HHS Public Access

Author manuscript

*Pediatr Obes*. Author manuscript; available in PMC 2016 December 01.

Published in final edited form as:

*Pediatr Obes*. 2015 December ; 10(6): 428–435. doi:10.1111/ijpo.12000.

# Recent trends in the prevalence of under- and overweight among adolescent girls in low- and middle-income countries

**Lindsay M. Jaacks**[1], **Meghan M. Slining**[2], and **Barry M. Popkin**[1]

[1]Department of Nutrition, The University of North Carolina at Chapel Hill

[2]Department of Health Sciences, Furman University, Greenville, South Carolina

## Abstract

**Background—**Most studies of childhood malnutrition in low- and middle-income countries (LMICs) focus on children <5 years, with few focusing on adolescence, a critical stage in development.

**Objective—**To evaluate recent trends in the prevalence of under- and overweight among girls (15–18 years) in LMICs.

**Methods—**Data are from Demographic and Health Surveys (53 countries) and national surveys conducted in Indonesia, China, Vietnam, Brazil, and Mexico. The most recent surveys with sample sizes ≥50 when stratified by rural-urban status were included: 46.6% of countries had a survey conducted in the past 5 years, while the most recent survey for 10.3% of countries was over 10 years old. The overall rural sample size was 94,857 and urban sample size was 81,025. Under- and overweight were defined using the IOTF sex- and age-specific BMI cut-points.

**Results—**South Asia had the highest prevalence of underweight; nearly double that of East Asia & the Pacific and Sub-Saharan Africa, and increasing annually by 0.66% in rural areas. Latin America & the Caribbean had the highest regional prevalence of overweight in both rural and urban settings and this prevalence is increasing annually by about 0.50%. In urban areas, 38% of countries had both an under- and overweight prevalence ≥10%.

**Conclusions—**There is substantial variation across and within regions in the burden of under- and overweight, with increasing dual burdens in urban areas. Innovative public health interventions capable of addressing both ends of the malnutrition spectrum are urgently needed.

### Keywords

dual burden; underweight; overweight; developing countries; adolescents

**Corresponding author:** Barry M. Popkin, Carolina Population Center, The University of North Carolina at Chapel Hill, 123 W. Franklin St., Chapel Hill, North Carolina 27516-3997, Telephone: +001 (919) 966-1732, Fax: +001 (919) 966-9159, popkin@unc.edu.

**Conflicts of interest**

The authors have no conflicts of interest to declare.

## Introduction

The world is not flat. The benefits of globalization have not been shared equally. The economic gap between the “have’s” and the “have not’s” has widened (1), and chronic hunger persists (2) in the face of a global obesity epidemic (3). The co-occurrence of under- and overnutrition, largely in low- and middle-income countries (LMICs), is termed “the dual burden” and has been documented at the individual, household, and national level in both adults and young children (3,4). However, as a result of data scarcity, the dual burden in LMICs has yet to be explored in adolescents.

A few published reports on a limited number of countries have evaluated adolescent underweight and overweight separately in LMICs, but most are outdated and not nationally representative. A systematic review of nine studies published between 2000 and 2009 of childhood (2–18 years) overweight and obesity (defined using CDC cut-points (5)) in various cities and states of India reported a pooled prevalence of 12.6% and 3.4%, respectively (6). Recent data from China indicate an increase in overweight (defined using IOTF cut-points (7)) among adolescent girls (11–18 years) from 3.5% in 1991 to 9.3% in 2011 (8). Similar analyses in Mexico showed an increase in overweight (defined using WHO cut-points (9)) among adolescent girls (12–19 years) from 11.1% in 1988 to 35.8% in 2012 (10). A 2006 systematic review on “worldwide trends in childhood overweight and obesity” included only five LMICs (Brazil, Chile, Serbia, Thailand, and China) and only two of those five studies included adolescents (Brazil and China) (11). Several years later, in 2009, a non-systematic review presented limited prevalence data for overweight and obesity among adolescents in seven LMICs (Democratic Republic of the Congo, Nigeria, Egypt, Bahrain, China, Vietnam, Mexico, and Brazil) and concluded that no country is free of increasing overweight (12).

There is an even greater paucity of data on trends in underweight among adolescents in LMICs. A recent systematic review reported the prevalence of underweight for adolescents in seven Asian LMICs (China, Bangladesh, India, Malaysia, Vietnam, Bahrain, and Iran) (13). In that review, the highest prevalence of underweight was observed in Indian adolescent girls (15–19 years) (46.8% in 2005–06, defined using IOTF cut-points (14)), followed by Malaysian adolescent girls (12–19 years) (14.3% in 2006, defined using WHO cut-points (15)) (13). As with the scientific literature on overweight in adolescents, interpreting and comparing the literature on underweight is made problematic by the use of different cut-points to define over- and underweight.

Adolescence is a key stage in development and poor health outcomes can be traced to this period (16). Adolescence not only represents a critical opportunity to improve maternal health, but also child health: both maternal underweight and overweight have been linked to poor birth outcomes (17,18). According to the World Health Organization, 16 million adolescent girls give birth each year (representing 11% of births worldwide) and 95% of these births occur in LMICs (19). Therefore, understanding and improving the nutritional status of adolescent girls in LMICs can have widespread impacts on global health. The objectives of this analysis were to 1) present the latest regional and national estimates for the prevalence of underweight, overweight (including obesity), and the dual burden among

adolescent girls in LMICs and 2) evaluate recent trends in the regional and national prevalence of underweight, overweight (including obesity), and the dual burden.

