

# Journal of Health Management

<http://jhm.sagepub.com/>

---

## **The Changing Face of Malnutrition in India**

Angan Sengupta and T.S. Syamala

*Journal of Health Management* 2012 14: 451

DOI: 10.1177/0972063412468976

The online version of this article can be found at:

<http://jhm.sagepub.com/content/14/4/451>

---

Published by:



<http://www.sagepublications.com>

**Additional services and information for *Journal of Health Management* can be found at:**

**Email Alerts:** <http://jhm.sagepub.com/cgi/alerts>

**Subscriptions:** <http://jhm.sagepub.com/subscriptions>

**Reprints:** <http://www.sagepub.com/journalsReprints.nav>

**Permissions:** <http://www.sagepub.com/journalsPermissions.nav>

**Citations:** <http://jhm.sagepub.com/content/14/4/451.refs.html>

>> [Version of Record](#) - Jan 23, 2013

[What is This?](#)

# The Changing Face of Malnutrition in India

**Angan Sengupta**  
**T.S. Syamala**

Journal of Health Management  
14(4) 451–465  
© 2012 Indian Institute of  
Health Management Research  
SAGE Publications  
Los Angeles, London,  
New Delhi, Singapore,  
Washington DC  
DOI: 10.1177/0972063412468976  
<http://jhm.sagepub.com>



## Abstract

This article analyzes the National Family Health Survey (NFHS) data in order to assess the levels and trends of malnutrition (both underweight as well as overweight) in India and its states. It not only examines the determinants of malnutrition through a binary logistic regression analysis but also addresses the possibility of simultaneous existence of underweight and overweight women in the Indian context. The results show that underweight in India seems to be a problem which cuts across all social and economic categories, whereas, the overweight or obesity seems to be more of a problem of the wealthier, urban women. The article also throws light on the changing face of malnutrition in India including the likely shift from the customary problems of chronic energy deficiency to the emerging problems of overweight/obesity in Indian society. The likelihood of the simultaneous existence of underweight and overweight especially in urban India is also observed. Therefore, along with the attempts in alleviating undernutrition, the nutrition policies in India have to focus its attention on the issues of being overweight as well.

## Keywords

Underweight, overweight, nutrition transition, double burden, trickle-down effect

## Introduction

Malnutrition is a broad term which refers to both undernutrition and overnutrition. Individuals are malnourished, while they suffer from undernutrition if their diet does not provide them with adequate calories and proteins for maintenance and growth. People are also malnourished, as they suffer from overnutrition if they consume too much of fats or calories. Thus, malnutrition can be defined as a condition resulting from inadequate (undernutrition or underweight) or excessive consumption (overnutrition or overweight) of nutrients. A number of different nutrition disorders may arise, depending on which nutrients are under or overabundant in the diet. According to the World Health Organization (WHO), malnutrition is the gravest single threat to global public health, leading to several diseases related to inadequacy and excess of nutrients in the diet. Being underweight is generally associated with mortality, especially child and maternal mortality and diseases like—anaemia, night blindness, ricket, bery-bery

---

**Angan Sengupta**, Research Scholar, Institute for Social and Economic Change, Bangalore.

Email: [angansengupta@isec.ac.in](mailto:angansengupta@isec.ac.in)

**T.S. Syamala**, Associate Professor, Institute for Social and Economic Change, Bangalore.

Email: [syamala@isec.ac.in](mailto:syamala@isec.ac.in)

and reducing stamina and immunity. On the other hand being overweight is associated with hypertension, diabetes, cardio-vascular diseases etc.

It is generally presumed that the low income developing countries are mainly characterized by the problems of undernutrition or being underweight whereas, high income developed countries are affected by overnutrition or obesity problems. This phenomenon can be explained by the classic epidemiological transition theory (Omran 1971). As per this theory, historically, undernutrition has been associated with higher prevalence of infectious diseases and high mortality; as populations move into epidemiologic transition, increases in the number of overweight and obesity begin to appear, along with the emergence of man-made diseases or non communicable diseases (NCD), while undernutrition and infectious diseases become past problems. Omran identified three stages of epidemiological transition such as pestilence and famine where death among the population was mainly due to infectious diseases; in the second stage, the stage of receding pandemics was identified by the shift in infectious to chronic diseases concomitant with improvement in the living standards and public health measures. The third stage of the man-made and degenerative disease was characterized by the lifestyle related diseases. Along with the changes in the disease pattern, demographic transition was also taking place where the level of mortality and fertility declined and life expectancy increased. These changes have caused a shift towards lower child-to-adult dependency ratios and greater numbers of elderly in the population, with NCD becoming more predominant as longevity increases.

