Review Article

Review on Epidemic of Obesity

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Abstract

There has been a growing concern about obesity worldwide. We performed a review on the prevalence and trends of obesity among adults and children. We reviewed the data on the prevalence of adult obesity and being overweight from the Global Database on Body Mass Index on the World Health Organisation (WHO) Website and prevalence of children being overweight from the International Obesity Task Force website. Various databases were also searched for relevant reviews and these include PubMed, EMBASE, NHS CRD databases and Cochrane. The prevalence of obesity is high in many parts of the world. Generally, there is an increasing trend of prevalence of adult obesity with age. The peak prevalence is reached at around 50 to 60 years old in most developed countries and earlier at around 40 to 50 years old in many developing countries. Obesity is a major health concern. Appropriate strategies need to be adopted to tackle obesity which itself brings about significant disability and premature deaths. Further observation may be needed to see if the trend of prevalence abates or increases in the near future.

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Key words: Epidemiology, Overweight, Prevalence

Introduction

According to the World Health Organization (WHO), there were about 1.6 billion overweight adults aged 15 years and above and at least 400 million adults are obese worldwide in 2005. Obesity increases the risk of chronic diseases such as diabetes mellitus, cardiovascular disease, stroke and some cancers. It is a serious public health problem that is growing in countries with low or middle income.[1]

In view of the growing concern about obesity worldwide, we therefore conducted a literature review on the recent systematic reviews on the epidemiology of obesity in order to better understand the magnitude of the problem. In 2005, a study by Prentice[2] reviewed the prevalence and trends of obesity based on data from the Global Database on Body Mass Index launched on the WHO website (http://www.who.int/bmi/index.jsphttp://www.who.int/bmi/index.jsp).[3] We also undertook a study to look at the latest statistics on the prevalence of obesity, both in Western and Asian countries.

Methodology

We viewed the data on the prevalence of adult obesity and being overweight from the Global Database on Body Mass Index launched on the WHO website (http://www.who.int/bmi/index.jsphttp://www.who.int/bmi/index.jsp). According to the WHO, an adult is classified as being overweight if the Body Mass Index (BMI) is more than or equal to 25 kg/m^2 and obese if the BMI is more than or equal to 30 kg/m.[2,3] We also reviewed the data on the prevalence of childhood overweight (including obesity) on the International Obesity Task Force Website at http://www.iotf.org/database/index.asp.

For the literature review, we performed an exploratory search for the relevant search terms. The population, intervention and outcome categories were filled with alternative terms considering the terminology and spelling variations. These included obesity or being overweight, epidemiology and prevalence. The following databases were searched: NHS CRD databases (DARE, NHS EED, HTA), the Cochrane Library on CD-ROM, PubMed (MEDLINE), and the systematic reviews and clinical queries filter in PubMed and EMBASE. A search was also done on Google. A combination of MeSH terms and free texts was used with Boolean operators "OR" or "AND". Only reviews were included in our search due to the vast amount of literature. We found 3 reviews suitable for inclusion in our study. The search ended on 28 April 2008.

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The 3 reviews examined the prevalence levels and time trends of being overweight and obese. A review by Wang and Beydoun[4] and the review by Wang et al[5] focused on studies conducted in the USA and China, respectively whereas the review by Wang and Lobstein[6] looked at studies conducted worldwide. The population of interest comprised adults, children and adolescents in Wang and Beydoun;[4] adults in the review by Wang et al;[5] and adolescents and children in Wang and Lobstein.[6]

The criteria of being overweight and obese differed among these 3 reviews. The review by Wang and Beydoun used WHO cut-off points of 25 kg/m^2 and 30 kg/m^2 for being overweight and obese respectively in adults, and mainly the 2000 Centers for Disease Control and Prevention Growth Charts for children and adolescents at risk of being overweight.[5] According to the CDC growth charts, the "at risk for being overweight" was defined as BMI for age greater than or equal to sex-specific 85th percentile but less than the 95th percentile, and being overweight was defined as BMI for age greater than or equal to the sex-specific 95th percentile.[7] The review by Wang et al used WHO cut-off points as well as Chinese standard of being overweight (BMI greater than or equal to 24 kg/m^2 and less than 28 kg/m^2) and obese (BMI greater than or equal to 28 kg/m^2).[5] The review by Wang and Lobstein used the IOTF cut-off points based on BMI centile curves that passed through the adult cut-off points of BMI 25 kg/m^2 and 30 kg/m^2 for being overweight and obese respectively.[6] Such differences limit the generalisability and comparability of the findings.