## Methods

### Data sources

Most data (53 countries) are from the Demographic and Health Surveys (DHS), a series of nationally representative surveys typically conducted every 5 years (available at http://www.measuredhs.com). Details of sampling methodology for DHS are described elsewhere (20). Additional data are from the Indonesian Family Life Surveys (representative of 83% of the Indonesian population) (21), the China Health and Nutrition Surveys (representative of 43% of the Chinese population) (22), the Vietnam National Health Survey (nationally representative) (23), the Brazil national surveys (nationally representative) (24), and the Mexican Health and Nutrition Surveys (nationally representative) (25).

### Study population and sample size

All analyses were restricted to non-pregnant girls aged 15.0 to 18.9 years (except in Brazil where pregnancy status was not available). For aim 1, the most recent national surveys with anthropometric data and samples sizes ≥50 when stratified by rural-urban status were included (n=58). For aim 2, only countries with at least two surveys with anthropometric data and sample sizes ≥50 were included (n=39). Surveys completed before 1997–98 were not considered. The overall rural sample size was 94,857 (mean: n=835; range: n=74 for China in 2011 to n=10,364 for India in 2005) and urban sample size was 81,025 (mean: n=978; range: n=65 for China in 2011 to n=7606 for India in 2005). The mean age of the rural sample was 16.5 years and of the urban sample was 16.6 years. A summary of survey characteristics is presented in Supplemental Table 1.

### Measures

All surveys used standardized protocols to measure weight and height. BMI was calculated as weight in kilograms divided by height in meters squared. Under- and overweight (including obesity) were defined using the sex- and age-specific cut-points recommended by the IOTF (7,14). The dual burden was defined as having prevalences of both underweight and overweight ≥10%.

Urban and rural status was defined by each country's statistical office at the time of each survey. Data on national population and gross domestic product per capita (GDPPC) are from the 2010 World Bank Development Indicators (26).

### Statistical analysis

All statistical analyses were conducted using STATA, version 13 (StataCorp, College Station, Texas). Nationally representative prevalence estimates of underweight and overweight were calculated according to urban-rural status. To evaluate recent trends in the prevalence of under- and overweight, we calculated the annualized change in prevalence according to urban-rural status using the two most recent surveys for each country. In order

to improve data visualization and interpretation, national-level results were sorted by GDPPC.

## Results

### Latest regional and national prevalence of under- and overweight

The latest regional and national prevalence of under- and overweight are presented in Figure 1 and Figure 2, respectively. While there appears to be a trend in rural areas towards higher overweight prevalence in countries with higher GDPPC, this trend is not as evident in urban areas: the average overweight prevalences for the top 10 versus bottom 10 countries by GDPPC in rural areas were 14.0% and 5.4%, respectively, but in urban areas they were much closer at 16.9% and 12.2%, respectively. Nearly one-third (n=17/58) of countries included in this analysis had a GDPPC >$2500 (Figure 2, Brazil through Egypt). With the notable exceptions of Namibia, Mexico, and Peru (which had much higher overweight prevalences in urban areas), all countries with a GDPPC >$2500 had approximately equivalent overweight prevalences in rural and urban areas.

Underweight remains a significant concern among adolescent girls in LMICs: 67% of rural areas and 50% of urban areas had a higher prevalence of underweight compared to overweight. South Asia had the highest prevalence of underweight, nearly double that of East Asia & the Pacific and Sub-Saharan Africa. While this may largely reflect 2005 data from India where approximately 40% of both rural and urban adolescent girls are underweight, the other two South Asian countries included in this analysis (Nepal and Bangladesh) also had underweight prevalences >20% indicating widespread undernutrition in this region. All East Asian & Pacific countries with the exception of urban China also had underweight prevalences >20% in both rural and urban areas. In contrast, there was substantial geographic variation in Sub-Saharan Africa with underweight prevalences as high as 36% in rural Senegal and as low as 4% in urban Malawi. There was also some geographic variation in Latin America & the Caribbean, though overall, the prevalence of underweight was quite low: only three of the nine countries included in the analysis of this region had prevalences > 10% in rural areas (Brazil, Guyana, and Haiti).

Latin America & the Caribbean had the highest regional prevalence of overweight in both rural and urban areas. Mexico in particular emerged as having the highest prevalence of overweight with over one-third of adolescent girls classified as overweight: prevalence of 33% and 42% in rural and urban areas, respectively. Two other Latin American countries, Bolivia and Nicaragua, also had high overweight prevalences with approximately one-quarter of adolescent girls in these countries being classified as overweight.

Several countries stood out due to apparent dual burdens of under- and overweight, especially in urban areas. Indeed, 38% of countries had both an under- and overweight prevalence ≥10% in urban areas. A smaller proportion of countries (19%) had both an under- and overweight prevalence ≥10% in rural areas, suggesting that the dual burden is currently more common in urban areas. Notable among these were the South American countries Brazil (underweight and overweight prevalence of about 15% in both rural and urban areas) and Guyana (underweight and overweight prevalence of about 20% in both

rural and urban areas), and the African country Mauritania (underweight prevalence just under 25% and overweight prevalence of 15% in both rural and urban areas). Interestingly, four African countries (Lesotho, Zimbabwe, Rwanda, and Uganda) had an apparent dual burden in rural areas but not in urban areas.

