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ORIGINAL ARTICLE

OBESITY AND BODY COMPOSITION IN URBAN AND RURAL *REDDY* POPULATION OF ANDHRA PRADESH

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Abstract:

Obesity is one of the attention topics worldwide and creating major health problems. A number of factors have been associated to obesity, including age, gender and socio-economic status with the advancement of science and technology. The assessment of body composition in populations, as well as in individuals, is important as it provides information about nutritional status and health risks. Present study is conducted on Reddy population from Chittoor district of Andhra Pradesh to assess body composition and obesity covering both urban and rural population among both the sexes.The data on various anthropometric measurements includes, surface measurements, circumference measurements and skinfold thickness was collected from 300 subjects of both sexes with an age range of 20-60 years. The prevalence of obesity is more in the age group of 30-40 and above 50 years than the other age groups of urban population than in rural population and more obesity were observed in females than males. High caloric diet, low physical activity and high economic status are main reasons for overweight/obesity in the urban Reddy population. But rural populations have high levels of physical activity and consume low caloric diet. Developing physical activity programs and low caloric diet designed to prevent obesity.

KEYWORDS:

Obesity, Body composition, Reddy population, Urban, Rural, Andhra Pradesh.

INTRODUCTION:

In spite of much development in physical anthropological research, biological anthropologists are continuing to show their interest in understanding the population variation using environmentally sensitive anthropometric variables. The measurement of obesity and body composition using these anthropometric variables is also of great interest to physical anthropologists. The obesity and body composition are considered in many metabolic and physiological studies, as they provide information on energy stores, risk factors for pathological process (Prijatmoko, 1993) and prognosis in a variety of acute and chronic illness (Prijatmoko, 1993; Roubenoff and Kehayias, 1991).

Obesity is increasing alarmingly throughout the world and WHO (1998) estimated that there are more than 300 million obese people world-wide. Obesity is defined as a condition of abnormal or excessive fat accumulation in the fat tissue of the body. The practical and clinical definition of obesity is based on the Body Mass Index (BMI; weight (kg)/height (m2) (WHO, 1998). Increasing urbanization, mechanization of jobs and transportation, availability of processed and fast foods, and dependence on television for

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leisure, people are fast adopting less physically active lifestyles and consuming more "energy-dense, nutrient-poor" diets (WHO, 2003; Bell, Ge and Popkin, 2002; Popkin, 2002; 2001; Popkin et. al., 2001; Drewnowski and Popkin, 1997). These changes have an impact on dietary practices and the levels of physical activity. In India also the prevalence of overweight and obesity has been showing an increasing trend for the last few years among the Indian populations (Gopalan, 1988). The prevalence is higher in urban populations than rural; however a rise is seen in both the groups (Venkatramana and Chengal Reddy, 2002). Research results to date emphasize to treat the overweight and obesity as a major public health issue which demands urgent attention.

Worldwide nearly 60 % of deaths are due to non-communicable diseases (NCDs) in both developed and developing countries. The other risk factors, hypertension, hypercholesterolemia, smoking, and low physical activity, overweight and obesity are playing a major role in causing epidemiological diseases such as diabetes (Bose, 1992), coronary heart disease (CHD) (Foster and Burton, 1985; Ghosh et al., 2004), respiratory complications, dyslipidaemia, osteoarthritis of large and small joints, sleep apnoea (Seidell and Bouchard, 1997), hypertension (Bose and Taylor, 1998; Vague et al., 1998). Because of its causative nature in several chronic non-communicable diseases, it is of great interest to measure body composition and obesity among the general populations. By measuring body composition i.e., Body mass index (BMI), the waist-hip-ratio (WHR) and waist circumference (WC) are being used to measure abdominal fat accumulation and it indicates a person's health status can be more accurately assessed and the effects of both dietary and physical activity programs are better directed. Therefore studies on body composition among general populations are needed to understand the population variation. Hence an attempt has been to understand the variation of obesity and body composition on an endogamous caste population namely the Reddy from Chittoor district of Andhra Pradesh covering both urban and rural areas.