Results

According to available data in 2004 from the Global Database on Body Mass Index launched on the WHO website, the worldwide prevalence of being overweight in 2004 has been found to range from less than 15% in Eritrea to more than 50% in the USA, Seychelles, New Zealand and Australia. The worldwide prevalence of obesity in 2004 also ranged from more than 20% in the USA, Seychelles and New Zealand to less than 10% in Eritrea and Singapore.[3]

Table 1 shows the prevalence of adults being overweight and obese in developed and developing countries. Overall, there were considerable differences within the developed and developing countries. The prevalence of being overweight for males and females ranged from 23.2% in Japan to 66.3% in the USA among the developed countries, and from 13.4% in Indonesia to 72.5% in Saudi Arabia among the developing countries. The prevalence of obesity for males and females ranged from 2.4% in the Republic of Korea to 32.2% in the USA among the developed countries, and from 2.4% in Indonesia to 35.6% in Saudi Arabia. No obvious trends were noted between the developed and developing countries.

No obvious trends were noted between males and females for adult obesity among the developed countries. However, it was noted from Table 1 that the prevalence of obesity was generally higher among females compared to males in the developing countries.

Table 2 shows the prevalence of children being overweight (including obesity) using IOTF cut-off. There was a broad range of prevalence noted. In general, the prevalence was higher in the Americas, Middle East and many parts of Europe, and lower in Africa and certain parts of Asia. There was no clear pattern of gender differences in the prevalence in both developed and developing countries.[8]

Supplementary Tables 1 and 2 show the prevalence of obesity by age groups in the developed countries and developing countries respectively. Generally, there was an increasing trend with age. The peak prevalence was reached at around 50 to 60 years old in most developed countries and earlier at around 40 to 50 years old in many developing countries. Thereafter, a drop in prevalence was noted in many countries. From Table 3, it was observed that most of the rural areas tended to have a lower prevalence of obesity than the urban areas in the developing countries. A gender difference was also noted with females having a higher prevalence of obesity in both rural and urban areas.

The prevalence of obesity continued to rise in many parts of the world. There was an increase in the average annual change ranging from 0.2% to 18.5% in developed countries and 0.1% to 35.3% in developing countries (Supplementary Tables 3 and 4). However, a few developed countries experienced a drop in the prevalence rate such as the UK (for males) and Germany. It is important to note that these findings were only based on the surveys carried out which might be outdated. As such, the data might not be representative of the present situation. For example, there was a recent report by the Baker Institute which showed that the prevalence of obesity had reached 26% among adults in Australia in 2007 and this had exceeded the rate in the USA.[9]

An overall increasing time trend among adults was noted in 2 reviews.[4,5] In the systematic review by Wang and Beydoun, 66.3% of adults aged 20 years and older were overweight or obese and 34.42% were obese between 2003 and 2004. The prevalence was higher in males than females. The obesity prevalence doubled from 15.1% in 1976 and 1980 to 30.9% in 1999 and 2000 among adults in the US. Both genders had a similar annual increase rate of prevalence. According to the review, the prevalence of at risk for being overweight (BMI more than or equal to 85th percentile) or overweight (BMI more than or equal to 95th percentile) was about 35% in children and adolescents aged 6 to 19 years old, and the prevalence of being

Table 1. Prevalences of Adult Obesity Worldwide[3]