### Recent trends in the prevalence of under- and overweight

Recent estimates of regional and national annualized change in the prevalence of under- and overweight are presented in Figure 3 and Figure 4, respectively.

The prevalence of underweight is decreasing in most all regions with the notable exception being rural South Asia. The largest decreases in underweight are occurring in Sub-Saharan Africa, namely rural Zambia (−1.17% annually), urban Nigeria (−1.60% annually), and urban Mali (−1.20% annually). Large decreases are also occurring in select Asian countries including urban Bangladesh (−1.75% annually) and urban China (−1.15% annually). As an example to put these results into context, the annualized change in underweight prevalence observed in Bangladesh would be equivalent to a 17.5 percentage point prevalence decrease over 10 years. In contrast, the largest increases in underweight are also occurring in Sub-Saharan Africa, namely rural Senegal (+1.60% annually) and urban Niger (+1.25% annually). Rural Bangladesh (+1.50% annually), urban Nepal (+1.40% annually), and rural Armenia (+1.20% annually) also experienced recent increases in the prevalence of underweight.

In rural areas of all regions except Eastern Europe & Central Asia and South Asia, the prevalence of overweight is increasing. The largest increases in overweight are occurring in rural Gabon (+1.17% annually). Urban Zimbabwe, urban and rural Nicaragua, and urban Peru all had an increase in the prevalence of overweight of 1.00% annually. The largest decreases in overweight occurred in urban Congo (−1.33% annually).

In regards to the dual burden, the prevalence of underweight in rural areas is decreasing in 46% of countries; while in all of these countries except two (Zambia and Zimbabwe), the prevalence of rural overweight is increasing. In urban areas, the prevalence of both under- and overweight is increasing in 18% of countries, representing an increasing dual burden.

## Discussion

Underweight remains a significant concern among adolescent girls in LMICs, especially in South Asia. India, Bangladesh, and Nepal have an increasing underweight prevalence that is nearly double that of East Asia & the Pacific and Sub-Saharan Africa. Of growing concern Latin America & the Caribbean had the highest regional prevalence of overweight in both rural and urban settings and this prevalence is increasing annually by about 0.5%, which is equivalent to a 5% increase over 10 years. Indeed, the latest overweight prevalence in urban Mexico (42%) was higher than that for U.S. adolescent girls (12–17 years old) in 2003–2004 (prevalence of combined overweight and obesity using the IOTF cut points: 34.5%) (27). Also of note is the rising prevalence of the dual burden: in 18% of countries the prevalence of both under- and overweight is increasing in urban areas.

India (2005) and Senegal (2010) stood out as having the highest prevalences of underweight, both in rural and urban areas. India (0.66% from 1998 to 2005) and Senegal (1.60% from 2005 to 2010) also had some of the highest annual increases in underweight in rural areas. Several other Sub-Saharan African countries also had annual increases in underweight in rural areas ≥0.50% including Mali, Madagascar, Niger, and Guinea; and another South Asian country, Bangladesh, had the second-highest annual increase in underweight in rural areas (1.50% from 2007 to 2011). A recent systematic review also reported increasing trends in the prevalence of underweight among children and adolescents in Asian LMICs (13). The substantial rises in underweight observed in Senegal and Bangladesh are likely the result of increasing food insecurity around the world stemming from the rise in grain prices between 2007 and mid-2008 and the subsequent great recession (28). This trend is not temporary; without international intervention, food prices and subsequent food insecurity will continue to increase as a result of plateaus in photosynthesis potential, climate change, water shortages, and soil erosion. Expanding disparities between the “have’s” and “have not’s” not only contribute to poor health outcomes, such as the dual burden described here, but also social and political unrest.

Egypt (2005) and several Latin American countries including Mexico, Bolivia, and Nicaragua, had the highest prevalence of overweight in both rural and urban areas. This result is consistent with previous country-specific data from the Middle East and Central America (11) as well as economic data. At some point in LMIC development, perhaps around a GDPPC of $2500 (29), the burden of overweight/obesity begins to shift from the affluent to the disadvantaged. In this analysis, with the exceptions of Namibia, Mexico, and Peru (which had much higher overweight prevalences in urban areas), all countries with a GDPPC >$2500 had approximately equivalent overweight prevalences in rural and urban areas. Further, particularly in rural areas, countries with higher GDPPCs tended to have higher overweight prevalences.

The primary challenge to previous studies that have attempted to compare representative data on adolescent under- and overweight between countries has been the use of different cut-points to define under- and overweight. We have overcome this challenge by conducting primary data analysis, applying the same IOTF sex- and age-specific cut-points throughout, and defining a specific age group for all countries. However, our analysis is not without limitations. DHS only collects data on women in the household, and therefore our analysis was restricted to girls aged 15.0 to 18.9 years. As data become available, sex differences will be an important area to explore. Meanwhile, the results presented here are of particular importance because girls of childbearing age are a critical point of intervention as pre-pregnancy BMI is a strong predictor of child health outcomes (17,18).

