded 1 = yes, 0 = no), with the year of measurement fitted as an indicator variable (2007–2009, 2010–2012, 2013–2015 and 2016–2019). The Wald F statistic was used to test the significance of trends with robust estimates of standard error using the variance–covariance matrix (VCE) option in STATA, taking clustering effect by governorate (province) into account. We repeated the analysis with the year of survey used as a continuous independent variable, evaluating linear increase or decrease over time. Linear regression analysis with HAZ or BMI-for-age z score as a dependent variable was conducted as a sensitivity analysis.

Ethics

This was a secondary data analysis of data collected by KNSS. KNSS is a public health activity, and the data collection was approved by the Ethics Committee at the Kuwaiti Ministry of Health (No.98:262/2015).

Results

Prevalence of stunting, underweight and overweight by gender and age This study included 48 108 children aged < 5 years (0–59 months), of whom 24 072 (50.04%) were girls. The prevalence of stunting during the entire study period was 5.18% [95% confidence interval (CI): 4.56–5.88%], which was significantly higher in boys than in girls (5.66% vs 4.71%; P = 0.001). Stunting declined significantly with age in both sexes, particularly after the first year (P <0.001). Similarly, the prevalence of obesity and overweight (which also includes obesity) was 2.62% (95% CI: 2.38–2.88%) and 8.77% (95% CI: 8.26–9.31%), respectively, which did not differ significantly between boys and girls (P = 0.597 for obesity and P= 0.941 for overweight). Overweight, which includes obesity, increased with age in both sexes (P < 0.001 for each). The prevalence of combined stunting and overweight was 1.09% (95% CI: 0.69–1.75%), which did not differ significantly between boys and girls (P = 0.679) and did not significantly change with age (P = 0.215). The prevalence of underweight was 2.64% (95%CI: 2.30–3.03%), which was significantly higher in boys than girls (2.97% vs 2.30%; P = 0.002). Underweight declined with age in both sexes (P < 0.001 for boys and P =0.004 for girls). The prevalence of wasting (n = 37 951 because weight-for-length/height z score could only be calculated for length/height 65–120 cm) was 2.58% (95% CI: 2.21–3.0%), which was significantly higher in boys than girls (2.79% vs 2.36%; P = 0.013). Wasting declined with age in both sexes (P < 0.001).

Trends in stunting

Tables 1 and 2 show the prevalence of stunting by age in boys and girls over the study period. The weighted prevalence of stunting at the end of the study period was 5.24% in boys and 5.06% in girls (5.15% in both sexes). The trends in stunting over the study period in boys and girls are shown in Figure 1A and B , respectively. Overall, there was evidence of an increasing trend of stunting over the study period among boys (P =0.010), particularly in those aged < 2 years, which was corroborated by the decline in HAZ (data not shown). Logistic regression analysis confirmed these findings and showed an increasing trend for stunting in boys, which did not reach significance in girls (Table 3). These findings were further verified by linear regression, which showed a significant decline in HAZ over the study period in both sexes (data not shown).

Trends in obesity and overweight

The prevalence of obesity and overweight (which includes obesity) over the study period by age in boys and girls is shown in Tables 1 and 2 , respectively. The weighted prevalence of overweight in boys and girls at the end of the study period was 10.46% and 11.11%, respectively (10.78% in both sexes). Trends in overweight (which includes obesity) in boys and girls are shown in Figures 1A and B , respectively. There was no increasing or decreasing trend in overweight in boys (P = 0.329) or girls (P = 0.228). These findings were supported by the trends in BMI-for-age z score over the

study period in boys and girls (data not shown). Logistic regression analysis supported these findings and showed no evidence for increasing or decreasing trends in overweight or obesity during the study period (
Table 3
), which was further verified through linear regression analysis that showed no upward or downward trends in BMI-for-age score (data not shown).

Trends in underweight and wasting

Tables 1 and 2 show the prevalence of underweight over the study periods by age in boys and girls, respectively, while trends in underweight in boys and girls are shown in
Figures 1A and B
, respectively. The weighted prevalence of underweight at the end of the study period was 2.72% in boys and 1.93% in girls (2.33% in both sexes). Although low, there was a tendency for underweight to increase, particularly in children aged < 2 years, which was more common in boys than girls (Tables
1
and
2
, respectively). Logistic regression analysis showed an increasing trend in underweight in boys but not girls (
Table 3
). Table 4 shows the prevalence of wasting over the study period by age in boys and girls. There was no increasing or decreasing trend in wasting over the study period.