Country	Year of survey	Age range (y)	National prevalence of overweight (%BMI >=25 kg/m²)			National prevalence of obesity (%BMI >=30 kg/m²)		
			Males	Females	Total	Males	Females	Total
Developed countries								
Australia	2004-2005	18-100	58.30	40.00	49.00	17.80	15.10	16.40
Canada	2003	18-100	56.90	39.60	48.20	15.90	13.90	14.90
Denmark	2000	16-100	49.60	34.00	41.70	9.80	9.10	9.40
Germany	2003	18-100	57.70	41.20	49.20	13.60	12.30	12.90
Japan	2004	15-100	27.30	19.90	23.20	2.86*	3.30*	3.10*
Norway	2002	15-100	37.80	25.50	31.50	6.40	5.90	6.10
Republic of Korea	2005	20-100	35.20	28.30	31.80	1.70**	3.00**	2.40**
Singapore	2004	18-69	35.00	29.90	32.50	6.40	7.30	6.90
Switzerland	2002	15-100	45.40	29.30	36.61	7.90	7.50	7.68
UK	2002	15-84	66.30	56.60	61.00	22.30	23.00	22.70
USA	2003-2004	20-100	70.80	61.80	66.30	31.10	33.20	32.20
Developing countries								
Bahrain	1998-1999	19-100	60.00	62.40	61.23	23.30	34.10	28.86
Brazil	2002-2003	20-100	41.10	40.00	40.60	8.90	13.10	11.10
Chile	2003	17-100	62.20	57.70	59.70	19.00	25.00	21.90
China	2002	18-100	19.10	18.80	18.90	2.40	3.40	2.90
Hungary	2003-2004	18-100	58.92	49.43	53.24	17.10	18.20	17.73
India	2005-2006	15-49	9.30	12.60	-	1.30	2.80	-
Indonesia	2001	15-100	8.40	17.80	13.40	1.10	3.60	2.40
Poland	2000-2001	19-100	56.70	48.60	52.20	15.70	19.90	18.00
Saudi Arabia	1995-2000	30-70	68.80	75.80	72.50	26.40	44.00	35.60
South Africa	1998	15-100	29.09	56.20	45.06	11.10	33.20	24.00
Zimbabwe	2005	25-100	18.30	43.30	37.30	3.90	19.40	15.70

*data is only in 2001 as data for 2004 is not available
**data is only in 1998 as data for 2005 is not available

overweight in this group was about 17%. Both genders had similar prevalences. The increase in the prevalence of being overweight grew more steeply with increasing age groups between 1976-1980 and 2003-2004 (children aged 2 to 5 years old: 7.2% to 10.3%; children aged 6 to 11 years old: 6.5% to 15.8%; adolescents aged 12 to 19 years: 5.0% to 16.1%).[4]

The review by Wang et al presented a similar picture of a rising trend of obesity in China. The prevalence of obesity of adults was 2.9% and that of overweight or obese was 21.8%. The review also noted an increase in the combined prevalence of being overweight and obese from 14.6% in 1992 to 21.8% in 2002. The increase in prevalence was more marked in males than females.[5]

The prevalence of being overweight had increased since the 1960s for overweight children and adolescents in the review by Wang and Beydoun.[4] Similarly, the review on childhood obesity by Wang Y and Lobstein T demonstrated an increasing trend of childhood overweight and obesity in almost all of the 60 countries studied except Russia and Poland. Of note, obesity had spread rapidly in some industralised countries and those undergoing rapid socio-economic changes. The review observed that the prevalence of being overweight was highest in North America, Europe and some parts of the Western Pacific. On the contrary, the prevalence was lower in some South East Asian countries and many parts of sub-Saharan Africa.[6]

Discussion

Our findings showed a high prevalence in many parts of the world. According to IOTF, it was estimated that the prevalence rate of obesity could reach 45% to 50% in the

Table 2. Prevalence of Childhood Overweight (Including Obesity) Worldwide Using IOTF Cut-Off[a]

