

Current trends in treatment of obesity in Karachi and possibilities of cost minimization

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Abstract: Our study finds out drug usage trends in over weight and obese patients without any compelling indications in Karachi, looks for deviations of current practices from evidence based antihypertensive therapeutic guidelines and identifies not only cost minimization opportunities but also communication strategies to improve patients' awareness and compliance to achieve therapeutic goal. In present study two sets were used. Randomized stratified independent surveys were conducted in hospital doctors and family physicians (general practitioners), using pretested questionnaires. Sample size was 100. Statistical analysis was conducted on Statistical Package for Social Science (SPSS). Opportunities of cost minimization were also analyzed. On the basis of doctors' feedback, preference is given to non-pharmacologic management of obesity. Mass media campaign and media usage were recommended to increase patients awareness and patients' education along with strengthening family support systems was recommended for better compliance of the patients to doctor's advice. Local therapeutic guidelines for weight reduction were not found. Feedbacks showed that global therapeutic guidelines were followed by the doctors practicing in the community and hospitals in Karachi. However, high price branded drugs were used instead of low priced generic therapeutic equivalents. Patient's education is required for better awareness and improving patients' compliance. The doctors found preferring brand leaders instead of low cost options. This trend increases cost of therapy by 0.59 to 4.17 times. Therefore, there are great opportunities for cost minimization by using evidence-based clinically effective and safe medicines.

Keywords: Cost minimization, overweight, obesity, evidence-based therapeutic guidelines, compelling indications.

INTRODUCTION

Obesity is on rise world over. According to the World Health Organization's estimates released in 2010, over one billion met the criteria for overweight out of which 300million were obese (WHO, 2010). This report further adds that number of obese patients doubled since 1980 (WHO, 2013). Overweight and obesity should be topmost urgency of the national health policy (Afridi *et al*, 2004).

In fact, obesity is result of unconsumed energy or energy intake exceeds energy utilization (Mahesar *et al*, 2011). New data revealed rampant spread of obesity in the globe including USA and UK. In last two decades, obesity in adults increased by more than 50% e.g. from 14.5% to 22.5% in USA. It was also highlighted that highest prevalence of weight-related problems were found in female and non-white population (Remay *et al*, 2003). According to 2003-Health Survey for England in the UK, the incidence of obesity was reported to be on rapid rise. The survey showed that the obesity increased in men from 13.8% (in year 1994) to 22.45 (in year 2003) whereas number of obese women increased from 17.3% to 23.4% in the year 1994 and 2003 respectively (MIMS, 2003). Pakistan also reported to have growing number of weight related problems such as overweight and obesity - the highest in the major SAARC countries. For overweight

patients, Pakistan is on the top with 23% whereas the lowest prevalence was in Bangladesh with 7.6%. For obesity, Pakistan stated to have highest incidence of 5.5% followed by Sri Lanka, India and Bangladesh (Common Health, 2013).

It has been established by clinical proven that numerous health ailments are due to Obesity. A long list of health problems includes diabetes (Mokdad *et al*, 2000), hypertension, coronary artery disease, stroke (Pi-Sunyer *et al*, 1993), hyperlipidemia, gall bladder and liver diseases and osteoarthritis (Flegal *et al*, 1998). This list expands to include depression (Carpenter *et al*, 2000), impaired quality of life (QOL) gynecological problems (abnormal menses, infertility) and disability for women (Han *et al*, 1998), increased early deaths are linked with obesity (Calle *et al*, 1999; Pi-Sunyer, 1991; Pi-Sunyer, *et al*, 1998).

Several studies showed that intervention could improve health condition and any expenditure on finding, laboratory tests, and interaction for life style change would be offset by cost saving due to better management of disease. There is high emphasis on the availability of quality data for better management of successful interventions (NICE, 2012).

