

Assessing Health Burden of Overnutrition: A Survey of the Literature

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Abstract: This study presents a systematic review of the studies that have examined the health implications of overnutrition. During the last decade, India has experienced a shift in health burden accruing more to overnutrition than undernutrition. This nutritional transition is likely to have health consequences in terms of rise in non-communicable diseases which will affect longevity and quality of life. This paper is synthesis of major findings on health impacts of overweight and obesity across world. It is found that overnutrition is a persistent health burden across developed world and a upcoming burden for the developing nations. It is suggested to undertake adequate policy measures to mitigate the health burden imposed due to inadequate nutrition worldwide.

Keywords: Health outcomes, life expectancy, non-communicables diseases and Overnutrition

1) Introduction

Improvement in health and nutritional status is an important goal for the development. The Sustainable Development Goals aim at improving nutrition and ensuring healthy lives across the population worldwide. The recent increase in overnutrition may pose a challenge to the fulfilment of these goals.¹ During the recent decades, obesity prevalence has increased across almost every country of the world and worldwide obesity is rising since 1975 (World Health Organization (WHO)).² In 2022, globally around 43% of the adult population was overweight and 16% was obese (WHO). Once associated with the high-income countries, overweight and obesity has now become an emerging problem among the low- and middle-income countries. The age standardised obesity prevalence estimates given by WHO show that high-income countries have a considerably higher obesity prevalence as compared to the low- and middle-income countries, however, if the obesity prevalence continues to grow at the current rates then it may become a pandemic problem and may impose a considerable health and financial burden among the low- and middle-income countries.

This paper presents a review of the studies that have analysed at the health impacts of overnutrition with a focus on longevity and mortality indicators. To assess the impact on quality of life, we also look at its impact on Non-Communicable Diseases (NCDs).

2) Overnutrition: Effect on Health Outcomes

Available literature that examines the effect of overnutrition on the health outcomes shows that overnutrition adversely affects health outcomes such as longevity, death rate, years of life lost, quality of life, etc. The studies such as Brunello et al. (2009), Lichtenberg (2011) and Bansal and Zilberman (2016) have investigated these effects for longevity. The study by Brunello et al. (2009), using cross-country data for the United States, Japan and ten European countries during the period of 1979-2004, examine the effect of obesity prevalence on life expectancy at birth. To address the potential

¹ Overnutrition is measured by the proportion of population which is overweight and/or obese.

² "At aggregate level, obesity prevalence is defined as the proportion of population having BMI ≥ 30 kg/m² and, overweight and obesity prevalence is defined as the proportion of population having BMI ≥ 25 kg/m². Body Mass Index (BMI) of an individual is defined as person's weight in kilograms divided by the square of his height in meters (kg/m²). WHO International BMI classification categorises individuals having BMI < 18.5 kg/m² as underweight; $18.5 \leq \text{BMI} < 25$ kg/m² as normal weight; $25 \leq \text{BMI} < 30$ kg/m² as overweight and BMI ≥ 30 kg/m² as obese" (WHO).

endogeneity of the explanatory variables, they define life expectancy as a function of one period lagged values of the explanatory variables. The results show a negative relationship between obesity and life expectancy at birth. Another study by Lichtenberg (2011) also provides an evidence on the negative relationship between overweight and obesity prevalence, and life expectancy by estimating a weighted-least squares model using state level data for the United States during the period of 1991-2004. Bansal and Zilberman (2016) have developed an analytical model which defines average life expectancy as a non-linear function of obesity prevalence. They also test their model empirically at macro level using cross-country panel data and find a statistically significant concave relationship between obesity prevalence and life expectancy at birth.