	Developed countries			
Country	**Year of survey**	**Age range (y)**	**Boys (%)**	**Girls (%)**
Australia	2003-2004	6-11	23.2	30.3
Canada	2004	12-17	32.3	25.8
Denmark	1996-1997	5-16	14.1	15.3
England	2004	5-17	29	29.3
France	2000	7-9	17.9	18.2
Germany	1995	5-17	14.1	14
Japan	1996-2000	6-14	16.2	14.3
Netherlands	1997	5-17	8.8	11.8
New Zealand	2000	11 and 12	30	30
Singapore*	1993	10 and 15	20.4	14.6
Sweden	2001	6-11	17.6	27.4
Switzerland	2002	6-12	16.6	19.1
USA	2003-2004	6-17	35.1	36
	Developing countries			
Country	**Year of survey**	**Age range (y)**	**Boys (%)**	**Girls (%)**
Algeria	2003	7-17	6	5.6
Bahrain	2000	12-17	29.9	42.4
Brazil	2002	7-10	23	21.1
Chile	2000	6	26	27.1
China	1999-2000	11 and 15	14.9	8
Hungary	1993-1994	10 and 15	17.8	15.9
India	2002	5-17**	12.9	8.2
Mexico	2000	10-17	17	20.7
Poland	2001	7-9	13.6	14.7
Russian Federation	1992	5-17	24.2	19.7
Saudi Arabia	2002	5-17	16.7	19.4
South Africa	2001-2004	6-13	14	17.9
Zimbabwe	1990-1994	5-17	1.7	2.4

* for overweight only
**5-15 years girls

USA, 30% to 40% in Australia, England and Mauritus and more than 20% in Brazil by 2025.[10] Obesity is also no longer restricted to developed countries. Of note, many developing countries face the double burden of obesity and undernutrition.[11]

It is not clear if an epidemic of obesity exists currently. According to Flegal,[12] the high prevalence and rapid increase in trend were consistent with the general definition of "obesity of epidemic", even though there was a lack of quantitative definition to ascertain if an epidemic had indeed occurred. Our review shows that the rate of increase in the prevalence of obesity varied widely and some countries experienced a drop in prevalence over time. In addition, a few studies have reported no significant change in the trend of prevalence of BMI.[13,14] For example, the study by Ogden et al[13] noted no significant change in the trend of prevalence of high BMI for age in children and adolescents in the USA between 2003 and 2006. Similarly, the report from the National Center for Health Statistics in the USA noted that the prevalence of obesity showed no significant change in adults in USA between 2003-2004 and between 2005-2006.[14] It is not known if the trends of obesity have been showing signs of ablation in some countries. It has been suggested that the distribution of BMI in different time periods would provide a better illustration of the trends in weight in BMI.[14]

Our findings have shown that the prevalence of obesity is generally higher among females compared to males in developing countries.

In developing countries, obese women are regarded as a sign of affluence and such cultural influence could be related to the higher prevalence among women compared to their male counterparts.[15] More research may be needed to look at the pattern of obesity in different genders. In addition, it has been reported that the higher prevalence of obesity was in the urban areas in developing countries and was associated with the change from rural to urban lifestyle along with decreased levels of physical activity and an increase of high-energy dense diet.[10]

The impact of obesity has been considerable. According to a WHO report, obesity has been identified as a major cause of disability and premature deaths in less developed countries. This has been attributed to shifts in diets and lifestyle changes.[16] Obesity has been related to a greater risk of many diseases including cardiovascular heart disease, hypertension, hyperlipidemia, diabetes mellitus and certain cancers. Besides the health consequences, it has been estimated that obesity accounts for 2% to 7% of total healthcare costs. There are also other costs to consider such as reduced quality of life and productivity loss attributed to medical leave.[10]

In view of the high prevalence of obesity in many parts of the world and the resultant health and economic consequences, much has been done to tackle the issue of obesity. The International Obesity Task Force was set up in 1996 to address the problem of obesity worldwide.[10] In 2004, the World Health Assembly adopted the WHO Global Strategy on Diet, Physical Activity and Health which call for action to tackle chronic diseases and risk factors such as an unhealthy diet and low physical activity.[1] Various strategies on the prevention and management of obesity have been adopted in many countries and some examples are programmes aimed at increasing fruit

Table 3. Prevalence of Adult Obesity in Urban and Rural Areas in Developing Countries[3]