There are no local guidelines for management of obesity in Pakistan. Internationally several guidelines are

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available from Australia (NHMRC, 2013), Scotland (SIGN, 2010), the World Health Organization (WHO, 1999), UK (NICE, 2014) and USA. Although pharmacologic interventions look necessary to the doctors for achieving the required weight of their patients, most of the doctors acknowledge that without non-pharmacologic measures, this initiative would yield no result. The World Health Organization (WHO) and the National Health

Services (NHS), UK recommend use of a drug for those adults with clinical risk factors and BMI 28Kg/m² or having BMI more than 30Kg/m². Both recommend Orlistat with life style intervention. However, National Heart, Lung, Blood Institute (NHLBI), National Institute of Health (NIH), USA and Scottish Intercollegiate Guidelines Network (SIGN) recommend Orlistat without any emphasizing on life style intervention. It has been

Table 1: Excerpts from International Therapeutic Guidelines for Obesity Management

Key: (1) NHMRC (Australia). (2) NHS (UK). (3) NHLBI (USA). (4) SIGN (Scotland). (5) WGO (USA). (6) WHO			
Focus	Parameters	Reference to the Guidelines	
Non-Pharmacologic interventions:			
BMI classification (Kg/m ²)	Underweight: <18.5	1, 3, 4, 5, 6	
	Normal: 18.5-24.9	1, 2, 3, 4, 5, 6	
	Overweight/ Pre-Obese: 25.0-29.9	1, 2, 3, 4, 5, 6	
	Obese/ Obese I: 30.0-34.9	1, 2, 3, 4, 5, 6	
	Obese II: 35.00-39.9	1, 2, 3, 4, 6	
	Obese III: =/>40.00	1, 2, 3, 4, 6	
Dietary measures	Reduction in Usual Daily Diet (Kcal/Day)	600 (2); 500 -1,000 (3); 200 -700 (5).	
	Very low calorie diet (Kcal/Day)	≤ 1,000 (2); ≤ 800 (5).	
	Low calorie diet (Kcal/Day)	1,000 – 1,600 (2); 800 -1,800 (4); 600 (6)	
	Others	Carbohydrate	55% of total energy (3); < 30g/day (4); <150g/day (5)
		Fat	< 30% of total daily energy (4) Cholesterol: <30mg/ day (3); 0.25mmol/l.(6)
Protein		15% of total daily energy (3); High intake {10 -15g Leucine diet (amino acid)} (5)	
Minerals, Table Salt & Fibers		Calcium: 1g-1.5g/ day (3); Sodium: Approx. 6g of sodium chloride (Table Salt)/ day (3); Fiber: 20-30 g/day (3).	
Physical activities (minutes/week):	Intensity aerobic physical activities moderate:	150-180 (2, 3); 150 (6).	
	Vigorous:	75 (6)	
	Aerobic activities in bouts	10 (2); 10 (6)	
	For additional benefits: Increase intensity activities moderate:	300(6)	
	Vigorous:	150 (6)	
	To prevent obesity	225 -360 (2)	
	To avoid weight regain	360-540 (2)	
Pharmacologic interventions:			
Conditions for Pharmacotherapy [For adults]	Having BMI 28Kg/m ² associated with risk factors or having BMI >30Kg/m ² .	Orlistat (2, 5)	
	Having BMI 27Kg/m ² associated with risk factors or having BMI >30Kg/m ² .	Sibutramine (2)	
	To be used in combination of life style intervention	Sibutramine (5)	
	No conditions attached for drug usage	Sibutramine (3) or Orlistat (3, 4)	
	For Short term usage:	Phentermine &Diethylpropion (5)	
	For selective conditions:	Rimonabant, fluoxetine, topiramate, bupropion, metformin & venlafaxine (5)	
Abbreviations: (1) NHMRC = Australian Government - National Health and Medical Research Council. (2). NHS = National Health Service, UK. (3) NHLBI = National Heart, Lung and Blood Institute, National Institute of Health, USA. (4) SIGN = Scottish Intercollegiate Guidelines Network. (5) WGO = World of Gastroenterologists Organizations, Global, USA. (6) WHO=World Health Organization.			

established that pharmacologic interventions should be with dietary and physical activities. Methylcellulose may be used because it could ease hunger by developing a feeling of fullness in the belly (MIMS, 2008).