Furthermore, some countries had small sample sizes and some regions had poor representation, particularly North Africa and Eastern Europe & Central Asia. A cut-point of n=50 for survey inclusion was chosen recognizing that anthropometric data for this age group in LMICs are limited, and that a comprehensive presentation of available data could nonetheless be informative for identifying gaps in our current knowledge. In particular, the sample size for Egypt was less than 100 in urban areas. This limitation renders the large decrease in overweight observed in urban areas of Egypt difficult to interpret and generalize.

Finally, while we present the latest available data for all countries, the "latest" data were still over 10 years old for 10.3% of countries (Vietnam, Nicaragua, Kazakhstan, Kyrgyz Republic, Morocco, and Mauritania). The most recent data available for India are from 2005, and since that time great achievements in poverty reduction have been made throughout India: in 2011–12, 26% of individuals in rural areas and 14% in urban areas lived below the poverty line compared to 42% and 26%, respectively, in 2004–05 (30). Given that socioeconomic changes and the subsequent nutrition transition and shifts in the food systems are occurring at a rapid pace in LMICs, surveys conducted 10 or more years ago may not be comparable to surveys conducted more recently. Overall, it is clear from this analysis that improved monitoring of adolescent health (e.g. increased sample size and survey frequency) is needed in LMICs.

The high levels of both adolescent under- and overweight represent important challenges for public health. Adolescent overweight/obesity is associated with severe obesity in adulthood, diabetes, and hypertension (16). From an intergenerational perspective, adolescence is a critical period as young women prepare for pregnancy. Inadequate maternal nutrition can lead to fetal growth restriction, ultimately resulting in small-for-gestational age and low birth weight infants (17). Maternal overweight/obesity, even without gestational diabetes, is a risk factor for large-for-gestational age, large infant birth weight, and infant overweight/obesity (17) as well as birth defects (18). Several recent campaigns highlight the importance of targeting adolescent girls for improving population health [e.g., the Center for Global Development's "Start with a Girl: A New Agenda for Global Health" and "Girls Count: A Global Investment and Action Agenda"].

Reflecting on the results reported here and comparing them to recent trends in under- and overweight among adult women in LMICs (3) there appears to be a puzzling contrast between high adolescent undernutrition and low adult undernutrition in LMICs. Future research needs to explore these age-specific issues and their implications for program and policy work.

In conclusion, there is substantial variation across regions and countries in the prevalence of adolescent under- and overweight, with increasing dual burdens observed in urban areas. Underweight remains an important concern for many countries and should not be overlooked. A lack of recent data on this age group, particularly from North Africa, Central Asia, Vietnam, and India, continues to be a challenge for comparing results across countries and regions. As LMICs develop and the prevalence of overweight increases, the unintended consequences of policies in place to combat undernutrition need to be considered. Innovative public health interventions that are capable of addressing both ends of the malnutrition spectrum are urgently needed, as the anthropometric markers reported here are important predictors of future adverse health outcomes for both the adolescent girl and her offspring.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

## Acknowledgments

BMP conceived the project and all others were involved in the development of the research plan. LMJ wrote the original manuscript and all authors contributed substantially to revisions and approved the final manuscript. We would also like to thank Dr. Phil Bardsley and Ms. Amanda Lyerley for programming support, and Mr. Tom Swasey for graphics support. Support for database development came from the Carolina Population Center and the National Institutes of Health (grant: 5 R24 HD050924).