MATERIAL AND METHODS

Data on age and different anthropometric measurements are recorded on 300 (Rural-150: Male-75, Female-75) (Urban-150: Male- 75, Female-75) subjects of the Reddy caste from Chittoor district of Andhra Pradesh. Both sexes were included with equal sex ratio. The Reddy community is one of the forward and affluent castes in Andhra Pradesh. Standard procedures were followed in recording the measurements (Lohman et al., 1988). The measurements includes, weight, height, sitting height, skinfold thickness measurements at six sites (Biceps, Triceps, Subscapular, Suprailiac, abdominal and calf), six diametric measurements (Biacromial, Biiliac, Wrist, Elbow, Knee and Ankle) and seven circumference measurements (Waist, Hip, Upper arm, Fore arm, Chest, Abdominal and Calf).

RESULTS

The mean values of age, weight, height, sitting height, skinfold measurements, biiliac, and biacromial measurements among the males of urban Reddy are higher compared to their rural counterparts (Table 1). But in remaining anthropometric variables rural males showed greater values compared to urban counterparts except for HC, BMI, height Index, TSF3, TSF6, %BF, FFW, and TBW. In females greater values for the urban compared to the rural except for sitting height, calf, biacromial, wrist, elbow, and WHR were found. No difference is found in height index and body density between urban and rural population (Table 1).

The descriptive statistics for anthropometric variables among normal weight and overweight/obese based on BMI classification for males and females is presented in Tables 2. The overweight/obese males and females showed greater mean values for all the anthropometric measures with a few exceptions compared to normal subjects. Based on the WHR classification (Tale 3) among normal weight and overweight/obese individuals, greater mean values are observed for males and females among overweight/obese category for WC, BMI and BF compared to normal category except for BMI and BF of the females. Anthropometric measurements among normal and overweight/obese based on WC classification for males and females is presented in tables 4. Higher mean values are observed for males and females among overweight/obese category for BMI, WHR and BF compared to normal weight category.

Variation in between different age groups for body composition measures among both sexes is presented in tables 5 and 6. A significant difference was observed in the BMI, WHR, WC and BF among the age groups of males. It is found that age 20-29 differs significantly with the remaining groups regarding BMI, WHR and WC. In case of BF the age groups 40-49 and >50 did not show significant difference, however the age groups 20-29 and 30-39 differs significantly. A significant difference was observed in the BMI, WHR, WC and BF among the different age groups of females. It is found that age 20-29 differs

significantly with the remaining groups regarding BMI, WHR and WC. In case of BF the age groups 30-39 and 40-49 did not show significant difference, however the age groups 20-29 and ≥50 differs significantly. Age wise distribution of subjects among both the sexes and the prevalence of overweight/obese is presented in the table 7. It is observed from the table 7 that 15.3% and 27.3% of males and females of the Reddy are overweight/obese. When the sexes were combined 21.3% of the subjects were of overweight/obese.

DISCUSSION

Many studies have reported information on health, nutritional status and body composition among elderly and young individuals using anthropometry from different parts of the world (Durnin et al., 1974; Shimokata et al., 1989; Micozzi et al., 1990; Dey et al., 1999; Ghosh et al., 2001). However, few studies so far are undertaken among the general populations from India (Singal and Sidhu, 1983; Manandhar et al., 1997; Ghosh et al., 2001). The results of the present study, variation in different body composition variables among the Reddy population agreement with earlier studies investigating the differences of adiposity and metabolic variables among different caste populations of Andhra Pradesh (Venktramana and Chengal Reddy, 2002); other parts of India (Gupta and Gupta 1996;1998; Chada, 1998) and in other developing countries (Khor et al., 1999) and from other parts of the world (Durnin et al., 1974; Shimokata et al., 1989; Guo et al., 1999). Several population studies have reported variation in the overall body fatness and its pattern of distribution in India (Johnston et al., 1991). In many modernizing societies increased adiposity is associated with socio economic status (Mc Gravey et al., 1989).

The prevalence of overweight/obesity among Indian populations (Dhurandar and Kulkarni, 1992; Gopinath et al., 1994; Gopalan et al., 1998; Zargar et al., 2000; Misra et al., 2002; Venkatramana and Reddy, 2002; Bhadra et al., 2005; Venkatramana et al., 2005; Priyanka and Aarti, 2007) is higher compared to other Asian populations (Khor et al., 1999). However, the results showed that the prevalence of overweight/obese among in Indian populations is increasing alarmingly. The reasons for the rising prevalence of overweight/obesity in Indian population could be better understood by considering three possible reasons such as environmental factors particularly associated with urbanization, stronger genetic factors and behavioral factors.