Studies have also examined the effect of overnutrition on years of life lost (YLL) and deaths or mortality attributable to obesity (Fontaine et al., 2003; Mayhew et al., 2009; Preston and Stokes, 2011; Flegal et al., 2004; Allison et al., 1999 and Thornton and Rice, 2008). Fontaine et al. (2003) discuss the adverse effects of obesity on life expectancy across different age groups in the United States. They show that YLL due to obesity increase with body mass index but at higher values of body mass index, YLL due to obesity decline with age. This indicates the heterogeneity in the effects on life expectancy across age groups. Mayhew et al. (2009) estimate the effect of excess body fat, measured by body mass index and waist-to-height, on YLL extracting data from the Health and Lifestyle Survey for the United Kingdom. They find a J-shaped relationship between these two measures of obesity and YLL across both male and female population.

Preston and Stokes (2011) estimating a population attributable fraction find that obesity contributes to the low life expectancy at 50 years of age in the United States.³ Flegal et al. (2004) also estimate the deaths attributable to the obesity in the United States using population attributable fraction index and find that relatively higher deaths are caused due to obesity among the older age groups as compared to the younger age groups. Another study by Allison et al. (1999) based on five prospective cohort studies find that about 2.8 lakhs annual deaths are attributable to obesity among US adults. Thornton and Rice (2008) estimate the effect of lifestyle factors on crude death rate in the United States and find a highly statistically significant positive effect of obesity on crude death rate.

Some studies have also investigated the effect of obesity on the future life expectancy. Preston et al. (2014) examine the effect of past and future changes in obesity and smoking on future life expectancy for the United States and find that obesity has a negative effect on the future life expectancy, however, this loss in life expectancy is expected to get more than off-set by the gains accruing to reduced smoking. Another study by Stewart et al. (2009) finds a contrary result. They find that the negative effects of increased obesity. However, the common inference is that obesity is expected to increase and impose a detrimental effect on the future longevity.

From the above discussion, we find that most of the evidence on the effects of obesity on longevity and mortality indicators comes from empirical studies based on the population in the United States and other high-income countries.

3) Overnutrition and Non-Communicable Diseases

Overnutrition is linked to the increased risk of NCDs such as diabetes, heart diseases, etc. Huffman et al. (2011), based on a cohort study, show that both obesity and diabetes prevalence have increased among married women in South Delhi, India during 1998-2002. Estimating a logistic regression model, they find that an increase in BMI has a positive impact on the probability of having hypertension and diabetes. Colditz et al. (1995) using a prospective cohort study on women in the United States during 1976-90 find that the risk of diabetes is increasing in BMI and every 10 kg rise in weight after 18 years of age doubles risk of diabetes. Geiss et al. (2017) examine the recent trends in obesity and diabetes at county level for the United States during 2004-12 and find that the growth in the incidence of diabetes is slowing down but has not reversed (indicating that diabetes will increase but at comparatively low rates) and the level of risk still remains high. The study by Rowley et al. (2017) using National Census data forecasts the changes in diabetes, and finds that diabetes is expected to increase in the United States during 2015-30. Sepp et al. (2014) find a statistically significant

³ $PAF_i = \frac{\sum_j (C_{ij}M_{sj} - C_{ij}^*M_{sj})}{\sum_j (C_{ij}M_{sj})}$; where i is an indicator for each country, age, and sex combination; C_{ij} =proportion of population i in BMI category j , M_{sj} =death rate in BMI category j , and C_{ij}^* =proportion of population i in BMI category j if all individuals above the optimal BMI were redistributed to the optimal category” (Preston and Stokes, 2011).

positive relationship between blood glucose levels and BMI for a sample of elderly population (65 years of age or above) in Southern Estonia, Europe. Another study by Malley et al. (2010) conducting a cross-sectional study across young obese children in Europe finds a positive association between BMI and fasting blood glucose levels. All these studies suggest that NCDs prevalence is likely to escalate with the rise in overweight and obesity.