## References

1. Milanovic B. Global inequality recalculated and updated: The effect of new PPP estimates on global inequality and 2005 estimates. J Econ Inequality. 2012; 10:1–18.
2. FAO, IFAD and WFP. The multiple dimensions of food security. Rome: FAO; 2013. The State of Food Insecurity in the World, 2013.
3. Popkin BM, Slining MM. New dynamics in global obesity facing low- and middle-income countries. Obes Rev. 2013; 14:11–20. [PubMed: 24102717]
4. Doak CM, Adair LS, Monteiro C, Popkin BM. Overweight and underweight coexist within households in Brazil, China and Russia. J Nutr. 2000; 130:2965–2971. [PubMed: 11110855]
5. US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics. CDC Growth Charts: United States. 2000.
6. Midha T, Nath B, Kumari R, Rao YK, Pandey U. Childhood obesity in India: A meta-analysis. Indian J Pediatr. 2012; 79:945–948. [PubMed: 22002317]
7. Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: International survey. BMJ. 2000; 320:1240–1243. [PubMed: 10797032]
8. Gordon-Larsen P, Wang H, Popkin BM. Overweight dynamics in Chinese children and adults. Obes Rev. 2014; 15:37–48. [PubMed: 24341757]
9. de Onis M, Onyango AW, Borghi E, Siyam A, Nishida C, Siekmann J. Development of a WHO growth reference for school-aged children and adolescents. Bull World Health Organ. 2007; 85:660–667. [PubMed: 18026621]
10. Barquera S, Campos I, Rivera JA. Mexico attempts to tackle obesity: The process, results, push backs and future challenges. Obes Rev. 2013; 14:69–78. [PubMed: 24103026]
11. Wang Y, Lobstein T. Worldwide trends in childhood overweight and obesity. Int J Pediatr Obes. 2006; 1:11–25. [PubMed: 17902211]
12. Poskitt EM. Countries in transition: Underweight to obesity non-stop? Ann Trop Paediatr. 2009; 29:1–11. [PubMed: 19222928]
13. Mak KK, Tan SH. Underweight problems in Asian children and adolescents. Eur J Pediatr. 2012; 171:779–785. [PubMed: 22350280]
14. Cole TJ, Flegal KM, Nicholls D, Jackson AA. Body mass index cut offs to define thinness in children and adolescents: International survey. BMJ. 2007; 335:194–201. [PubMed: 17591624]
15. WHO. Physical status: The use of and interpretation of anthropometry, report of a WHO expert committee. WHO; Geneva: 1995.
16. Inge TH, King WC, Jenkins TM, et al. The effect of obesity in adolescence on adult health status. Pediatrics. 2013; 132:1098–1104. [PubMed: 24249816]
17. Yu Z, Han S, Zhu J, Sun X, Ji C, Guo X. Pre-pregnancy body mass index in relation to infant birth weight and offspring overweight/obesity: A systematic review and meta-analysis. PLoS One. 2013; 8:e61627. [PubMed: 23613888]
18. Block SR, Watkins SM, Salemi JL, Rutkowski R, Tanner JP, Correia JA, Kirby RS. Maternal pre-pregnancy body mass index and risk of selected birth defects: Evidence of a dose-response relationship. Paediatr Perinat Epidemiol. 2013; 27:521–531. [PubMed: 24117964]
19. WHO. Fact Sheet: Adolescent Pregnancy. Last updated: May 2012. Accessed: 28 February 2014. Available at: http://www.who.int/mediacentre/factsheets/fs364/en/
20. Corsi DJ, Neuman M, Finlay JE, Subramanian S. Demographic and Health Surveys: A profile. Int J Epidemiol. 2012; 41:1602–1613. [PubMed: 23148108]

21. The Indonesia Family Life Survey (IFLS). 2014. Available at: http://www.rand.org/labor/FLS/IFLS.html
22. Popkin BM, Du S, Zhai F, Zhang B. Cohort profile: The China Health and Nutrition Survey—monitoring and understanding socio-economic and health change in China, 1989–2011. Int J Epidemiol. 2010; 39:1435–1440. [PubMed: 19887509]
23. Tuan NT, Tuong PD, Popkin BM. Body mass index (BMI) dynamics in Vietnam. Eur J Clin Nutr. 2008; 62:78–86. [PubMed: 17299463]
24. Instituto Brasileiro de Geografia e Estatística (IBGE). Pesquisa de orçamentos familiares, 2008–2009: Análise do consumo alimentar pessoal no brasil. 2011:1–150.
25. Romero-Martínez M, Shamah-Levy T, Franco-Núñez A, Villalpando S, Cuevas-Nasu L, Gutiérrez JP, Rivera-Dommarco JA. Encuesta nacional de salud y nutrición 2012: Diseño y cobertura. Salud Publica Mex. 2013; 55:S332–S340. [PubMed: 24626712]
26. World Bank. World Development Indicators (WDI). 2014. Available at: http://data.worldbank.org/indicator
27. Lobstein T, Jackson-Leach R. Child overweight and obesity in the USA: Prevalence rates according to IOTF definitions. Int J Pediatr Obes. 2007; 2:62–64. [PubMed: 17763012]
28. Timmer CP. Reflections on food crises past. Food Policy. 2010; 35:1–11.
29. Monteiro CA, Conde WL, Lu B, Popkin BM. Obesity and inequities in health in the developing world. Int J Obes Relat Metab Disord. 2004; 28:1181–1186. [PubMed: 15211362]
30. Government of India Planning Commission. Press note on poverty estimates, 2011–12. 2013

**What is already known about this subject:**

- A few published reports from a limited number of low- and middle-income countries (LMICs) have evaluated adolescent underweight and overweight separately, but most are outdated and not nationally representative
- Furthermore, while the dual burden of under- and overweight has been documented at the individual, household, and national level in both adults and children < 5 years living in LMICs, it has not been assessed in adolescents

**What this study adds:**

- This is the first study to describe both under- and overweight in adolescent girls living in 58 countries using nationally representative data
- Underweight remains a significant issue for adolescent girls in LMICs: half of the countries evaluated had higher prevalences of under- compared to overweight
- Nonetheless, there is substantial variation across and within regions in the burden of under- and overweight, with increasing dual burdens in many urban areas