Tsai *et al* (2011) reported direct medical cost of overweight and obesity for an individual and society in the US. According to his report, per person direct medical cost for overweight management was US \$266 and for obesity it was US\$1,723 in 2008. Financial burden on national exchequer was US \$113.9 billion for both overweight and obese patients' management (Tsai *et al*, 2011). In diabetic patients, a cost of quality adjusted life year (QALY) ranged between £10,000 to £20,000 (NICE, 2012).

Local guidelines for weight management were not available in Pakistan. The doctors were using different international guidelines shown in (table 1). Classification of underweight, normal weight, overweight and obese was based on Body Mass Index. Almost same criteria were used by most of the international therapeutic guidelines.

National Health Service (NHS, UK) recommended reduction of calories in usual daily diet. 600Kcal, 500 to 100 Kcal and 500Kcal daily reduction in usual diet was recommended by NHS UK, NHLBI USA, and WGO USA respectively. Low calorie diets were recommended by NHS and SIGN. Specific compositions of diets were suggested by the US guidelines.

Physical activities were endorsed by the WHO. Other guidelines did not elaborate much except NHS.

Method

The present study focuses on different aspects of management of overweight and obesity. The data was collected from sample of 100 doctors working in general practice or in hospitals through randomized stratified survey. The doctors were from different geo-socio-economic locations in Karachi. Pretested questionnaire

was used as data a collecting instrument. Those who were neither MBBS nor registered medical practitioners and/or refused to fill the questionnaire were excluded from the study. To gauge the general trend of medical practice, medical specialists, consultants or academicians were also not selected for the study. Information on perceived confidence as a result of doctors' feedback was also collected.

STATISTICAL ANALYSIS

Descriptive and Spearman's analysis was conducted using SPSS version 17. Adherence to therapeutic guidelines and financial impact were also studied. Responses with Likert scale rating 1(low score) to 5 (high score) and binary choices (yes/no) were presented as mean and 95% C.I. respectively. Open-ended questions were also used explore more information or get clarification.

Research questions

1. Do the doctors have national guidelines for clinical management of overweight and obese patients?
2. What are the prominent international therapeutic guidelines for obesity management?
3. Do the doctors acknowledge any guideline for obesity management?
4. Do the doctors prefer non-pharmacological measures for obesity management?
5. Do the doctors give importance to patients' readiness for weight management?
6. Do the doctors practice as per the international guidelines in the absence of local guidelines?
7. What is the general perception of the doctors about the patients' adherence to medical advice?
8. Do the doctors prefer different options to improve patient awareness and compliance?
9. Do the doctors opt for cost effective therapeutic regimen?
10. Could cost of therapy be minimized?

RESULTS

Table 2: Doctors' preferred choice for weight management in first presentation

Likert Scale:----->						
5	Very high impact			2	Low impact	
4	High impact			1	Very low impact	
	3	Measurable impact				
Parameters	Doctors consideration of impact factor					Doctor's response rate %
	5	4	3	2	1	
Patients readiness for weight management	35	11	12	4	15	90.60%
Dietary measures	32	15	4	12	8	95.30%
Medication	8	12	19	15	12	77.50%
Exercise	25	10	21	12	9	90.60%
Others	3	2	0	4	4	15.30%

Table 3: Doctors' Preferred Anti-Obesity Drug

S No.	Pharmacologic agents	Frequency	Percentage	Doctors' Response rate %
1	Sibutramine*	42	49.4%	
2	Orlistat	21	24.7%	
3	Sibutramine +Orlistat	4	4.7%	
4	No drug should be used	5	5.9%	
5	Other drugs:	5	5.9%	

List of other drugs includes amphetamine as well.
 *Now withdrawn due to Serious Adverse Reactions (ADRs) and no longer available in local market.