		Prevalence of obesity in urban area (%)			Prevalence of obesity in rural area (%)		
Country	**Year**	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**
Bahrain	1991-1992	20.00	40.26	30.99	13.89	22.37	18.24
Brazil	2002-2003	9.00	10.80	-	6.10	11.70	-
China	2002	3.80	4.30	4.00	1.80	3.00	2.40
Czech Republic	2002	11.42	14.04	12.84	16.99	20.13	18.58
India	2005-2006	2.40	6.10	-	0.60	1.30	-
Philippines	2002	3.50	5.90	5.00	2.40	4.90	3.90
Saudi Arabia	1995-2000	-	-	39.70	-	-	27.00
South Africa	1998	11.10	33.20	24.00	6.30	25.10	17.55

consumption in the workplace and schools in Denmark, banning vending machines in all schools in France, nutritional standards for school meals in Greece, Scotland and the UK, maternal leave to encourage breastfeeding in Norway and the growing of vegetables on rooftops in the Russian Federation.[17]

Some interventions have met with success[17,18] and one notable example is Singapore's "Fit and Trim" programme to tackle obesity in school children. The programme involves activities aimed at healthy eating, increasing physical activities and the management of obese students. The programme has led to a drop of prevalence of obesity from 16.6% in 1992 to 14.6% in 2000 among children aged 11 to 12 years old, and from 15.5% in 1992 to 13.1% in 2000 among students aged 15 to 16 years old.[18]

It is essential for individual countries to develop strategies to address the growing problem of obesity. It has been suggested that a population-based approach would be beneficial in dealing with the problem. There is, unfortunately, a lack of proven population-based interventions.[15] However, it is still worthwhile to look at the various interventions carried out in different countries. Care should also be taken about generalising strategies across different socio-economic groups, cultures and geographic regions.

It is important to note the limitations in our review. Firstly, the comparisons of prevalence in obesity need interpretation with caution due to the difference in survey sampling methods, sample sizes, age range of subjects, quality of data in terms of height and weight measurement and whether national programmes or strategies to tackle obesity are in place. Even within the same country, the prevalence and trend of obesity may not be homogenous in view of different ethnicities, geographic regions and socio-economic status.

Furthermore, publication bias poses a limitation in this review. Although we did not limit our search by English, we did not find non-English articles although there was no limitation in our search by language. There could be other databases which yield non-English articles. Further research could be conducted to look at the non-English studies.

Conclusion

Obesity is of major public health concern. Appropriate strategies need to be adopted to tackle obesity which itself brings about significant disability and premature deaths.

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REFERENCES

1. World Health Organisation. Fact sheet: obesity and overweight. Available at: http://www.who.int/mediacentre/factsheets/fs311/en/print.html. Accessed 11 June 2008.
2. Prentice AM. The emerging epidemic of obesity in developing countries. Int J Epidemiol 2006;35:93-99.
3. World Health Organisation. Global database on body mass index. Available at: http://www.who.int/bmi/index.jsp?introPage=intro_3.html. Accessed 11 June 2008.
4. Wang Y, Beydoun MA. The obesity epidemic in the United States – gender, age, socioeconomic, racial-ethnic, and geographic characteristics: a systematic review and meta-regression analysis. Epidemiol Rev 2007;29:6-28.
5. Wang Y, Mi J, Shan X-y, Wang QJ, Ge K-y. Is China facing an obesity epidemic and the consequences? The trends in obesity and chronic disease in China. Int J Obes 2007;31:177-188.
6. Wang Y, Lobstein T. Worldwide trends in childhood overweight and obesity. Int J Paed Obes 2006;1:11-25.
7. Centre for Disease Control and Prevention. Use and interpretation of the CDC growth charts. Available at:_http://www.cdc.gov/nccdphp/dnpa/growthcharts/resources/growthchart.pdf. Accessed 30 October 2008.
8. International Obesity Taskforce. Global trends in childhood overweight prevalence. Available at: http://www.iotf.org/database/index.asp. Accessed 13 June 2008.
9. Baker IDI Heart and Diabetes Institute. Australia's future 'fat bomb': a report on the long-term consequences of Australia's expanding waistline on cardiovascular disease. Available at: http://baker.edu.au/assets/contentFiles/39/fatBomb_report.pdf. Accessed 24 June 2008.