Discussion

Over a 13-year period (2007–2019), using the same operational definitions of stunting, underweight and overweight, we found no evidence of increasing or decreasing trends in overweight or obesity in children aged < 5 years in Kuwait. Although stunting and underweight were both low, there was evidence of an increasing trend among children aged < 2 years.

According to the new threshold for the prevalence of stunting suggested by WHO (15), the prevalence at the end of our study period was low, between 2.5% and < 10%. Out of 134 countries that have provided data on stunting, 26 fall into this category, while 44 fall into the very high category (≥ 30%) (15). Stunting is an irreversible outcome of poor nutrition, and recurrent or chronic infections in childhood reflecting poor overall child well-being and social inequalities. High standards of living in Kuwait may explain the low prevalence of stunting. It may be possible to further reduce the prevalence of stunting in children aged < 2 years, among whom stunting was 11% in boys and 7.98% in girls. At these younger ages, stunting is determined by maternal nutritional and health status before, during and immediately after pregnancy (16). Low birth weight (LBW) is the most dominant predictor associated with stunting

(17) and may account for 20% of cases in childhood (1). More than 20% of Kuwaiti children aged < 2 years are born with LBW (< 2.5 kg) (13). KNSS started collecting data on birthweight, as recalled by mothers, only in 2015, hence it was not possible to include birthweight in our analysis, and no other source of data on birthweight can be directly linked to individual data records in KNSS.

The increasing trend in stunting in children aged < 2 years may have been due to an increasing trend in moderate or late prematurity, partially as a result of elective caesarean section (> 30% of children aged < 2 years were born by caesarean section (13)). We have no data on gestational age (prematurity); therefore, we were unable to use the corrected age with WHO or other growth references for premature babies (18). We call for investigation of early causes of stunting, including maternal factors, LBW, and infant and young child feeding practices to elucidate the underlying causes of this trend. It is worth noting that we previously reported that children aged < 2 years with stunted growth were likely to have been exclusively breastfed (13), which could be due to the lack of use of growth charts that take prematurity into account.

In our setting, the prevalence of overweight (which includes obesity) at the end of the study period was medium (5 to < 10%) or high (10 to < 15%) according to the new threshold for overweight in children aged < 5 years (15). Out of 128 countries that have provided data to WHO, 50 countries fall in this category. This high prevalence highlights the need for policies and actions aimed to improve infant and young child feeding practices, focusing on improving exclusive breastfeeding which has been shown (age-appropriate breastfeeding) to be negatively associated with overweight among children aged < 2 years in Kuwait(13) and among children, adolescents and adults worldwide (19).

Although the prevalence of overweight in children aged < 5 years was high, there was no evidence of an increasing trend during the study period. Data on secular trends in obesity and overweight in children aged

< 5 years are lacking in Kuwait and other Arabian Gulf countries. A previous review showed that, up to 2010, there were only 6 cross-sectional studies on this age group in Arabian Gulf countries, and they used different definitions of overweight and obesity (20). A protocol for systematic review and meta-analysis of overweight and obesity in early childhood in the Gulf Cooperation Council countries was published previously (21), but we were unable to locate any published results from this work. The lack of evidence for an increasing trend in overweight among children aged < 5 years should not encourage complacency because the prevalence of overweight at the end of the study period was high (weighted prevalence in both sexes in 2016–2019 was 10.78%), exceeding the global prevalence of 6–7% (5, 22). This suggests that

the increasing trend in overweight may have occurred before the study period, which is supported by the findings of a previous review that estimated obesity to be 8.2% in 1998 (20).

At the end of the study period, other anthropometric indicators of malnutrition in children aged < 5 years such as underweight, wasting and combined stunting with overweight were all low. This is not surprising given the standards of living, which minimize the possibility of low caloric intake. There was no significant trend in underweight, and fluctuation shown in children aged < 2 years may reflect variation in moderate or late prematurity and the lack of data on gestational age; hence using corrected age or other growth references suitable for premature babies. Combined stunting and overweight is increasingly recognized as a distinct indicator. For example, the prevalence of concurrent overweight and stunting was 5% in nonindigenous children, and > 10% in indigenous children aged 2–5 years in impoverished areas of rural Mexico (23). The combined prevalence of overweight and stunting was 1.99% in Ethiopia (24), 1.2% in Ghana (25) and 1% in children aged < 7 years in China (26). Concurrent overweight and stunting seems not to be a major public health issue in children aged < 5 years in Kuwait, nor is it increasing over time.