Table 4: Set of measures for weight management in obese and overweight patients (Doctors' Preference)

Weight Reduction Goal				Physical Activity				Dietary Measures			
S. No.	Goals	Frequency		S. No.	Activities	Frequency		S. No.	Measures	Frequency	
		N	%			N	%			N	%
1	10% Weight reduction	32	41%	1	30-minute/ day for 7 days a week	39	45.9	1	Reduce 500Kcal./day	24	28.2
2	0.5 to 1.0Kg reduction per week	13	17%	2	45-minute/ day for 5 days a week	12	14.1	2	Reduce 1000Kcal./ day	5	5.9
3	Maintenance of current body weight	14	18%	3	45-minutes/ day for 3 days a week	7	8.2	3	Total Kcal intake per day: less than 800	10	11.8
4	Goals # 1 & 2	1	1%	4	Jogging or running for 15 minutes	7	8.2	4	Total intake per day	22	25.9
5	All given Above goals	18	23%	5	Waxing car for 45 minutes	1	1.2		Male: 1,200 to 1,600Kcal.		
				6	Others	8	9.4		Female: 1,000 to 1,200 Kcal		
	Response Rate		92%		Response Rate		87%		Response Rate		72%

Table 5: The factors driving patients to doctors' clinics for the treatment of over-weight or obesity problems

Likert Scale:----->							
5	Very high impact					2	Low impact
4	High impact					1	Very low impact
	3	Measurable impact					
Factors driving patients to doctor's clinics for weight management	Doctors rating of impact factor					Doctor's response rate %	
	5	4	3	2	1		
Disease awareness programs on media	42	11	7	4	15	92.90%	
Articles in general press (Print)	7	13	26	15	10	83.50%	
Road shows organized by pharmaceutical companies, NGOs, professional bodies e.g. Pakistan medical association (PMA)	6	17	13	13	16	76.50%	
Seminars/group discussions	8	13	13	14	11	69.40%	
Cost effective treatment	13	5	8	7	24	67.40%	
Mass media campaigns on electronic media	20	11	10	9	14	75.60%	
Advertisements in medical press	13	5	7	10	14	57.60%	
Others	3	1	1	0	1	8.20%	
Cosmetic and personality reasons, influence of family and friends, self-motivation, social problems, job delivery constraints.							

Table 6: The factors improving patients’ compliance to doctors’ advice during anti-obesity treatment

Likert Scale:----->						
5	Very high impact			2	Low impact	
4	High impact			1	Very low impact	
	3	Measurable impact				
Factors improving patients compliance to doctors advice for weight management	Doctors rating of impact factor					Doctor’s response rate %
	5	4	3	2	1	
Patient’s readiness	46	6	3	2	18	88.20%
Patient’s family support	10	21	21	16	6	87.10%
Patient’s readiness for physical activities	25	25	11	5	6	84.70%
Educational material for patients	12	19	16	14	5	77.60%
Effectiveness of drugs	19	8	9	8	17	71.80%
Dietary regulation	30	11	12	6	9	80.00%
Others	1	0	0	0	0	1.20%
Opinion: Quote, “In my opinion no antiobesity drug is safe and reliable, and hence I do not prescribe any drug for weight management. I had very bad adverse drug reaction (ADR) with Ponderal”. Unquote. A doctor wrote.						

Table 7: Doctors’ Consideration for recommending Pharmacological Therapy

	(1) With a BMI ≥ 30	(2) With BMI between 25 to 29.9	(3) High risk waist circumference	(4) Two or more risk factors	(5) 2 and 4	(6) No response	(7) 3 and 4	
Family Physician /GP	10	7	4	13	3	1	5	43
Hospital Doctor	15	4	7	8	2	0	1	37
Total	25(31.25%)	11(13.75%)	11(13.75%)	21(26.25%)	5(6.25%)	1(1.25%)	6(7.5%)	80(100%)