10. International Obesity Task Force Secretariat. The global challenge of obesity and the International Obesity Task Force. Available at: http://www.iuns.org/features/obesity/obesity.htm. Accessed 24 June 2008.
11. Asia Pacific Cohort Studies Collaboration. The burden of overweight and obesity in the Asia-Pacific region. Obes Rev 2007;8:191-6.
12. Flegal KM. Commentary: the epidemic of obesity – what's in a name? Int J Epidemiol 2006;35:72-74.
13. Ogden CL, Carroll MD, Flegal KM. High body mass index for age among US children and adolescents, 2003-2006. JAMA 2008;299:2401-5.
14. Ogden CL, Carroll MD, McDowell MA, Flegal KM, Division of Health and Nutrition Examination Surveys. Obesity among adults in the United States – no statistically significant change since 2003-2004. Available at: http://www.cdc.gov/nchs/data/databriefs/db01.pdf. Accessed 13 August 2008.
15. Lawlor DA, Chaturvedi N. Treatment and prevention of obesity-are there critical periods for intervention. Int J Epidemiol 2006;35:3-9.
16. World Health Organisation. Report of a joint WHO/ FAO Expert. Consultation. Diet, nutrition and the prevention of chronic diseases. WHO technical report series No. 916. Available at: http://whqlibdoc.who.int/trs/WHO_TRS_916.pdf. Accessed 24 June 2008.
17. World Health Organisation Regional Office for Europe. The challenge of obesity in the WHO European Region and the strategies for response for response. Available at: http://www.euro.who.int/document/E90711.pdf. Accessed 24 June 2008.
18. Toh CM, Cutter J, Chew SK. School based intervention has reduced obesity in Singapore. BMJ 2002;324:427.

Supplementary Table 1. Prevalence of Adult Obesity by Age Groups in Developed Countries[3]

Males

Country	Australia	Canada	France	Japan	Norway	Republic of Korea	Singapore	Sweden	UK	US
Year of survey	2004-2005	2003	2003	1991-1995	2002	2001*	2004	2002-2003	2003-2004*	2003-2004
15-19				-		-				-
20-24	6.70†	9.20†	1.90		3.10	-		3.20§	7.50§	
25-29				2.05		-	9.60‡			
30-34	17.00	15.90	7.50		7.30			10.30	16.20	
35-39						2.97	5.00			28.00
40-44	21.20	15.90	11.30		7.80			10.00	24.40	
45-49				2.30		2.38	6.50			
50-54	23.20	18.70	14.60		8.50			11.10	27.50	
55-59				1.80		2.55	4.70			34.80
60-64	22.60	20.30	18.10		6.70			15.10	33.30	
65-69	-			1.49	-	2.86	5.10	-		
70-100	-	14.00	15.30	0.84	-	-	-	-	15.00	30.40

Females

Country	Australia	Canada	France	Japan	Norway	Republic of Korea	Singapore	Sweden	UK	US
Year of survey	2004-2005	2003	2003	1991-1995	2002	2001*	2004	2002-2003	2003-2004*	2003-2004
15-19				-		-				-
20-24	7.30†	6.30†	2.60		2.10	-		3.10§	13.40§	
25-29				1.16		-	4.00‡			
30-34	13.10	12.00	0.10		5.60			7.20	20.50	
35-39				1.74		10.42	8.50			28.90
40-44	14.90	13.10	11.80		5.40			9.00	25.50	38.80
45-49				2.81		5.73	7.40			
50-54	18.10	16.00	14.10	3.26	6.50	8.00	8.40	9.30	26.40	
55-59										
60-64	21.70	19.70	14.10		8.60			14.00	31.90	
65-69	-	14.70	15.50	4.22	-	6.71	10.00	-		
70-100	-			3.28	-	-		-	17.00	31.50

* Subnational †18-24 years ‡18-29 years §16-24 years

Supplementary Table 2. Prevalence of Adult Obesity by Age Groups in Developing Countries[3]