The problems of overweight and obesity are caused by chronic imbalance between energy intake and actual energy needs of the body. So, dietary changes include consumption of excess calories, reduction in complex carbohydrates, and increased consumption of simple sugars and fats. Such diets have been partly responsible for several conditions including diabetes, cardio-vascular diseases, cancer and gastrointestinal problems (Ramachandran, 2003). In India because of socio-economic development over the last 40-50 years resulted in a dramatic change in lifestyle from traditional to modern, leading to physical inactivity due to technological advancement, affluence leads to consumption of diets rich in fat, sugar and calories and a high level of mental stress (Mohan et al., 2004).

As observed in the present study gender differences are seen in most other countries including India that more women than men being obese (Ismail et al., 2002; Mokhtar et al., 2001; Zargar et. al., 2000; Kadyrova and Salkhanov, 1990; Misra et al., 2002; Bhadra et al., 2005; Venkatramana and Reddy, 2002; Venkatramana et al., 2005). In contrast, the proportion of men who are overweight tends to be greater than women. Research on obesity in India has found prevalence to be higher among women (Gopinath et. al., 1994), and among economically better off persons (Griffiths and Bentley, 2001; Singh et al., 2000; Dhurandhar and Kulkarni, 1992). The same trend is observed among the present study population also. Higher socio-economic status has been consistently associated with greater risk of obesity (Al-Mannai et. al., 1996).

In the present study the association between BMI and obesity modified by ethnicity supports the need for a redefinition of obesity based on geographical region and ethnicity as suggested by the joint enterprise of the Regional Office for the Western Pacific of the WHO, the International Association for the Study of Obesity and the International Obesity Task Force (WHO, 2000). Although BMI is a simple and non-invasive method for assessing obesity and excessive fat stores within a single population, it is less reliable when it comes to comparing body composition between populations (Norgan, 1994; Deurenberg et al., 1999). Their findings indicate that BMI is an unreliable measure for studying the association between obesity and body composition across ethnic groups. They found that the overall effect of age on the prevalence of obesity differed considerably between the ethnic groups even in subjects with the same BMI. Further it is observed that the prevalence started to increase at a middle age in the European cohort than in any other group studied.

However, cross-sectional study like present one can only draw tentative conclusion regarding body composition variation in age and sex. Result of the present investigation indicate that it is utmost essential to understand the underlying factors involved in the causation of this significant negative trend

that could have serious health implications particularly in clinical nutrition and serious disability associated with increasing age. Further studies are needed on other ethnic groups residing in rural as well as urban areas of India to determine whether a similar phenomenon exists among them.

Table 1. Descriptive statistics for age and different anthropometric variables.