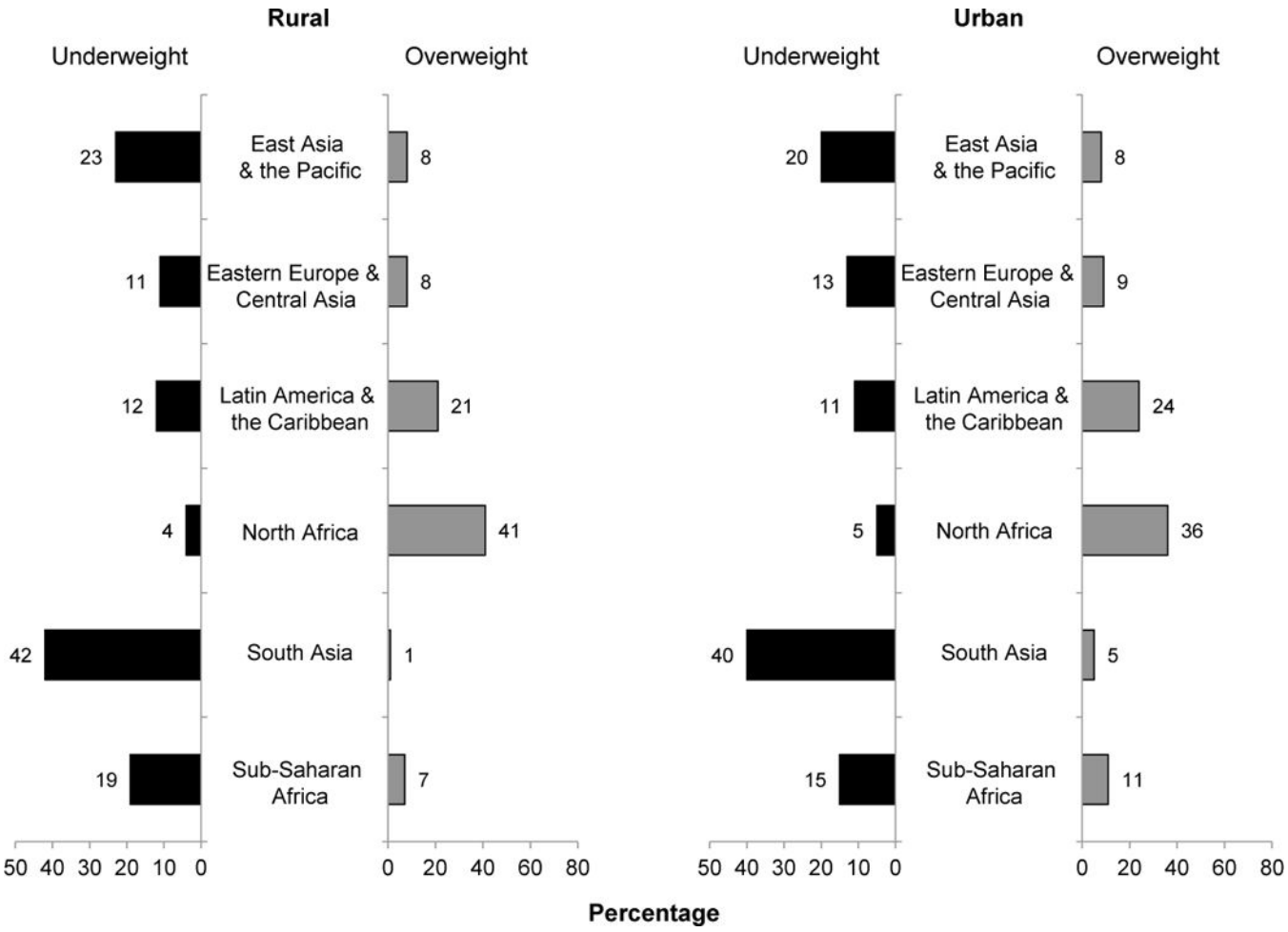


**Figure 1.**

Latest regional prevalence of under- and overweight among non-pregnant girls aged 15 to 18 years. Data are weighted by each country's population and based on the most recent nationally representative survey. Under- and overweight defined according to IOTF BMI cut-points.