Studies have also examined how the increased prevalence of NCDs affects health outcomes. Sikdar et al. (2010) find that diabetes reduces both life expectancy and health adjusted life expectancy based on a representative data set for a province in Canada. Eliminating diabetes improves life expectancy by more than one year and health adjusted life expectancy by up to two years. The study by Rowley et al. (2017) obtains similar results considering mortality as the health indicator instead of life expectancy. They find that annual deaths associated with diabetes are expected to increase during 2015-30 in the United States. Andreyeva et al. (2007) investigate the effect of obesity on chronic health conditions across ten European countries using a logistic regression model. They find that people who are moderately or severely obese are almost twice more likely to report poor health status, disability or some chronic health conditions. Studies also advocate that the risk of NCDs is higher among Asian population as compared to the population in the European countries, Canada and the United States. (Razak et al., 2007 and Gray et al., 2011). Razak et al. (2007) consider a random sample of 1078 individuals from Asian and European countries and find that for a given BMI, Asian population is more likely to have elevated blood glucose levels and blood pressure levels as compared to the European population. Gray et al. (2011) also obtain similar results. They consider 4688 White Europeans and 1333 South Asians in the age group 40-75 years who are residents of the United Kingdom during 2004-07. They find that for a given BMI, South Asian population faces a higher risk of cardiovascular diseases and diabetes as compared to the European population. Also, diabetes is more prevalent in South Asian countries like India, Pakistan and Bangladesh as compared to the European countries. Patel et al. (2001) compare the perceived and actual obesity among diabetic and non-diabetic women across these two regions and find that awareness about obesity is low among South Asian women than European women. Also, women aware about their diabetes status have more realistic body weight perception.

From the above discussion, it is found that overnutrition increases the risk of NCDs and this risk varies across population in different regions. Much of the evidence on the effects of overweight and obesity on NCDs comes from high-income countries and is based on small population size, therefore, the results obtained from these studies cannot be generalised for the entire population.

4) Conclusion

This rapid emergence of overnutrition is expected to pose a major health challenge. Overnutrition imposes both health and economic burden. Overnutrition increases the risk of non-communicable diseases and has an adverse impact on the health outcomes such as longevity, mortality, quality of life, etc. The policy implication of this study is that the policy makers can reduce the burden of non-communicable diseases and improve health outcomes by addressing the rise in overweight and obesity prevalence. Effects of overnutrition on the health status is expected to be heterogenous across regions and a uniform health policy may not be appropriate. Therefore, government can design different policies based on the nutritional status of the state to improve the health conditions.

References

- Allison, D.B., Fontaine, K.R., Manson, J. E., Stevens, J. and VanItallie, T. B. (1999), "Annual Deaths Attributable to Obesity in the United States", *Journal of the American Medical Association*, 282(16): 1530–38.
- Andreyeva, T., Michaud, P. C. and Soest, A. V. (2007), "Obesity and Health in Europeans Aged 50 years and Older", *Public Health*, 121: 497–509.
- Bansal, S. and Zilberman, D. (2016), "Does Health Care Expenditure Counter Adverse Effects of Obesity on Health: Evidence from Global Data", Presented on January 6-8, 2017 at Allied Social Sciences Association (ASSA) Annual Meeting Chicago, Illinois.