However, a detailed analysis of the disease burden and causes of death statistics from various countries have shown that today in many countries in the world infectious and chronic diseases coexist over long periods of time breaching the classic stages of epidemiological transition. Evidence of this has been documented in countries as diverse as China (Cook and Dummer 2003) and South Africa (Chopra 2004). These developing countries customarily had high levels of underweight. Although proportion of underweight population has declined over the years, the pace of decline was relatively slow and therefore a considerably high proportion of underweight population still exists in these countries. On the other hand, the proportion of overweight population is fast increasing in these countries giving way to the paradoxical coexistence of both underweight and overweight together in the same population. This typical situation is called the existence of double burden of malnutrition and generally observed in the societies experiencing a transition in the dietary intake (Popkin 1993).

As India is one of the developing countries in the midst of epidemiological transition concomitant with high socio-economic development, it will be of great interest to see the changing face of the malnutrition in India. The primary focus of the nutrition researches and policies in India has always been on the various dimensions of the control and prevention of undernutrition. However, recent studies show concerns on the rising proportion of overweight and obesity in the Indian population. A more detailed analysis on nutrition scenario conducted after 2000s has clearly shown that the levels of undernutrition almost remained stagnant in the recent years, while the levels of overweight or obesity among women continued to rise. This phenomenon may result to a particular situation of simultaneous existence of under and overnutrition in a same population, and may arise strongly in the Indian context also. Besides this, the country is also characterized by huge heterogeneity in its population size, distribution, composition and other socio-economic entities provides further scope to understand the possibly existing unique paradoxical nutritional scenario of the country.

Given this background, this article tries to address the issue of the existence of underweight and overweight in the population in general and also investigates the possibility of the coexistence of both the underweight and the overweight.

## Objectives

- To understand the levels and trends of malnutrition (underweight as well as overweight) in India and its states
- To analyze the variations in underweight and overweight across different socio-economic categories
- To assess the possibility of coexistence of under and overnutrition in the Indian context

## Data

The data for the present study are drawn from the 2nd and 3rd National Family Health Survey (NFHS-2 and NFHS-3) conducted during 1998–99 and 2005–06, respectively. The major objective of this survey was to provide state-level and national-level estimates on various demographic indicators such as fertility, family planning, infant and child mortality, reproductive and child health, nutrition and morbidity of adults and children, the quality of health and family welfare services and socio economic conditions. NFHS-3 collected information from a sample of 1,24,385 women aged 15–49 years, and 74,369 men aged 15–54 years which covers 99 per cent of India's population in 29 states. Although NFHS collected information on men, women and children, data on ever-married women alone are used in this article. NFHS-2 collected information from ever married women aged 15–49 years whereas NFHS-3 collected information from all women aged 15–49 years. Hence to draw a proper comparison between the second and third rounds of the concerned survey, only the ever married women from both surveys were considered.

Nutritional status of the adults is given in terms of the Body Mass Index (BMI). BMI is an anthropometric measure, which has been calculated based on the height and weight of the individuals. A person with a BMI value below 18.5 kg/m<sup>2</sup> is considered as thin or underweight, whereas BMI ranging from 25–29.99 kg/m<sup>2</sup> and more than equal to 30 kg/m<sup>2</sup> are considered as overweight and obese respectively. Bivariate and multivariate analysis has been carried out to understand the prevalence rate of under and overweight problems with respect to various background factors.

## Analysis and Discussion

### *Levels of Nutritional Status*

Data on the levels of malnutrition in India is presented in Table 1. The table clearly shows that in India, underweight among women is still a major problem to be tackled, although a substantial proportion of women are also overweight or obese. The figures show that a little more than one in every three ever-married women in India suffers from being underweight whereas being overweight or obesity has affected one in every six ever-married women. Although the level of underweight in India is quite high, there are substantial variations in the levels across the states. The proportions of underweight across different states range from as high as 41.5 per cent in Jharkhand to as low as 10.7 per cent in Delhi during 2005–06. Similarly, the levels of overweight and obesity in India also show substantial variations across