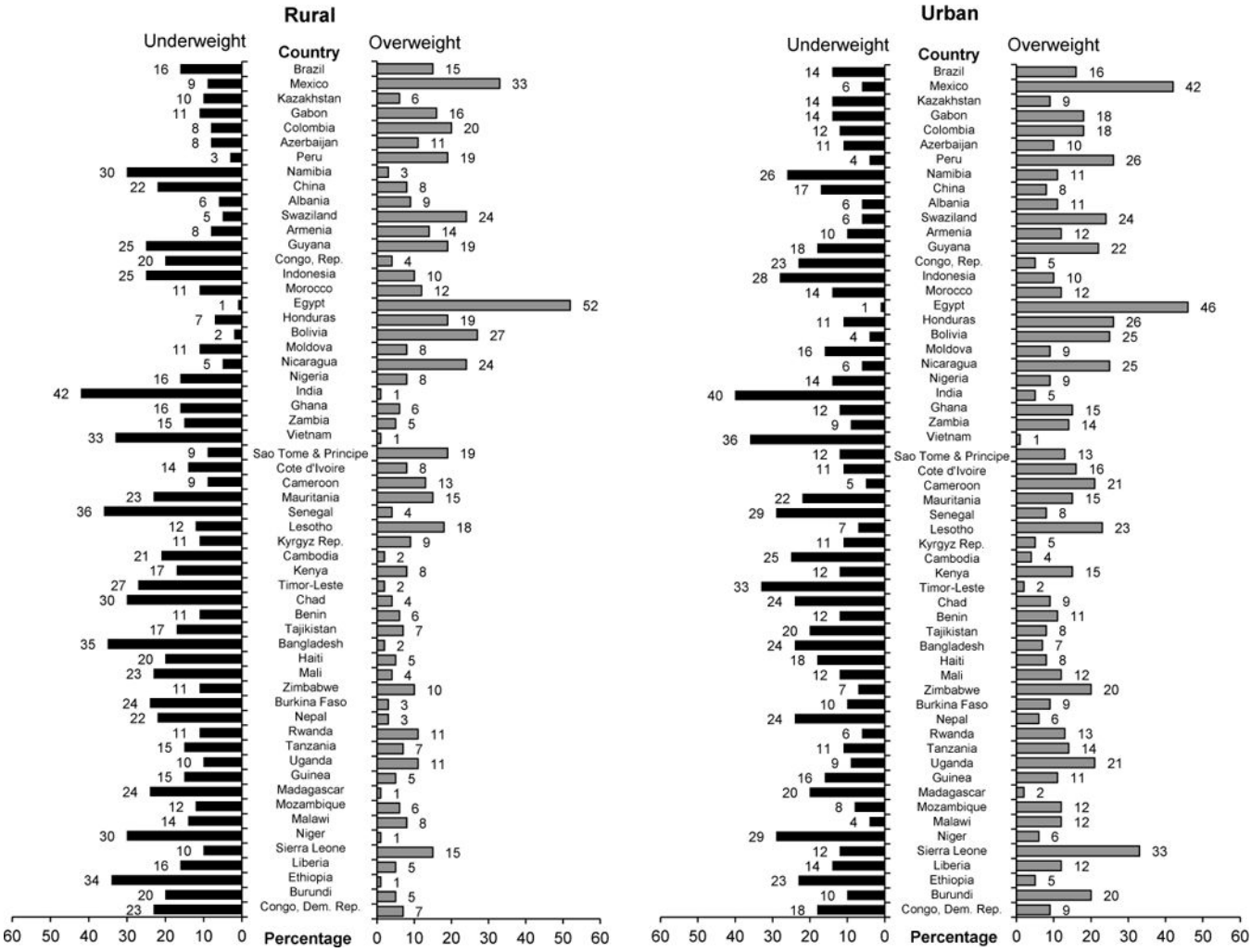


**Figure 2.**

Latest national prevalence of under- and overweight among non-pregnant girls aged 15 to 18 years in low- and middle-income countries sorted by gross domestic product per capita (GDPPC). Based on the most recent nationally representative survey. Under- and overweight defined according to IOTF BMI cut-points.