There were several strengths in this study, including the large sample size, which allowed us to investigate sex- and age-specific trends in stunting, underweight and overweight over a 13-year period. We have provided data for the first time on the prevalence of combined stunting and overweight in children aged < 5 years in Kuwait. This study had some limitations, including the lack of data on the socioeconomic status of children aged < 5 years. By their nature, surveillance data are descriptive and aim to ascertain trends over time and highlight issues for further investigations but not to identify the underlying causes or risk factors, which requires analytical studies that collect extensive data on risk factors and potential confounders. We had no data on gestational age or birthweight to investigate whether trends in stunting among children aged < 2 years reflected an increase in prematurity. Although KNSS collected data on birthweight recalled by mothers, these were available only from 2015 and many mothers were unable to recall their child’s birthweight.

Conclusion

Long-term trends in malnutrition are difficult to ascertain due to incomparability of data from different time periods and methodological variation. Over a 13-year period, using individual data records and the same operational definitions of stunting, underweight and overweight, we found no evidence of increasing or decreasing trends in overweight in children aged < 5 years in Kuwait. Although stunting and underweight were both low, there was some evidence for an increasing trend among children aged < 2 years, which highlights the need to investigate the early causes of stunting.

Acknowledgement

We would like to thank Ms Faheema Alanezi and Mrs Monica Subhakaran for their efforts in supervising data collection and data entry at KNSS.

Funding: None

Competing interests: None declared.

Tendances du retard de croissance, de l'insuffisance pondérale et du surpoids chez les enfants de moins de cinq ans au Koweït : résultats du système koweïtien de surveillance nutritionnelle (2007-2019)

Résumé

Contexte : Il existe peu de données sur les tendances séculaires du retard de croissance et du surpoids chez les enfants âgés de moins de cinq ans dans les pays riches en pétrole du Moyen-Orient.

Objectifs : Examiner les tendances séculaires du retard de croissance, de l'insuffisance pondérale et du surpoids chez les enfants âgés de moins de cinq ans au Koweït entre 2007 et 2019.

Méthodes : Nous avons utilisé de grands enregistrements de données individuelles (n = 48 108) provenant du système de surveillance nutritionnelle du Koweït pour calculer les scores z de taille/longueur pour l'âge, du poids pour l'âge et de l'indice de masse corporelle (IMC) selon l'âge en utilisant les références de croissance de l'Organisation mondiale de la Santé. Le retard de croissance et l'insuffisance pondérale ont été définis comme inférieurs à –2 écarts types (ET) et le surpoids (y compris l'obésité) comme supérieur ou égal à +2 ET. Les tendances en matière de retard de croissance, d'insuffisance pondérale et de surpoids ont été analysées à l'aide de modèles de régression logistique.

Résultats : La prévalence du retard de croissance, de l'insuffisance pondérale et du surpoids était respectivement de 5,15 %, 2,33 % et 10,78 %. Le retard de croissance a augmenté

WHO EMRO | Trends of stunting, underweight and overweight among children aged less than 5 years in

pendant la période de l'étude, mais cette augmentation était limitée aux enfants âgés de moins de deux ans. Il n'y avait pas de tendance à l'augmentation du surpoids pendant la période de l'étude. Ces résultats ont été corroborés par la distribution des scores z de taille/longueur pour l'âge et de l'IMC pour l'âge. La prévalence du retard de croissance et du surpoids combinés au moment de l'étude était de 1,53 % chez les garçons et de 1,98 % chez les filles.

Conclusion : La prévalence du retard de croissance et de l'insuffisance pondérale au moment de l'étude était faible au Koweït et reflétait le fait que la dénutrition n'est plus un problème majeur de santé publique. Le retard de croissance tend à augmenter chez les enfants âgés de moins de deux ans, ce qui souligne la nécessité d'étudier les causes précoces du retard de croissance, comme les facteurs liés à la mère et à la grossesse.

اتجاهات التقزُّم، ونقص الوزن، وزيادة الوزن في صفوف الأطفال الأقل من 5 سنوات في الكويت : نتائج نظام الترصُّد التغذوي في الكويت (2007-2019)

نوال القعود، عبد الله الطيار

الخلاصة

: هناك نُدرة في البيانات بشأن الاتجاهات الطويلة الأجل للتقزم وزيادة الوزن الخلفية
في صفوف الأطفال الذين تقل أعمارهم عن 5 سنوات في البلدان الغنية بالنفط في الشرق
الأوسط .

: هدفت هذه الدراسة إلى فحص الاتجاهات الطويلة الأجل للتقزم، ونقص الوزن، الأهداف
وزيادة الوزن لدى الأطفال الذين تقل أعمارهم عن 5 سنوات في الكويت بين عامي 2007 و2019.