**Table 1.** Malnutrition Levels among Ever-married Women Aged 15–49 Years in India, NFHS-3, 2005–06

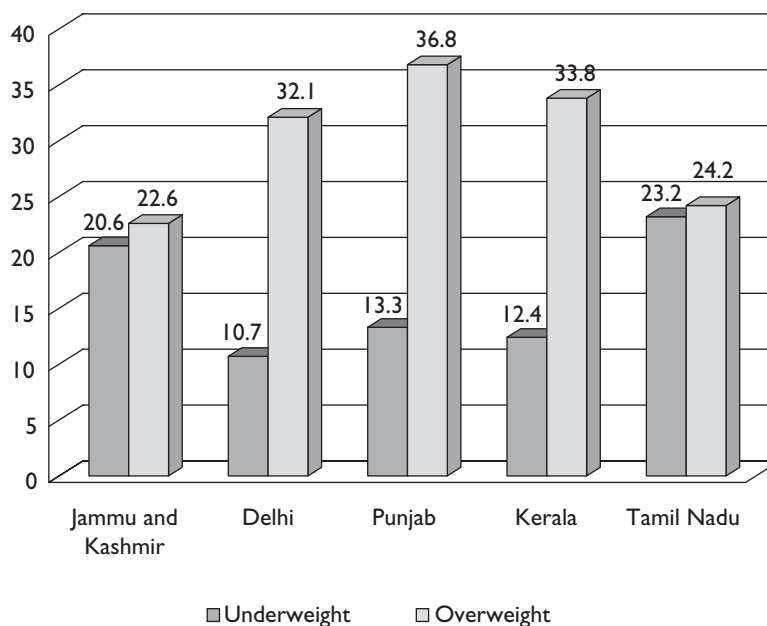
States	Underweight	Normal	Overweight	Obese
Jammu & Kashmir	20.6	56.9	17.6	4.9
Himachal Pradesh	24.2	58.9	14.3	2.7
Punjab	13.3	49.8	25.2	11.6
Uttaranchal	25.0	59.1	12.7	3.2
Haryana	26.9	52.8	15.4	5.0
Delhi	10.7	57.3	22.2	9.9
Rajasthan	32.7	57.5	7.8	2.0
Uttar Pradesh	32.6	56.5	8.9	2.0
Bihar	41.1	53.6	4.5	0.8
Assam	35.8	55.4	7.9	1.0
West Bengal	37.1	50.7	10.1	2.2
Jharkhand	41.5	52.7	4.6	1.2
Orissa	39.5	53.1	5.9	1.5
Chhattisgarh	39.7	53.8	4.9	1.58
Madhya Pradesh	38.6	53.3	6.6	1.5
Gujarat	31.7	48.6	14.4	5.3
Maharashtra	32.1	51.2	12.4	4.2
Andhra Pradesh	30.3	52.3	12.7	4.8
Karnataka	30.6	51.6	13.4	4.4
Kerala	12.4	53.9	27.8	6.0
Tamil Nadu	23.2	52.6	18.1	6.1
<b>India</b>	<b>32.2</b>	<b>53.4</b>	<b>11.1</b>	<b>3.3</b>

**Source:** Authors' research.

states. The overweight proportion ranges between a wide margin of 37 per cent in Punjab to 5 per cent in Bihar. On one hand we have states like Punjab, Kerala and Delhi with high levels of overweight among ever-married women (more than 30 per cent prevalence rate) and on the other hand we have Bihar, Jharkhand and Chhattisgarh with lowest proportion of overweight women (less than 7 per cent prevalence rate).

### States with Overweight Proportions Exceeding Underweight

Literatures have established that as India is facing the nutrition transition the problem of being overweight among women is coming up rapidly and may outclass the proportion of underweight in some states (Ramesh and Jareena 2009; Shetty 2002). Naturally, in majority of the states of India, the proportion of underweight women exceeds that of the proportion of overweight women. However, in



**Figure 1:** States with Overweight Proportions Exceeding Underweight

**Source:** Authors' research.

2005–06, in five states namely, Jammu and Kashmir, Punjab, Delhi, Kerala and Tamil Nadu, not only the level of overweight is quite high, but the proportion of overweight ever-married women exceeds that of underweight (Figure 1). In Jammu and Kashmir and in Tamil Nadu proportion of overweight women is marginally higher than that of the proportion of the underweight women whereas in Punjab, Delhi and Kerala, overweight proportions are more than double than that of underweight proportions.

In Delhi, Punjab and Kerala, the rural proportion of overweight ever-married women has already overtaken the urban figures, while in Punjab and Kerala the rural prevalence rate of overweight problems is more than twice than the prevalence rate in urban areas. It proves the evidence of the trickling down of obesity from urban-to-rural areas in these three states. Except these three states, in 12 other Indian states (including Jammu and Kashmir and Tamil Nadu), it has been observed that (Table 2) the prevalence rate of overweight or obesity among ever-married women exceeds that of underweight, though still not in rural areas. In these states there is a possibility that soon the problems related to overweight may eventually trickle down even to the rural areas as well, posing a severe public health threat. This clearly shows the changing face of malnutrition, that is, the shift from the customary problems of underweight to the newly emerged problems of overweight in some states of India, which means that the country is now left to deal with a simultaneous burden of both under and overweight problems and its related diseases.