	Male (n=150)		Female (n=150)	
	Rural (n=75)	Urban (n=75)	Rural (n=75)	Urban (n=75)
	Mean ± S.D	Mean ± S.D	Mean ± S.D	Mean ± S.D
Age	37.64 ± 12.33	39.71 ± 11.11	39.47 ± 11.15	45.60 ± 13.50
Weight	60.48 ± 8.64	62.36 ± 10.14	50.78 ± 8.27	56.20 ± 10.49
Height	167.39 ± 5.76	166.99 ± 5.05	152.65 ± 5.22	151.63 ± 5.89
Sitting Height	85.38 ± 3.19	86.50 ± 3.80	79.71 ± 3.52	78.63 ± 3.28
Biceps	3.23 ± 1.81	4.36 ± 2.33	5.33 ± 2.25	8.05 ± 3.60
Triceps	11.15 ± 4.29	13.52 ± 4.22	15.24 ± 4.29	21.09 ± 6.85
Subscapular	15.65 ± 5.80	16.84 ± 5.13	18.01 ± 5.09	22.40 ± 6.72
Suprailiac	18.59 ± 7.55	21.12 ± 6.73	18.65 ± 5.42	24.04 ± 6.88
Abdominal	20.61 ± 8.04	22.72 ± 7.00	19.95 ± 6.18	25.81 ± 6.89
Calf	11.49 ± 3.98	14.51 ± 3.60	15.92 ± 3.10	15.53 ± 4.46
Biacromial Dia.	35.91 ± 2.50	37.69 ± 2.10	33.27 ± 1.95	33.14 ± 1.58
Biiliac Dia.	30.00 ± 1.82	31.66 ± 1.93	30.07 ± 2.11	31.63 ± 2.08
Wrist Dia.	5.37 ± 0.29	5.23 ± 0.27	4.85 ± 0.24	4.80 ± 0.29
Elbow Dia.	6.58 ± 0.57	6.30 ± 0.39	5.76 ± 0.29	5.90 ± 0.40
Knee Dia.	9.76 ± 0.63	9.80 ± 0.61	9.57 ± 0.64	9.83 ± 0.57
Ankle Dia.	6.72 ± 0.51	6.49 ± 0.32	5.98 ± 0.27	6.03 ± 0.36
Waist Cir.	80.39 ± 8.62	80.13 ± 8.18	76.74 ± 6.90	78.08 ± 8.06
Hip Cir.	90.75 ± 7.29	92.06 ± 7.98	92.45 ± 8.02	97.35 ± 8.62
Upperarm Cir.	27.24 ± 2.71	26.84 ± 2.29	26.45 ± 2.91	27.19 ± 2.68
Forearm Cir.	26.70 ± 2.09	25.70 ± 1.47	24.59 ± 2.03	24.14 ± 2.19
Chest Cir.	87.72 ± 6.32	87.41 ± 6.49	85.79 ± 6.96	87.36 ± 8.62
Abdominal Cir.	85.00 ± 9.56	84.31 ± 9.82	80.23 ± 9.86	81.99 ± 9.67
Calf Cir.	33.66 ± 2.59	33.42 ± 2.79	32.23 ± 2.70	34.45 ± 2.60
BMI	21.59 ± 2.90	22.32 ± 3.16	21.73 ± 2.94	24.41 ± 4.21
WHR	0.89 ± 0.05	0.87 ± 0.05	0.83 ± 0.07	0.80 ± 0.06

Note: Cir.: Circumference; Dia.: Diameter

Table 2. Mean ± S.D values of anthropometric variables according to BMI classification among normal weight and overweight/obese for males and females.

	Normal weight Mean ± S.D		Overweight/ Obese Mean ± S.D	
	Male (n=127)	Female (n=109)	Male (n=23)	Female (n=41)
WC	78.21±7.18	75.15±6.67	91.57± 4.67	83.41±6.23
WHR	0.88±0.05	0.82±0.07	0.89±0.03	0.81±0.06
BF	10.58±3.29	10.17±2.86	18.35±3.10	16.44±3.08

Table 3: Mean ± S.D values for anthropometric variables for abdominal obesity (WHR) among normal weight and overweight/obese groups for males and females

	Normal weight Mean ± S.D		Overweight/ Obese Mean ± S.D	
	Male (n=109)	Female (n=64)	Male (n=41)	Female (n=86)
WC	78.55±8.13	74.02 ± 7.39	84.84± 7.32	79.93 ± 6.58
WHR	21.90±3.12	23.22 ± 4.17	22.10±2.86	22.96 ± 3.63
BF	11.71±4.34	12.53 ± 3.96	11.94±4.24	11.40 ± 4.06

Table 4: Mean ± S.D values for anthropometric variables for central obesity (WC) among normal weight and overweight/obese groups for males and females

	Normal weight Mean ± S.D		Overweight/ Obese Mean ± S.D	
	Male (n=132)	Female (n=64)	Male (n=18)	Female (n=86)
BMI	21.32 ± 2.52	21.57 ± 3.07	26.63 ± 2.37	25.90 ± 6.58
WHR	0.87 ± 0.05	0.80 ± 0.07	0.91 ± 0.03	0.84 ± 0.05
BF	10.80 ± 3.41	10.38 ± 3.32	18.92 ± 3.25	14.71 ± 3.79