- Brunello, G., Michaud, P. C. and Galdeano, A. S. (2009), "The Rise of Obesity in Europe: An Economic Perspective", *Economic Policy*, 24(59): 551-596.
- Colditz, G.A., Willett, W. C., Rotnitzky, A. and Manson, J. E. (1995), "Weight Gain as a Risk Factor for Clinical Diabetes Mellitus in Women", *Annals of Internal Medicine*, 122(7): 481-6.
- Dhana, K., Nano, J., Ligthart, S., Peeters, A., Hofman, A., Nusselder, W., Dehghan, A. and Franco, O. H. (2016), "Obesity and Life Expectancy with and without Diabetes in Adults Aged 55 Years and Older in the Netherlands: A Prospective Cohort Study", *PLOS Medicine*, 13(7): 1-13.
- Flegal, K. M., Williamson, D. F., Pamuk, E. R. and Rosenberg, H. M. (2004), "Estimating Deaths Attributable to Obesity in the United States", *American Journal of Public Health*, 94(9): 1486-89.
- Fontaine, K. R., Redden, D. T., Wang, C., Westfall, A. O. and Allison, D. B. (2003), "Years of Life Lost Due to Obesity", *Journal of the American Medical Association*, 289(2): 187-93.
- Geiss, L. S., Kirtland, K., Lin, J., Shrestha, S., Thompson, T., Albright, A. and Gregg, E. W. (2017), "Changes in Diagnosed Diabetes, Obesity, and Physical Inactivity Prevalence in US Counties, 2004-2012", *PLOS One*, 12(3): e0173428.
- Gray, L. J., Yates, T., Davies, M. J., Brady, E., Webb, D. R., Sattar, N. and Khunti, K. (2011), "Defining Obesity Cut-Off Points for Migrant South Asians", *PLOS One*, 6(10): e26464.
- Huffman, M. D., Prabhakaran, D., Osmond, C., Caroline, H. D. F., Fall, C. H. D., Tandon, N., Lakshmy, R., Ramji, S., Khalil, A., Gera, T., Prabhakaran, P., Biswas, S. K. D., Reddy, K. S., Bhargava, S. K. and Sachdev, H. S. (2011), "Incidence of Cardiovascular Risk Factors in an Indian Urban Cohort: Results From the New Delhi Birth Cohort", *Journal of American College of Cardiology*, 57(17): 1765-1774.
- Lichtenberg, F. R. (2011), "The Quality of Medical Care, Behavioral Risk Factors and Longevity Growth", *International Journal of Health Care Finance Economics*, 11:1-34.
- Malley, O. G., Santoro, N., Northrup, V., D'Adamo, E., Shaw, M., Eldrich, S. and Caprio, S. (2010), "High Normal Fasting Glucose Level in Obese Youth: A Marker for Insulin Resistance and Beta Cell Dysregulation", *Diabetologia*, 53(6): 1199-209.
- Mayhew, L., Richardson, J. and Rickayzen, B. (2009), "A Study into the Detrimental Effects of Obesity on Life Expectancy in the UK", Cass Business School, London, United Kingdom. URL: https://www.actuaries.org.uk/system/files/documents/pdf/Mayhew_obesity.pdf
- Patel, S., Bhopal, R., Unwin, N., White, M., Alberti, K. G. M. M. and Yallop, J. (2001), "Mismatch between Perceived and Actual Overweight in Diabetic and Non-Diabetic Populations: A Comparative Study of South Asian and European Women", *Journal of Epidemiology and Community Health*, 55(5): 332-333.
- Preston, S. H. and Stokes, A. (2011), "Contribution of Obesity to International Differences in Life Expectancy", *American Journal of Public Health*, 101(11): 2137-2143.
- Razak, F., Anand, S. S., Shannon, H., Vuksan, V., Davis, B., Jacobs, R., Teo, K. K., McQueen, M. and Yusuf, S. (2007), "Defining Obesity Cut Points in a Multiethnic Population", *Circulation*, 115(16): 2111-8.
- Rowley, W. R., Bezold, C., Arikian, Y., Byrne, E. and Krohe, S. (2017), "Diabetes 2030: Insights from Yesterday, Today, and Future Trends", *Population Health Management*, 20(1): 6-12.
- Sepp, E., Kolk, H., Loivukene, K. and Mikelsaar, M. (2014), "Higher Blood Glucose Level Associated with Body Mass Index and Gut Microbiota in Elderly People", *Microbial Ecology in Health and Disease*, 25:10.3402/mehd.v25.22857. URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4048595/>

Sikdar, K. C., Wang, P. P., MacDonald, D. and Gadag, V. G. (2010), “Diabetes and its Impact on Health-Related Quality of Life: A Life Table Analysis”, *Quality of Life Research*, 19(6): 781-787.

Stewart, S. T., Cutler, D. M. and Rosen, A. B. (2009), “Forecasting the Effects of Obesity and Smoking on U.S. Life Expectancy”, *The New England Journal of Medicine*, 361: 2252-60.

Thornton, J. A. and Rice, J. L. (2008), “Determinants of Healthcare Spending: A State Level Analysis”, *Applied Economics*, 40: 2873-89.

World Health Organization (2022). *Global Health Observatory Data Repository*.