**Table 2.** States with Urban Overweight Proportions Exceeding Underweight

States	Type of Place of Residence	Underweight (Proportions)	Overweight or Obese (Proportion)
States where overall overweight proportion exceeds underweight proportion			
Punjab	Urban	11.6	44.7
	Rural	14.3	32.3
Delhi	Urban	10.3	32.9
	Rural	15.7	22.9
Kerala	Urban	8.9	39.7
	Rural	14.2	30.7
Tamil Nadu	Urban	16.1	34.7
	Rural	29.4	15.2
Jammu & Kashmir	Urban	8.5	40.8
	Rural	25.3	15.4
States where overweight proportion exceeds underweight proportion in urban areas			
Himachal Pradesh	Urban	10.7	37.5
	Rural	25.6	14.8
Uttaranchal	Urban	11.4	30.3
	Rural	29.6	11.2
Haryana	Urban	16.8	34.7
	Rural	31.1	14.4
Uttar Pradesh	Urban	23.3	24.3
	Rural	35.4	7.0
Assam	Urban	22.5	22.7
	Rural	38.5	6.0
West Bengal	Urban	19.8	28.8
	Rural	43.9	5.7
Gujarat	Urban	19.3	31.3
	Rural	40.8	11.2
Maharashtra	Urban	20.8	27.0
	Rural	41.8	7.8
Andhra Pradesh	Urban	16.2	31.1
	Rural	36.8	11.1
Karnataka	Urban	19.5	31.1
	Rural	37.2	10.0

**Source:** Authors' research.

## Trends in Nutritional Status

Table 3 provides the trends in underweight and overweight among ever-married women aged 15–49 years in India. We have already stated that for the comparison purpose between NFHS-2 and NFHS-3, our analysis will focus only upon the ever-married women. The data presented here are for the 21 major

**Table 3.** Statewise Comparison of Nutrition Levels among Ever-married Women between NFHS-2 and NFHS-3

States	Underweight (%)		Overweight or Obese (%)	
	NFHS-2	NFHS-3	NFHS-2	NFHS-3
Delhi	12.0	10.7	33.8	32.1
Haryana	25.9	26.9	16.6	20.4
Himachal Pradesh	29.7	24.2	13.1	16.9
Jammu & Kashmir	26.4	20.6	13.8	22.6
Punjab	16.9	13.3	30.2	36.8
Uttaranchal	NA	25.0	NA	15.9
Rajasthan	36.1	32.7	7.1	9.8
Madhya Pradesh	38.2	38.6	6.1	8.1
Chhattisgarh	NA	39.7	NA	6.5
Uttar Pradesh	35.8	32.6	7.5	10.9
Bihar	39.3	41.1	3.7	5.3
Jharkhand	NA	41.5	NA	5.8
Orissa	48.0	39.5	4.4	7.4
West Bengal	43.7	37.1	8.6	12.3
Assam	27.1	35.8	4.2	8.9
Gujarat	37.0	31.7	15.8	19.7
Maharashtra	39.7	32.1	11.7	16.6
Andhra Pradesh	37.4	30.3	12.0	17.5
Karnataka	38.8	30.6	13.6	17.8
Kerala	18.7	12.4	20.6	33.8
Tamil Nadu	29.0	23.2	14.7	24.2
India	35.8	32.2	10.6	14.4

**Source:** Authors' research.

states of India. Overall, the data show that the proportion of underweight women in India has been declining over the last seven years whereas there is a steady increase in the proportion of overweight women. Although in aggregate, there is a decline in the underweight proportion, the statewise data show mixed results. Out of the 21 states, in a majority of the states the underweight proportion has declined, while in four states (Assam, Bihar, Haryana and Madhya Pradesh) the underweight proportion has increased. However, unlike the underweight the proportion of overweight in India has increased during this period. The statewise data also show that except in Delhi, in all other states the proportion of overweight ever-married women has increased. The trends in the overall malnutrition (both under and overweight problems together) levels in India therefore has not declined in the last seven years; instead there has been a slight increase in the malnutrition levels. The overall malnutrition levels are as high as 50 per cent in India. The declining undernutrition level in India during the 1980s and 1990s gave the hope that malnutrition problems were finally under control. But the growing overweight proportion among women and the stagnancy in underweight levels in the recent years may bring out new kind of challenges to the country wherein one can observe an increase in the overall malnutrition levels. If this trend remains unchanged for a long period of time, that is a sluggish decline in the underweight proportions



along with a faster increase in the overweight proportions, India may begin to feel the pressure of tackling the problems of the underweight and the overweight simultaneously. Evidences of this can be clearly seen in states like Kerala, Punjab and Delhi and states like Tamil Nadu, Haryana and Himachal Pradesh may soon join this group. This kind of situation may soon lead to a different kind of public health challenge in India where India may have to tackle both the issue of being underweight as well as overweight simultaneously. The characteristics of women who suffer from being underweight may totally be different from the characteristics of women who suffer from being overweight or obesity. Therefore it will be a challenging task to design policies to tackle both the problems of the underweight and the overweight in the same population.