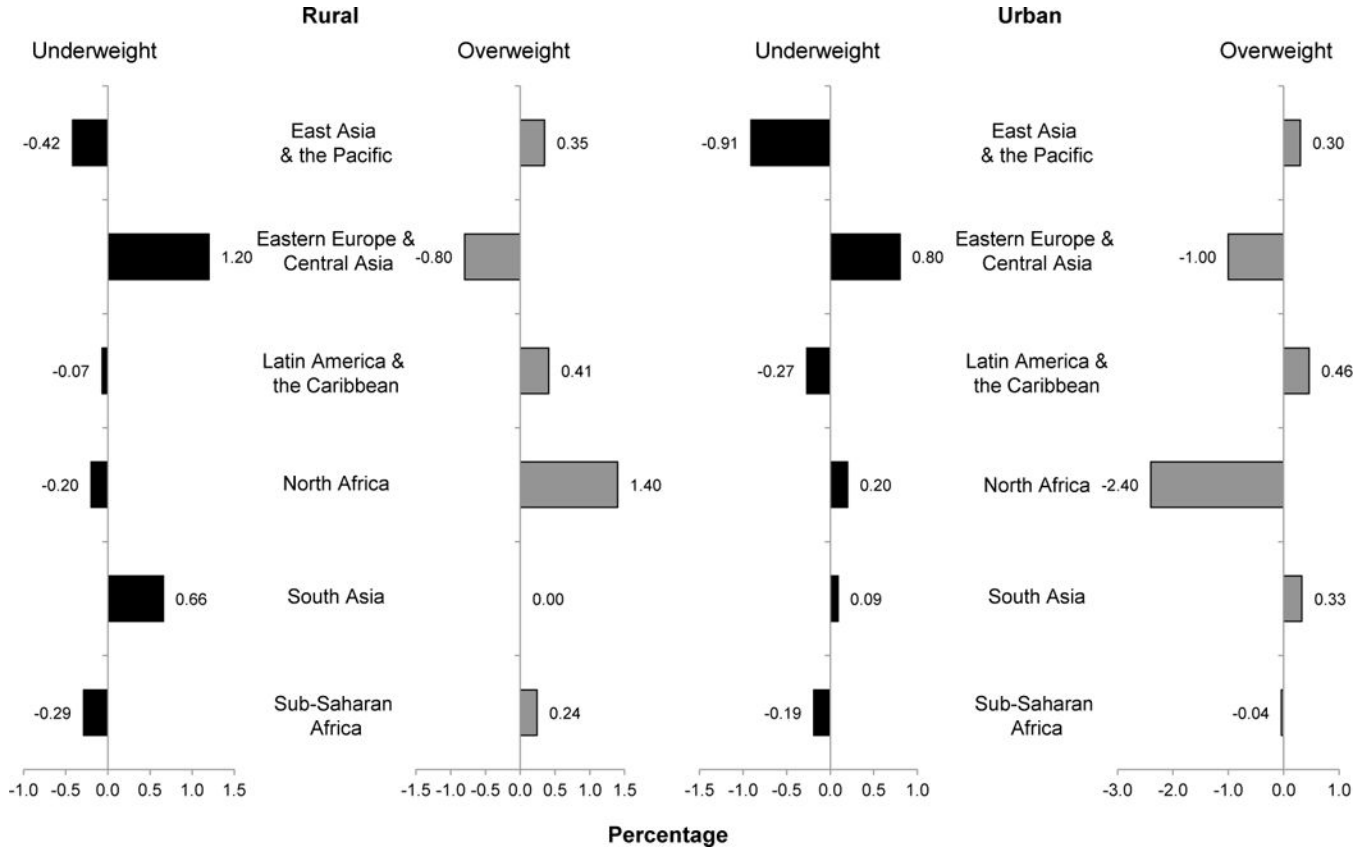


**Figure 3.**

Regional annualized change in the prevalence of underweight and overweight among non-pregnant girls aged 15 to 18 years. Data are weighted by each country's population and based on the two most recent nationally representative surveys. Underweight and overweight defined according to IOTF BMI cut-points.

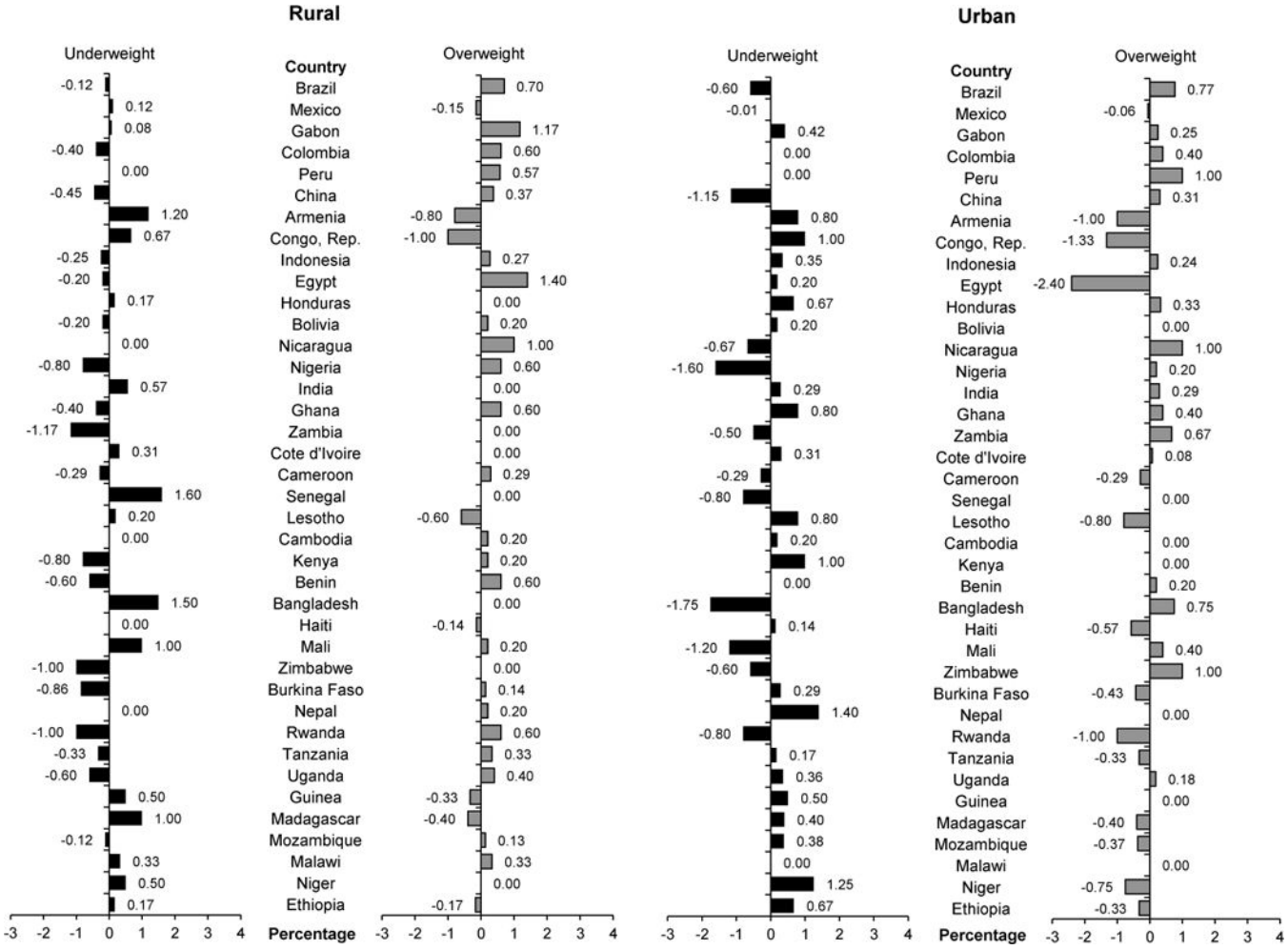


**Figure 4.**

National annualized change in the prevalence of under- and overweight among non-pregnant girls aged 15 to 18 years in low- and middle-income countries sorted by gross domestic product per capita (GDPPC). Based on the two most recent nationally representative surveys. Under- and overweight defined according to IOTF BMI cut-points.