Table 5:. Mean ±SE of Body composition parameters of male sample by age groups

Age groups	BMI	WHR	WC	BF
	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE
20-29 (n=32)	20.61 ± 0.47[a]	0.85 ± 0.01[a]	75.34 ± 1.29[a]	9.70 ± 0.58[a]
30-39 (n=58)	22.70 ± 0.42[b]	0.88 ± 0.01[b]	82.28 ± 1.12[b]	13.09 ± 0.61[b]
40-49 (n=32)	21.99 ± 0.49[b]	0.89 ± 0.01[b]	81.10 ± 1.50[b]	11.88 ± 0.67[b]
= 50 (n=28)	21.89 ± 0.56[b]	0.89 ± 0.01[b]	80.74 ± 1.33[b]	11.28 ± 0.80[b]
F	3.41	6.66	5.37	4.75
P	0.019	0.001	0.002	0.003

Table 6: Mean ±SE of Body composition parameters of female sample by age groups

Age groups	BMI	WHR	WC	BF
	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE
20-29 (n=25)	21.57 ± 0.74[a]	0.81 ± 0.01[a]	73.51 ± 1.46[a]	11.08 ± 0.84[a]
30-39 (n=39)	22.88 ± 0.50[b]	0.82 ± 0.01[a]	77.07 ± 1.13[b]	12.07 ± 0.55[a]
40-49 (n=37)	23.26 ± 0.57[b]	0.82 ± 0.01[a]	78.09 ± 1.18[b]	12.13 ± 0.50[a]
= 50 (n=49)	23.84 ± 0.65[b]	0.82 ± 0.01[a]	79.16 ± 1.09[b]	11.95 ± 0.72[a]
F	2.00	0.40	3.42	0.40
P	0.116	0.754	0.019	0.750

Table 7: Age wise distribution of subjects among both the sexes and the prevalence of overweight/obese

		Overweight/Obesity
Males		
20-29	32	2 (6.3)
30-39	58	15 (25.9)
40-49	32	3 (9.4)
=50	26	3 (10.7)
Total	150	23 (15.3)
Females		
20-29	25	3 (12.0)
30-39	39	13 (33.3)
40-49	37	9 (24.3)
=50	49	16 (32.6)
Total	150	41 (27.3)

REFERENCES

1.Al-Mannai, A., Dickerson, J.W., Morgan, J.B. and Khalfan, H.1996. Obesity in Bahraini adults. Journal of Research in Social Health. 116(1): 30-2, 37-40.
2.Bell, A.C., K. Ge., and Popkin. B.M. 2002. The road to obesity or the path to prevention: Motorized transportation and obesity in China. Obes. Res. 10 (4), 277–283.
3.Bhadra, M., Mukhopadyya, A., and Bose, K. 2005. Overweight and obesity among adult Bengalee Hindu women of Kolkata, India.
4.Bose, K. 1992. Non- insulin-dependent (type II) diabetes mellitus and obesity in Asian in UK; scope for future studies. J. Roy. Soc. Hlth. 112: 291-293.
5.Bose, K. And Mascie-Taylor, C.G.N.1998. conocity index and waist-hip ratio and their relationship with total cholesterol and bloodpressure in middle aged European and migrant Pakistan men. Ann.Hum.Biol. 25: 11-16.
6.Chadha, S.L. 1998. Urban- rural differences in prevalence of coronary heart disease and its risk factors. Curr.Sci. 74: 1069-1073.
7.Deurenberg-Yap, M., Yian, T.B., Kai, C.S., Deurenberg, P., and van Staveren, W.A. (1999). Manifestation of cardiovascular risk factors at low levels of body mass index and waistto- hip ratio in Singaporean Chinese. Asia Pac. J. Clin. Nutr. 8 (3), 177–183.
8.Dey, D. K., Rothenberg, E., Sundh, V., Boseaus, I., and Steen, B. 1999. Eur. J. Clin. Nutr., 53: 905.
9.Dhurandhar, N.V., and Kulkarni, P.R. 1992. Prevalence of obesity in Bombay. Intl. J. Obes. and Rel.Met. Disr. 16 (5): 367–375.
10.Durnin, J.V.G.A., Womersley, J. 1974. Body fat assessed from total body density and its estimation from skinfold thickness: measurements on 481 men and women from 16 to 72 years. Br. J. Nutr. 32:77-97.
11.Foster, W.R., and Burton, B.T. 1985. (Eds): Health implications of obesity, National institute of health consensus development conference. Ann. Intern. Med.103: 1055-1065.
12.Ghosh, A., Bose, K., and Das Chaudhuri, A. B. 2001. Ann. Hum. Biol. 28 : 616.
13.Ghosh, A. 2004. Age and Sex Variation in Measures of Body Composition Among the Elderly Bengalee Hindus of Calcutta, India. Coll. Antropol. 28, 2: 553–56
14.Gopalan, C. 1998. Obesity in the urban middle class. NFI Bulletin, 19 (1). From http://www.nutrionfoundationofindia.org/archieve.asp? archieved=147.
15.Gopalan, C. 1988. Dietary guidelines for affluent Indians, Nutrition foundation of India Bull. Vol, 9(3): 1-4.
16.Gopinath, N., Chadha, S.L., Jain, P., Shekhawat, S., and Tandon, R. 1994. An epidemiological study of obesity in adults in the urban population of Delhi. The Journal of the Association of Physicians of India. 42 (3): 212–215.
17.Gordon, T., Castelli, W.P., Hjortland, M.C., Kannel, W.B. and Dawber, T.R. 1977. Diabetes, blood lipids and the role of obesity in coronary heart disease risk for women: The Framingham study. Ann. Intern. Med. 87: 393-397.
18.Griffiths, P.L., and Bentley, M.E. 2001. The nutrition transition is underway in India. Nutrition. 131(10): 2692–2700.
19.Guo, S. S., Zeller, C., Chumlea, W. C., and Siervogel, R. 1999. Am. J. Clin. Nutr. 70: 405
20.Gupta, R and Majumdar, S. 1996. Meta analysis of coronary heart disease prevalence in India. Ind Heart