### **Differentials in the Underweight Category among Women**

After analysing the levels and trends in nutritional status, the next step is to understand how the levels of malnutrition vary across different demographic and socio-economic categories. Analysis based on the data from various countries have shown that the underweight are more common among women of low socio-economic status (SES) whereas being overweight is significantly more common among women of a higher socio-economic status (SES) in all low-income economies. Whereas, in all high income countries, the overweight are more widespread among the women of a lower socio-economic status. However, there are mixed results regarding the relationship between obesity and SES in the lower middle income countries (Monteiro et al. 2004). For example, in Brazil obesity has increased intensely and continuously among adult women from the economically less developed region and among lower-income women from the more developed region. On the other hand, the richer sections of Brazilian women from the developed regions had a significant increase in obesity in the earlier decades and then the prevalence of obesity among them declined significantly over time (Monteiro et al. 2002). These phenomena actually resemble the experiences from the developed countries regarding their movement within the stages of nutrition transition with the course of development. At the same time, in countries like Vietnam and Bangladesh, obesity is positively related to socio-economic well-being and mostly concentrated in developed and urbanized regions (Khan and Kramer 2009; Nguyen 2007). These results indicate that in the developing countries overweight is more of a problem among the well-to-do section whereas underweight is more among the women of low socio-economic status. Further it also indicates that the high level of underweight and the growing problem of overweight in the developing countries are exposing them towards the dual burden of underweight and overweight simultaneously.

In order to study the variations at nutritional status across different socio-economic categories of the individuals, the proportion of underweight and overweight is compared across different background characteristics such as age, place of residence, wealth index, education, occupation, religion and caste. Table 4 shows the variations in underweight and overweight among women across different socio-economic characteristics.

This table clearly shows that underweight in India is more prevalent among younger women, rural women, women with no education and women belonging to the lowest wealth quintiles. Further, the underweight proportion is higher among agricultural labourers and those who live in the countryside. Hindu women and scheduled tribe women also exhibited higher chronic energy deficiency in India.

**Table 4.** Percentage Distribution of Women Aged 15–49 Years in India by Level of Body Mass Index (BMI) According to Selected Background Characteristics, NFHS-3. (n = 98,922)

Characteristics	Underweight	Overweight or Obese
<b>Age</b>		
15–19	38.2	2.3
20–29	36.0	8.2
30–49	29.0	20.0
<b>Place of Residence</b>		
Urban	19.7	28.4
Rural	37.6	8.4
<b>Education</b>		
No education	39.9	7.4
Primary	31.8	13.6
Secondary	24.3	21.8
Higher	11.3	36.0
<b>Wealth Index</b>		
Poorest	48.7	2.1
Poor	43.7	4.4
Middle	34.3	8.6
Richer	23.5	18.6
Richest	11.7	37.8
<b>Occupation</b>		
Not Working	27.7	18.2
Non manual	21.0	25.5
Agricultural	43.0	4.8
Manual	36.3	11.3
<b>Type of Caste or Tribe</b>		
Scheduled Caste	38.3	10.0
Scheduled Tribe	44.9	3.8
Other Backward Classes	31.8	13.3
Others	25.4	21.5
<b>Religion</b>		
Hindu	33.1	13.3
Muslim	31.3	16.6
Christian	18.9	22.3
Sikh	11.7	39.9
Others	34.0	14.1
<b>TOTAL</b>	<b>32.2</b>	<b>14.4</b>

**Source:** Authors' research.

Although, the propensity to become underweight is more among the women from the low socio-economic stratum, the women from well-to-do groups is also not devoid of the problems of underweight. The chronic energy deficiency therefore is widespread in India; it cuts across all social and economic categories. Except among women from the richest wealth quintile, on an average more than one-fourth of women belonging to all the other groups had the problems of chronic energy deficiencies. It has been generally observed that the population which suffers from the problems of chronic energy deficiency (underweight) is likely to have differential characteristics than population suffering from problems of overweight and obesity. In India, generally people from the low SES is expected to have higher prevalence of chronic energy deficiency, whereas well-to-do people have greater propensity to become overweight or obese.

### **Differentials in Overweight/Obesity among Women**

Although underweight seems to be a problem which cuts across all social and economic groups, obesity seems to be more of a problem of the wealthier groups, urban women and older women. Overall, a little more than 14 per cent of all women in India are either overweight or obese. However, this proportion is close to 40 among the richest group. Nearly one-fourth of the urban women and one-fifth of the women aged 35–49 years, are overweight in India. Further, women who are not working and women belonging to Sikh religion are more prone to be overweight or obese in India as compared to their counterpart. Apparently these findings suggest that underweight in India is a problem of all whereas overweight mostly remained socially segregated where it is more of a problem of the urban residents, richest and relatively older women.