: استخدمنا سجلات كبيرة للبيانات الفردية (العدد = 48108) من نظام الترصُّد طرق البحث
التغذوي في الكويت لحساب مقياس Z للارتفاع / الطول المقابل للعمر، و مقياس Z للوزن
المقابل للعمر، و مقياس Z لمَنسب كتلة الجسم المقابل للعمر باستخدام مراجع النمو
الخاصة بمنظمة الصحة العالمية . وحُدِّد التقزم ونقص الوزن كلاهما بأنهما أقل من < -2
انحرافيْن معياريين، بينما كانت زيادة الوزن (ومن ذلك السمنة) أكبر من أو تساوي
انحرافيْن معياريين موجبيْن . واستُقصيت اتجاهات التقزم، ونقص الوزن، وزيادة الوزن
باستخدام نماذج الانحدار اللوجستي .

: كان معدل انتشار التقزُّم، ونقص الوزن، وزيادة الوزن 5.15% ، و 2.33% ، و 10.78% النتائج

10 / 14

[illegible] Z [illegible] 1.53% [illegible] 1.98% [illegible]

[illegible]

References

1. Black RE, Victora CG, Walker SP, Bhutta ZA, Christian P, de Onis M, et al. Maternal and child undernutrition and overweight in low-income and middle-income countries. Lancet, 2013 Aug 3;382(9890):427–51. https://doi.org/10.1016/S0140-6736(13)60937-X

2. Grantham-McGregor S, Cheung YB, Cueto S, Glewwe P, Richter L, Strupp B. Developmental potential in the first 5 years for children in developing countries. Lancet, 2007 Jan 6;369(9555):60–70. https://doi.org/10.1016/S0140-6736(07)60032-4

3. Global database on child health and malnutrition. UNICEF/WHO/The World Bank: joint child malnutrition estimates – levels and trends; 2019 (http://www.who.int/nutgrowthdb/estimates/en/).

4. de Onis M, Blössner M, Borghi E. Prevalence and trends of stunting among pre-school children, 1990–2020. Public Health Nutr, 2012 Jan;15(1):142–8. https://doi.org/10.1017/S1368980011001315 PMID:21752311

5. Di Cesare M, Sorić M, Bovet P, Miranda JJ, Bhutta Z, Stevens GA, et al. The epidemiological burden of obesity in childhood: a worldwide epidemic requiring urgent action. BMC Med. 2019 Nov 25;17(1):212. https://doi.org/10.1186/s12916-019-1449-8 PMID: 31760948 PMCID:

6. Comprehensive implementation plan on maternal, infant and young child nutrition. Sixty-fifth World Health Assembly – resolutions and decisions, annexes. Geneva: World Health Organization; 2012 (https://www.who.int/nutrition/topics/WHA65.6_resolution_en.pdf).

7. Urke HB, Mittelmark MB, Valdivia M. Trends in stunting and overweight in Peruvian pre-schoolers from 1991 to 2011: findings from the Demographic and Health Surveys. Public Health Nutr, 2014 Nov;17(11):2407–18. https://doi.org/10.1017/S1368980014000275 PMID:24625838

8. Al-Taiar A, Alqaoud N, Sharaf Alddin R, Alanezi F, Subhakaran M, Dumadag A, et al. Stunting and combined overweight with stunting among schoolchildren in Kuwait: trends over a 13-year period. Med Princ Pract. 2021;30(6):515–21. https://doi.org/10.1159/000518533 PMID:34348312

9. Jones RE, Jewell J, Saksena R, Ramos Salas X, Breda J. Overweight and obesity in children under 5 years: surveillance opportunities and challenges for the WHO European Region. Front Public Health. 2017 Apr 13;5:58. https://doi.org/10.3389/fpubh.2017.00058 PMID:28451584

10. Kotanidou EP, Grammatikopoulou MG, Spiliotis BE, Kanaka-Gantenbein C, Tsigga M, Galli-Tsinopoulou A. Ten-year obesity and overweight prevalence in Greek children: a systematic review and meta-analysis of 2001–2010 data. Hormones (Athens), 2013 Oct–Dec;12(4):537–49. https://doi.org/10.14310/horm.2002.1442 PMID:24457402

11. Oguoma VM, Coffee NT, Alsharrah S, Abu-Farha M, Al-Refaei FH, Al-Mulla F, et al. Prevalence of overweight and obesity, and associations with socio-demographic factors in Kuwait. BMC Public Health, 2021;21:667. https://doi.org/10.1186/s12889-021-10692-1