J. 48: 241-245.
21.Gupta, R., and Gupta, V. P. 1998. Lessons for prevention from a coronary heart disease epidemiological study in Western India. Curr. sci. Vol.74, No.12, 1074-1077.
22.Guo, S. S., Zeller, C., Chumlea, W. C., and Siervogel, R. 1999. Am. J. Clin. Nutr. 70: 405
23.Ismail, M.N., Chee, S.S., Nawawi, H., Yusoff, K., Lim, T.O. and James, W.P. 2002. Obesity in Malaysia. Obesity Review. 3(3): 203-8.
24.Johnston, R. and Lyth, D. (1991), "Service quality: implementing the integration of customer expectations and operational capability", in Brown, S.W., Gummesson, E., Edvardsson, B. and
25.Kadyrova, R.K.H, and Salkhanov, B.A., 1990. The prevalence of obesity among the adult population of Kazakhstan. Vopr. Pitan. (1): 30-3.
26.Lohman, T.G., Roche, A.F. and Mortorell, A.R. 1988. Anthropometric standardization reference
27.manual. Human kinetics books, Champaign Manandhar, M. C., Ankelsaria, P. S., Myatt, M., and ISMAIL, S. J. 1997. J. Nutr.Health Aging. 1: 75.
28.Misra, A., Chaudhary, D., Vikram, N.K., Pandey, R. M., Mittal, V., Rama Devi, J., Khanna, N., Sharma, R. and Peshin, S. 2002. Insulin resistance and clustering of atherogenic risk factors in women belonging to low socio-economic strata in urban slums of North India. Diabetes. Res. Clin. Pract. 56:73 – 75.
29.Mohan,V., Madan, Z., Jha, R., Deepa, R. and Pradeepa, R. 2004.Diabetes-social and economic perspectives in the new millennium. Int. J. Diab. Dev. Countries. 24:29 – 35.
30.Mokhtar, N., Elati, J., Chabir, R., Bour, A., Elkari, K., Schlossman, N.P., Caballero B., and Aguenaou, H.2001. Dietculture andobesity in northern Africa. J. Nutr. 131(3): 887S-892S.
31.Norgan, N.G. 1994. Population differences in body composition in relation to the body mass index. Eur. J. Clin. Nutr. 48 (Suppl), 3: S10-S27.
32.Popkin, B.M. 2001. Nutrition in transition: the changing global nutrition challenge. Asia Pac. J. Clin. Nutri. 10 (Suppl): S13–S18.
33.Popkin, B.M. 2002. The shift in stages of the nutritional transition in the developing world differs from past experiences. Pub. Heal. Nutr. 5 (1A): 205–214.
34.Popkin, B.M., Horton, S., Kim, S. and Shuigao., J. 2001. Trends in Diet. Nutritional status and diet-related non- communicable diseases in China and India: The economic costs of the nutrition transtition. Nutrition Reviews. 59: 379-90.
35.Priyanka, T., and Aarti, S. 2007. Prevalence of Obesity, Weight Perception and Dietary Behaviour of Urban College Going Girls. J. Hum. Ecol., 21(3): 181-183.
36.Ramachandran, A. 2003. Identifying the risk factors: Diabetes in Asian Indians. Diabetes voice. 48:17 – 19.
37.Roubenoff, R., Kehayias, JJ. 1991. The meaning and measurement of lean body mass. Nutr.Rev. 46:163-175.