Regarding the co-existence of under and overweight among various groups in India, the table shows that the co-existence seems to be more in the urban areas, in large cities and among the richer group than their counterparts. Among the poorer group, more than half of the women are underweight and only a negligible proportion is overweight, whereas among the richer sections one in every three women are overweight or obese and nearly one in every five women are underweight. This clearly shows that the poor people in India has to mainly worry about the undernourishment problem whereas the wealthier groups in this country has to deal with the problems of overweight and obesity and also simultaneously address the issue of undernutrition. Therefore the double burden of malnutrition i.e., the co-existence of underweight and overweight in India is more prevalent among the richer sections than among the poorer segment of population. Despite rapid economic growth, India has yet to experience a situation in which underweight and overweight coexist in the low-SES groups as in case of the developed and other middle-income countries.

### **Double Burden of Malnutrition**

With the growing overweight proportion and the stagnancy in the underweight proportion, India is moving towards the threat of the existence of double burden of malnutrition that is the simultaneous existence of under and overnutrition within the populations. And in the initial stages, this double burden may be more prominent among the richer sections of the society than the poorer sections as overweight proportions are substantially higher among the richer sections. But in the due course of development, the

obesity problem may even trickle down to the poorer section and also into the rural areas in the near future. Once the trickling down takes place to the poor population, the gap in the proportion of overweight between the richer and poorer segment may narrow down as explained by the trickling down theory where benefits of economic development will first be manifested among the richer section and then slowly trickle down to the poorer section. In such a situation, obesity also becomes a problem among the poorer groups and double burden can occur probably at all levels.

This phenomenon of trickling down effect in India can be studied by analyzing data from the selected states of India, which are Delhi, Punjab and Kerala, where the overweight is a serious problem than the underweight among women. Unlike other states, the proportion of overweight in these states is more than the proportion of underweight. Further, with substantial high levels of overweight, it can be presumed that the gap in overweight proportions between rich and poor or rural and urban would have narrowed down in these states.

Evidences of such kind of phenomenon can be traced in many studies. Initially the nutrition transition has first begun in the well-developed countries and in urban locations and then slowly it started to trickle down to developing countries and rural areas as well. The developing countries which are at the early or at the middle phases of the nutrition transition are leaning towards high fat based diets, which are processed and contain high level of oil, sugar etc., resulting in an uprising trend of obesity, especially among the urban well-to-do, exposing the population towards potential 'double burden of malnutrition'. Being influenced by the globalization, urbanization and mechanization of occupation, the rural people also tend to change their diet and activity pattern over the time and eventually overweight and obesity becomes more prevalent even among them.

The dual burden of the simultaneous existence of underweight and overweight women is not only manifested in urban, educated and richer sections, but it seems to have penetrated even among the rural, uneducated and the poorer section of the society. However, in case of India, this problem is more manifested in urban areas and the trickling effect to the rural areas is yet to happen.

Overall, the chronic energy deficiency is found to be widespread in India; cutting across all social and economic categories whereas overweight problem mostly remained socially segregated where it is more of a problem of the richer sections than among the poorer section. The analysis shows the existence of double burden of malnutrition in India mainly manifested among the richer sections of the society. However, the data from Kerala, Punjab and Delhi shows that the obesity problems seem to have trickled down even to the rural, less educated and even to the poorer sections. Therefore the dual burden of malnutrition is visible not only among the wealthier groups but also among the poorer sections of the society in these states. Therefore the burden on health care will be felt more by the poor as with the limited resources, they have to tackle both the problems of underweight and overweight.

## Binary Logistic Regression Analysis

In the previous section, it was observed that there are differentials in underweight and overweight proportion among women by various socio-economic and demographic characteristics. These are gross differences without controlling for the effect of background variables. In order to quantify the net effect of the background variables on underweight and overweight, a binary logistic regression analysis is carried out. Since in the present analysis, the dependent variable is dichotomous in nature (women who are

underweight or not and women who are overweight or not) binary logistic regression is an appropriate technique to assess the influence of explanatory variables on the dependent variables. The explanatory variables included are age of the women (15–19 is reference category), place of residence (rural is reference category), wealth Index (poorest is the reference category) education of the respondent (no education is a reference category), religion (Hindu is the reference category). Caste (other caste is reference category), occupation of the women (non-working is reference category). Two different models were used to understand the determinants of underweight (dependent variable: women who are underweight=1 and others=0) and the other to understand the determinants of overweight (dependent variable: women who are overweight=1 and others=0)

The result of logistic regression analysis is presented in Table 5. The table clearly shows after adjusting the effect of background variables, age, place of residence, education wealth index, religion, caste and occupation are significant variables determining both underweight and overweight among women in India. The linkages between age of the women and the propensity to be underweight/overweight shows that younger women are more likely to be underweight whereas older women have greater chances to be overweight. Women who are above 30 years of age are almost seven times more likely to be overweight or obese than their younger counterparts. Rural females are 19 per cent more likely to be underweight, while the risk of being overweight is 27 per cent lesser for them as compared to their urban counterparts.