12. Al-Taiar A, Alqaoud N, Ziyab AH, Alanezi F, Subhakaran M, Sharaf Alddin R, et al. Time trends of overweight and obesity among schoolchildren in Kuwait over a 13-year period (2007-2019): repeated cross-sectional study. Public Health Nutr. 2021 Nov;24(16):5318–28. https://doi.org/10.1017/S1368980021003177 PMID:34342262

13. Al-Taiar A, Alqaoud N, Hammoud MS, Alanezi F, Aldalmani N, Subhakaran M. WHO infant and young child feeding indicators in relation to anthropometric measurements. Public Health Nutr. 2020 Jul;23(10):1665–76. https://doi.org/10.1017/S1368980019004634 PMID:32285763

14. de Onis M, Lobstein T. Defining obesity risk status in the general childhood population: which cut-offs should we use? Int J Pediatr Obes. 2010 Dec;5(6):458–60. https://doi.org/10.3109/17477161003615583 PMID:20233144

15. de Onis M, Borghi E, Arimond M, Webb P, Croft T, Saha K, et al. Prevalence thresholds for wasting, overweight and stunting in children under 5 years. Public Health Nutr. 2019 Jan; 22(1):175–9. https://doi.org/10.1017/S1368980018002434 PMID:30296964

16. Ozaltin E, Hill K. Subramanian SV. Association of maternal stature with offspring mortality, underweight, and stunting in low- to middle-income countries. JAMA 2010 Apr 21;303(15):1507–16. https://doi.org/10.1001/jama.2010.450 PMID:20407060

17. Aryastami NK, Shankar A, Kusumawardani N, Besral B, Jahari AB, Achadi E. Low birth weight was the most dominant predictor associated with stunting among children aged 12–23 months in Indonesia. BMC Nutrition. 2017;3:16. https://doi.org/10.1186/s40795-017-0130-x

18. Villar J, Giuliani F, Barros F, Roggero P, Coronado Zarco IA, Rego MAS, et al. Monitoring the postnatal growth of preterm infants: a paradigm change. Pediatrics. 2018 Feb;141(2):e20172467. https://doi.org/10.1542/peds.2017-2467 PMID:29301912

19. Horta L, Loret de Mola C, Victora CG. Long-term consequences of breastfeeding on cholesterol, obesity, systolic blood pressure and type 2 diabetes: a systematic review and meta-analysis. Acta Paediatr. 2015 Dec;104(467):30–7. https://doi.org/10.1111/apa.13133 PMID:26192560

20. Ng SW, Zaghloul S, Ali HI, Harrison G, Popkin BM. The prevalence and trends of overweight, obesity and nutrition-related non-communicable diseases in the Arabian Gulf States. Obes Rev. 2011 Jan;12(1):1–13. https://doi.org/10.1111/j.1467-789X.2010.00750.x

PMID:20546144

21. Nahhas MA, Asamoah F, Mullen S, Nwaru BI, Nurmatov U. Epidemiology of overweight and obesity in early childhood in the Gulf Cooperation Council countries: a systematic review and meta-analysis protocol. BMJ Open. 2018 Jun 8;8(6):e019363. https://doi.org/10.1136/bmjopen-2017-019363 PMID:29884693

22. Global nutrition targets 2025: childhood overweight policy brief. Geneva: World Health Organization; 2014 (https://apps.who.int/iris/bitstream/handle/10665/149021/WHO_NMH_NHD_14.6_eng.pdf?ua=1)

23. Fernald LC, Neufeld LM. Overweight with concurrent stunting in very young children from rural Mexico: prevalence and associated factors. Eur J Clin Nutr. 2007 may;61(5):623–32. https://doi.org/10.1038/sj.ejcn.1602558 PMID:17136036

24. Farah AM. Nour TY, Endris BS, Gebreyesus SH. Concurrence of stunting and overweight/obesity among children: evidence from Ethiopia. PLoS One. 2021 Jan 15;16(1):e0245456. https://doi.org/10.1371/journal.pone.0245456 PMID:33449970

25. Atsu BK, Guure C, Laar AK. Determinants of overweight with concurrent stunting among Ghanaian children. BMC Pediatr. 2017 Jul 27;17:177. https://doi.org/10.1186/s12887-017-0928-3 PMID:28750614

26. Zhang YQ, Li H, Wu HH, Zong XN. Stunting, wasting, overweight and their coexistence among children under 7 years in the context of the social rapidly developing: Findings from a population-based survey in nine cities of China in 2016. PLoS One. 2021 Ja n14;16(1):e0245455. https://doi.org/10.1371/journal.pone.0245455 PMID:33444425

Thursday 11th of July 2024 02:34:10 PM