38.Seidell, J.C., and Bouchard, C. 1997. Visceral fat in relation to health; Is it a major culprit or simply an innocent bystander. Int. J. Obes. 21: 626-636.
39.Shimokata, H., J. D., Tobin, D. C. Muller, D. Elahi, P. J. Coon, R. And Andres, J. 1989. Geron. 44: 66.
40.Singh, R.B., Beehom, R., Verma, S.P., Haque, M., Singh, R.,. Mehta, A.S., De, A.K., Kundu, S., Roy, S., Krishnan, A., Simhadri, H., Paranjpe, N.B., Agarwal, N. 2000. Association of dietary factors and other coronary risk factors with social class in women in five Indian cities. Asia Pac. J. Clin. Nutr. 9 (4): 298–302.
41.Steering Committee, 2000. The Asia-Pacific perspective: Redefining obesity and its treatment. Melbourne: International Diabetes Institute.
42.Stunkard, A.J. and Wadden, T.A. 1993. Obesity: theory and therapy. Second edition, New York: Raven press.
43.Vague, J., Vague, P., Jublin, J., and Barre, A.1998. Fat distribution, obesities and health: evolution of concept. Pp. 9-41. In. Fat distribution during growth and later Health outcomes. Bouchard, C., and Jhonston, F.E.(Eds). Alan R Liss Inc., New York.
44.Venkatramana, P., Geethavani, C..and Chengalreddy, P. 2001. Association of body mass index, body fat distribution and fat pattering with blood pressure in two populations of Andhra Pradesh. J. Hum. Ecol., 12(1): 63 – 68.
45.Venkatramana, P., and C Reddy, P.2002. Association of overall and abdominal obesity with coronary heart disease risk factors: comparison between urban and rural Indian men. Asia Pacific. J. Clin. Nutr. 11(1): 66–71.
46.Venkatramana, P., Chandrasekhar Rao, P., Annaiah, P., Madhavi, P. and Chengal Reddy, P. 2005. Prevalence of overweight and obesity among the rural populations of Andhra Pradesh. Hum. Ecol. 13:99-102.
47.World Health Organization (WHO), International Association for the Study of Obesity (IASO), &

International Obesity Task Force (IOTF), 2000. The Asia-Pacific Perspective: Redefining Obesity and Its Treatment. Geneva: World Health Organization.
48.World Health Organization. 1998. Obesity: Preventing and Managing the global epidemic. Report of WHO consultation on obesity. WHO, Geneva.
49.World Health Organization. 2002. Nutrition Data Banka. Global Data Base on obesity and body mass index (BMI) in adults.
50.World Health Organization. 2003. Diet, Nutrition and the Prevention of Chronic Diseases.Report of a joint WHO/FAO expert consultation. Technical Report Series No.916.Geneva.
51.Zargar, A.H,, Masoodi, S.R., Laway, B.A., Khan, A.K., Wani, A.I, Bashir, M.I., and Akhtar, S.2000. Prevalence of obesity in adults--an epidemiological study from Kashmir Valley of Indian Subcontinent. J. Assoc. Physicians. India. 48(12):1170-4.

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