Prevalence of underweight depicts a negative relationship with the wealth index of the respondents and the overweight problem augments with the betterment of socio-economic standards. As compared to the poorest people the risk of chronic energy deficiency is 78 per cent lesser for the better-off people of the society, whereas the risk of facing nutritional disorder in terms of overweight or obesity is almost 11 times higher for the wealthiest section of the society. The odds ratios in terms of the educational status show that women with no education are more vulnerable to be underweight whereas better educated women are more likely to be overweight or obese. Religious variation with respect to underweight and overweight show that the propensity to become underweight is more among Hindus and chances of being overweight is most among Sikh women (OR 2.30). The risk of suffering from chronic energy deficiency is higher for the scheduled castes (OR 1.16) and scheduled tribes women whereas the other caste women face are more likely to face problems of overweight/obesity. Women engaged with agricultural activities and manual jobs are more vulnerable from underweight related problems and less likely to suffer from the problems of opulent in recent times.

## Conclusion

Nutrition research in India has often focused on the issues of undernutrition and the policies so far were targeting the poor and the rural people to improve their nutritional standards. However, this article shows the need to focus its attention on the problems of overweight as well among adult Indian women. Further, this article also discusses about the need to look at the issue of underweight and overweight problems co-existing simultaneously in Indian society, mainly because the underweight problem which seems to cut across all sections of the society whereas the prevalence of overweight and obesity is increasing rapidly. Overweight problem mostly remained socially segregated with highest burden among the urban and well-off sections of the society. In states like Delhi, Punjab and Kerala the public health measures

**Table 5.** Determinants of Underweight and Overweight, India: Results of Logistic Regression Analysis, NFHS-3

Covariates	Exp(B)	95.0% C.I. for EXP(B)		Exp(B)	95.0% C.I. for EXP(B)	
		Lower	Upper		Lower	Upper
<b>Age</b>						
15–19 (Reference)	–	–	–	–	–	–
20–29	1.11*	1.04	1.19	2.35*	1.97	2.80
30 +	0.78*	0.72	0.83	6.69*	5.62	7.96
<b>Place of Residence</b>						
Urban (Reference)	–	–	–	–	–	–
Rural	1.19*	1.14	1.24	0.73*	0.70	0.77
<b>Wealth Index</b>						
Poorest (Reference)	–	–	–	–	–	–
Poorer	0.84*	0.80	0.89	1.84*	1.58	2.14
Middle	0.63*	0.59	0.66	3.20*	2.78	3.68
Richer	0.43*	0.40	0.45	5.80*	5.05	6.66
Richest	0.22*	0.20	0.23	10.75*	9.33	12.39
<b>Education</b>						
No education (Reference)	–	–	–	–	–	–
Primary	0.90*	0.86	0.95	1.24*	1.16	1.32
Secondary	0.92*	0.88	0.96	1.37*	1.30	1.45
Higher	0.64*	0.59	0.71	1.40*	1.30	1.51
<b>Religion</b>						
Hindu	–	–	–	–	–	–
Muslim	0.92*	0.87	0.97	1.34*	1.26	1.42
Christian	0.44*	0.40	0.48	1.07	0.98	1.18
Sikh	0.53*	0.46	0.61	2.30*	2.07	2.54
Others	0.65*	0.58	0.72	1.02	0.90	1.15
<b>Caste</b>						
Others (Reference)	–	–	–	–	–	–
SC	1.16*	1.11	1.22	0.94	0.89	1.00
ST	1.07*	1.00	1.13	0.53*	0.48	0.59
OBC	1.02	0.98	1.06	0.99	0.95	1.03
<b>Occupation</b>						
Not Working (Reference)	–	–	–	–	–	–
Non-manual	0.88*	0.82	0.93	1.00	0.94	1.05
Agricultural	1.21*	1.16	1.26	0.63*	0.58	0.67
Manual	1.20*	1.14	1.27	0.78*	0.73	0.84
<b>Constant</b>	0.45			0.01		
<b>-2 Log likelihood</b>	92758.05			68198.96		

**Source:** Authors' research.

**Note:** \*Significant at  $P < 0.05$ .

should pay greater attention to overweight problems and in near future a few other states like Tamil Nadu and Jammu & Kashmir are going to join this group where the problem of overweight will be a greater concern than problem of underweight in both the urban and rural areas. The likelihood of the rural people to leap into the potential risk of overweight problems in these states proves the trickling down effect from urban to rural populations. If this trend continues, a few other Indian states will also join this group in the near future.