Table 8: Doctors claiming adherence to Guidelines for weight reduction therapies

Specialty	Do you prescribe as per therapeutic guidelines?			Total
	Yes	No	Not Sure	
Family Physician/GP	37 (52.1%)	3 (60%)	1 (100%)	41 (53.2%)
Hospital Doctor	34 (47.9%)	2 (40%)	0	36 (46.8%)
Total	71 (92.2%)	5 (6.5%)	1 (1.3%)	77 (100%)

Table 9: Comparative Analysis of Cost of Therapy

Product	Cost of daily dose (Rs)			Cost of drug times of:
	Brand leader	Average	Lowest	
Sibutramine*	59.64	24.17	14.29	
	1	2.47	4.17	Brand Leader Price
	0.41	1	1.69	Average Price
	0.24	0.59	1	Lowest Price
Orlistat	60.00	49.42	38.95	
	1	1.21	1.54	Brand Leader Price
	0.82	1	1.27	Average Price
	0.65	0.79	1	Lowest Price

*Withdrawn from the market due to serious side effects.

Sibutramine:

- 10 out of 18 products were costlier than the average cost of daily dose (other than Brand Leader). Range was Rs. 25 to Rs.28 (The brand leader cost 59.64/ day).
- 8 out of 18 products were cheaper than the average cost of daily dose. Range was Rs.14.29 to Rs.21.43.

Orlistat:

- 7 out of 14 products were costlier than the average cost of daily dose (including Brand Leader). All had same cost of daily dose e.g. Rs.60.00 per day.
- 7 out of 14 products were cheaper than the average cost of daily dose. Range was Rs.35.00 to Rs.43.58.

DISCUSSION

85% doctors (46 family physicians/general practitioners and 39 hospital doctors) responded. 15% doctors (4 family physicians/general practitioners' and 11 hospital doctors) either did not respond or did not fill the questionnaires.

The doctors' preference for weight management in first presentation was presented (table 2). Most of the doctors gave great importance to "patients' readiness" followed by dietary measures and exercise. Doctor's response rate ranges from 90.6% to 95.3%. Usage of pharmacologic agent, though considered to have measurable impact, got less response e.g. 77.5%.

Doctors' response rate to preferred anti-obesity drugs was 90.6%. Sibutramine was the most preferred drug (49.4%) followed by Orlistat (24.7%) (table 3). 4.7% doctors showed their interest in prescribing both the above mentioned drugs. 5.9% of the doctors informed that they would not like to use any drug and opined that no obesity drug should be used because of high risk of serious adverse effects. Usage of Orlistat was substantiated by the evidence (NICE 2013; Pi-Sunyer *et al*, 1998; WHO 1999).

In response to query for weight management in overweight and obese patients (table 4), doctors opted for setting weight reduction goal, physical activities and diet control measure. Doctors' response rate ranged from 72% to 92%. For setting "Weight Reduction Goal", 41% doctors preferred "10% weight reduction" followed by "maintenance of current body weight" (17.9%) and "0.5 to 1.0Kg reduction per week" (16.7%). 21% of the doctors opted for all above options for different type of patients. For physical activity, 45.9% doctors gave top rating for "30-minute/ day for 7 days a week" whereas 14.1% of the respondents said they recommended "45-minute/ day for 5 days a week". For dietary measures, 28.2% of the doctors wanted their patients to reduce "500Kcal per day" whereas 25.9% doctors restricted total calorie intake per day which for men 1,200 to 1,600 Kcal and for women for 1,000 to 1,200Kcal. Although the recommendations were close to the international guidelines, emphasis on different non-pharmacologic components was less consistent (NICE 2013, NIH 1998; WHO 1999).

On the factors driving patients to doctors' clinics for the treatment of overweight and obesity (table 5), doctors gave highest rating to "Disease awareness programs on media". The doctors' response rate was 92%. Another measure, which was considered impactful, was mass media campaigns on electronic media. Road shows organized by the pharmaceutical companies, non-

governmental organizations (NGOs), professional bodies such as Pakistan Medical Association (PMA) were not considered impactful. Advertisements in medical press or seminars and group discussions were also not considered helpful in bring the patients to the clinics. 67% doctors responded to cost effective therapy.