## References

- Agarwal, P. and V. Mishra (2004). Covariates of overweight and obesity among women in India. *Population and Health Series*, East-West Center Working Papers No. 116, January.
- Chopra, M. (2004). Globalization, urbanization and nutritional changes in South Africa. *Globalization of food systems in developing countries: Impact on food security and nutrition*, Food and Nutrition Paper, 83: 119–33. Rome: FAO.
- Cook, I. and T. Dummer (2003). Changing health in China: Re-evaluating the epidemiological transition model. *Health Policy*, 67: 329–43.
- Deaton, A. and J. Dreze (2009). Food and nutrition in India: Facts and interpretations. *Economic and Political Weekly*, 44 (7): 42–65.
- Gopalan, C. (1998). Obesity in the Indian urban ‘middle class’. *Bulletin of the Nutrition Foundation of India*, 19 (1), 1–5.
- International Institute for Population Sciences (2000). *National family health survey–2 report (1998–99)*. Mumbai: IIPS.
- (2007). *National family health survey–3 report (2005–06)*. Mumbai: IIPS.
- Ke-You, G. and F. Da-Wei (2001). The magnitude and trends of under- and over-nutrition in Asian countries. *Biomedical and Environmental Sciences*, 14 (1–2): 53–60.
- Kennedy, G., G. Nantel and P. Shetty (2006). Assessment of the double burden of malnutrition in six case study countries. *In the double burden of malnutrition: Case studies from six developing countries*, Food and Nutrition Paper (pp. 1–41). Rome: Food and Agricultural Organization of the United Nations.
- Khan, M.M.H. and A. Kraemer (2009). Factors associated with being underweight, overweight and obese among ever-married non-pregnant women in Bangladesh. *Singapore Medical Journal*, 50 (8): 804–13.
- Mendez, M. and B. Popkin (2004). Globalization, urbanization and nutritional change in the developing world. *Globalization of food systems in developing countries: Impact on food security and nutrition*, Food and Nutrition Paper, (pp. 55–80). Rome: FAO.
- Monteiro, C.A., W.L. Conde and B.M. Popkin (2002). Is obesity replacing or adding to undernutrition? Evidence from different social classes in Brazil. *Public Health Nutrition*, 5 (1A): 105–12.
- (2004). Socio-economic status and obesity in adult populations of developing countries: A review. *Bulletin of the World Health Organization*, 82 (12).
- National Nutrition Monitoring Bureau (NNMB) (1997–2002). *NNMB Reports*. Hyderabad: NNMB, National Institute of Nutrition (NIN).
- Nguyen, M.D., S.A.A. Beresford and A. Drewnowski (2007). Trends in overweight by socio-economic status in Vietnam: 1992 to 2002. *Public Health Nutrition*, 10 (2): 115–21.
- Omran, Abdel R. (1971). The epidemiologic transition: A theory of the epidemiology of the population change. *The Milbank Fund Quarterly*, 64: 355–90.
- Popkin, B.M. (1993). Nutritional patterns and transitions. *Population and Development Review*, 19 (1): 138–57.
- (2001). The nutrition transition and obesity in the developing world. *The Journal of Nutrition*, 131: 871S–873S.
- (2003). The nutrition transition in the developing world. *Development Policy Review*, 21 (5–6): 581–97.

- Ramachandran, P. (2006). The double burden of malnutrition in India, FAO. *In the double burden of malnutrition: Case studies from six developing countries, food and nutrition paper* (pp. 99–160). Rome: Food and Agricultural Organization of the United Nations.
- Ramesh, P. and S. Jareena (2009). Overweight exceeds underweight among women in Kerala: An analysis of trends and determinants. *Journal of Human Ecology*, 25 (2): 93–103.
- Shafique, S., N. Akhter, G. Stallkamp, S. de Pee, D. Panagides and M.W. Bloem (2007). Trends of under- and overweight among rural and urban poor women indicate the double burden of malnutrition in Bangladesh. *International Journal of Epidemiology*, 36: 449–57.
- Shetty, P. (2002). Nutrition transition in India. *Public Health Nutrition*, 5 (1A): 175–82.
- Subramanian, S. and G.D. Smith (2006). Patterns, distribution and determinants of under- and overnutrition: A population based study of women in India. *American Journal of Clinical Nutrition*, 84: 633–40.
- Subramanian, S.V., J.M. Perkins and K.T. Khan (2009). Do burdens of underweight and overweight coexist among lower socioeconomic groups in India? *American Journal of Clinical Nutrition*, 90: 369–76.
- World Health Organization (2002). *World health report: Reducing risks, promoting healthy life*. Geneva: WHO.
- (2004). Appropriate Body Mass Index for Asian populations and its implications for policy and intervention strategies. *The Lancet*, 363: 157–63.