When doctors were asked for factors assisted them in improving patients' compliance to doctors' advice for successful treatment of obesity (table 6), "patient's readiness", "dietary regulations", and "patients' preparedness for physical activities" were considered very impactful. Patients' family support was found measurable impactful in managing weight. For these factors, doctors' response rate was 88.2%, 80.0% and 84.0% respectively. "Effectiveness of drug" and "education material" was considered less impactful with doctors' response rate 71.8% and 77.8% respectively.

31% doctors said that they recommend treatment when patients had BMI more than 30; 14% of the doctors did the same for those who had BMI more than 25; 14% doctors wanted to recommend pharmacotherapy when patients had high risk waist circumference whereas 26% doctors liked to use anti-obesity drug when patients came with two or more than two risk factors (table 7). International therapeutic guideline usage by the doctors was assessed. 92% of the doctors responded that they were using a therapeutic guideline for treating obesity and overweight (table 8).

Most of the guidelines recommended orlistat and sibutramine. NHS put conditions for using these agents; However, NHLBI and SIGN did not attach any condition for pharmacotherapy. The WGO also recommended phentermine, diethyl propionate, metformin, etc.

Pharmacologic usage was in line with the international therapeutic guidelines (table 9). Most of the doctors opted for sibutramine and orlistat. Price difference was significant ranging from 1.21 to 4.17 times. Most the doctors preferred brand leader over generic drugs. Although doctors gave high value to cost effectiveness of drugs, the data did not substantiate their priority of using the lowest priced drugs.

CONCLUSIONS

This work showed that doctors did not have local guidelines; however, their approach was not very far with the international recommendations. So, it would be a satisfying stage that in the absence of local guidelines, they tried to follow international guidelines for the treatment of obesity in Pakistan. Non-pharmacologic measures e.g. physical activities, lifestyle intervention and dietary measures were preferred over pharmacologic intervention. The anti-obesity drugs were recommended

with non-pharmacological measures. It was clear in the minds of the doctors that those non-pharmacologic measures along with patients' readiness and patients' family support were lifeblood for the success of weight reduction.

Doctors showed concerns about the low level of awareness and lack of compliance by the patients in weight management. Several measures were assessed and could be used to drive patients to the doctors' clinics and improve their adherence to doctors' advice. Government medical agencies, hospitals and pharmaceutical companies should focus on this issue and take needful steps to fulfill this gap.

The pharmacological option where the doctors were giving preference to Sibutramine which was declared as 2nd option by international guidelines because of some serious adverse effects and cautions associated with it. Since this drug is no longer available in Pakistan at the time of this study, it was widely available in Pakistan; this would not be threat for the local patients. Orlistat was selected by the doctors after Sibutramine. No other drug was selected by the doctors. The doctors preferred brand leaders despite higher cost of therapy. Encouragement of non-pharmacologic measures would help in minimizing long term cost impact by saving the patients from several complications whereas usage of low cost drugs would help in reducing of cost of therapy many times.

RECOMMENDATIONS

Patients' education and family support should be activated through awareness programs on different forums including electronic media. These measures could be initiated by the public private partnership and Corporate Social Responsibility activity. The pharmaceutical companies should be encouraged to run campaigns to drive overweight and obese patients to doctors' clinics. Early intervention would lessen the chances of complications. The medical experts and clinical scientists should developed local therapeutic guidelines. The guidelines should be simple to administer. For example a message could be "Reduce 20% of calories from the diet and undertake 30 minutes of brisk walk daily (5 day a week)" plus 'If such effort does not help reduce your weight within specified period time, please visit your doctor'. Continuous public and medic education is mainstay for overpowering of obesity the mother of many diseases.

REFERENCES

Afridi AK, Siddiqui M, Safdar M and Khan A (2004). Prevention and treatment of obesity an overview. *Pakistan Journal of Nutrition*, **3**(5): 310-317.

- Allison DB, Fontaine KR, Manson JE, Stevens J and Vanitallie TB (1999). Annual deaths attributable to obesity in the United States. *JAMA.*, **282**: 1530-1538.
- Calle EE, Thun MJ, Petrelli JM, Rodriguez C and Heath CW (1999). Body mass index and mortality in perspective cohort of U.S. adults. *N. Eng. J. Med.*, **341**: 1097-1095.
- Carpenter KM, Hasin DS, Allison DB and Faith MS (2000). Relationships between obesity and DSM-IV major depressive disorder, suicide ideation and suicide attempts: Results from general population study. *Am. J. Public Health*, **90**: 251-257.
- NHMRC. Clinical Practice Guidelines for the Management of Overweight and Obesity in Adults, Adolescents and Children in Australia (2013). http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/n57b_obesity_guidelines_summary_guide_131219.pdf. (Accessed on Jun.1, 2014).
- Common Health Online (2013). Overweight & Obesity. <http://www.commonwealth.org/facts-and-figures/overweight-and-obesity/> (Accessed on Jul. 2013).
- Flegal KM, Kuczmarski RJ and Johnson CL (1998). Overweight and obesity in the United States: Prevalence and trends, 1960-1994. *City St. Stockton Press*, **1**: 39-47.
- Ferguson C, Langwith C, Muldoon A and Leonard J (2010). Improving obesity management in adult primary care. White Paper. Pp.1-14.
- Han TS, Tijhuis MA, Lean ME and Seidell JC (1998). Quality of life in relation to overweight and body fat distribution. *Am. J. Public Health*, **88**: 1814-1820.
- Mokdod AH, Ford AS and Bowman BA *et al* (2000). Diabetes trends in the US: 1990-1998. *Diabetic Care*, **23**: 1278-1283.
- MIMS (2008). Patient Fact Sheet Obesity. <http://www.mims.co.uk/PatientResource/PatientFactSheet/882295/Obesity/>. (Accessed on July 20, 2013).
- Mahesar H, Khand F and Seehar GM (2011). Prevalence of hypertension and Obesity in Hyderabad. *Sindh University Research Journal (Sci. Ser.)*, **43**(2): 219-224.
- Nice Preventing type 2 diabetes: Risk identification and interventions for individuals at high risk (2012). *Nice public health guidance*, PH38. (Accessed on Jul. 24, 2013).
- Nice Obesity: Guidance on the prevention, identification, assessment and management of overweight and obesity in adults and children (2014). *Nice Clinical Guidelines*.
- Pi-Sunyer FX (1993). Medical hazards of obesity. *Ann. Intern. Med.*, **199**: 655-660.
- Pi-Sunyer FX, Dietz WH, Becker DM, Bouchard C and Foreyt JP (1998). NHLBI Obesity Education Initiative – The Practical Guide on Identification, Education, and Treatment of overweight and obesity in adults (2000). *NIH Publication No. 98-4083*: 20-25. http://www.nhlbi.nih.gov/files/docs/guidelines/ob_gdlns.pdf (Accessed on Jul.24, 2013).

- Remay CA, Cashman S, Savageau J, Fletcher K, Kinney R and Long-Middleton E (2003). Under diagnosis of obesity at a community health center. *J. Am. Board Fam. Pract.*, **16**(1): 14-21.
- Tsai AG, Williamson DF and Glick HA (2011). Direct medical cost of overweight and obesity in the United States: A quantitative systemic review. *Obes. Rev.*, **12**(1): 50-61.
- WHO (2010). Global Strategy on diet, physical activity and health: Obesity and Overweight. <http://www.who.int/dietphysicalactivity/publication's/facts/obesity/en> (Assessed on Nov. 11, 2010).
- WHO (2013). Obesity and Overweight. Factsheet, fs311 <http://www.who.int/mediacentre/factsheets/fs311/en/index.html>. (Assessed on Jul. 24, 2013).
- WHO (1999). Obesity: Preventing and managing the global epidemic. *Consultation Report 2000*, **894**: 1-16.