Males

Country	Bahrain	Brazil	Chile	China	Hungary	India	Indonesia	Philippines	Poland	Saudi Arabia	South Africa	Vietnam
Year of survey	1998-1999	2002-2003	2003	1996*	2003-2004	2005-2006	2001	1998	2000-2001	1995-2000	1998	2000
15-19	-	-				0.20		-	-	-		-
20-24		3.10	10.00‡	2.00			0.30			-	2.70	0.26
25-29	14.62†	6.20		-		0.70			4.30¦¦	-		0.12
30-34		8.20		-	7.40§		0.80				7.80	0.37
35-39	33.03					1.80		2.80	11.60	25.20		0.40
40-44		11.30	18.00	2.00			1.20				12.80	0.08
45-49	34.68					2.30			20.00	30.30		0.79
50-54		12.40		2.00		2.40	2.30				17.30	-
55-59	25.42				20.70	-		4.20	25.30	27.80		-
60-64		11.90	24.40	3.00		-	0.90				14.40	
65-69	19.29	-		-		-				22.10¶		
70-100	9.29	-	27.80	-	21.50	-	1.20	1.00	19.30	-	13.90	0.50

Females

Country	Bahrain	Brazil	Chile	China	Hungary	India	Indonesia	Philippines	Poland	Saudi Arabia	South Africa	Vietnam
Year of survey	1998-1999	2002-2003	2003	1996*	2003-2004	2005-2006	2001	1998	2000-2001	1995-2000	1998	2000
15-19	-	-				0.20		-	-	-		-
20-24		4.70	7.10‡	4.00			0.90			-	9.60	0.44
25-29	19.70†	7.00				1.40			3.40¦¦	-		0.34
30-34		11.30		3.00	8.60§		3.20				27.00	0.32
35-39	35.02				19.80	3.90		6.90	11.50	40.20		0.71
40-44		12.80	23.40	4.00			6.90	5.80			39.30	0.49
45-49	54.21		36.30			6.40			17.30	50.20		1.31
50-54	45.00			9.00		-	4.90		28.80	45.90	45.50	0.23
55-59		18.40				-						1.07
60-64		21.80		8.00		-	2.90				46.10	
65-69	27.89	-		-		-				39.00¶		
70-100	17.83	-	29.80	-	23.40	-	2.60	3.90	37.20	-	33.30	0.82

* Subnational †19-29 years ‡17-24 years §18-34 years ¦¦19-29 years ¶60-70 years

Supplementary Table 3. Rate of Change in Prevalence of Obesity in Developed Countries[3]

			Males				Females			
Country	**Year**	**Age range**	**Sample size**	**% obese**	**% change**	**% average annual change**	**Sample size**	**% obese**	**% change**	**% average annual change**
Australia	2004-2005	18-100	-	17.8	-6.8	-1.0	-	15.1	-22.6	-3.2
	1995-1996	18-100	5096	19.1			5576	19.5		
Canada	2003	18-100	54854	15.9	96.3	3.2	65296	13.9	9.4	0.3
	1970-1972	20-69	2662	8.1			3301	12.7		
Finland	2005	15-64	1500	14.9	96.1	3.0	1727	13.5	-14.6	-0.5
	1966-1972	15-100	8827	7.6			8467	15.8		
France	1991-1992	20-100	7250	6.4	0.0	0.0	7856	7.8	23.8	2.6
	1980-1981	20-100	6792	6.4			7150	6.3		
Germany	2003	18-100	24222	13.6	-12.3	-0.8	25235	12.3	-27.6	-1.7
	1984-1986	25-69	2324	15.5			2456	17		
Italy	2004	18-100	1407	7.4	4.2	0.2	1525	8.9	17.1	0.9
	1983	15-100	34787	7.1			37497	7.6		
Japan	2001	15-100	3885	2.86	240.5	12.0	4847	3.3	22.7	1.1
	1976-1980	20-100	24823	0.84			33555	2.7		
New Zealand	2002-2004	15-100	5075	21.9	73.8	18.5	7854	23.2	38.9	9.7
	1997	15-100	1511	12.6			1986	16.7		
Norway	2002	15-100	-	6.4	-	-	-	5.9	34.4	3.8
	1991-1992	30-49	-	-			56267	4.39		
Singapore	2004	18-69	-	6.4	56.1	5.1	-	7.3	19.7	1.8
	1992	18-69	1712	4.1			1856	6.1		
Sweden	2002-2003	16-84	5723	10.4	108.0	5.4	6098	9.5	90.0	4.5
	1980-1981	16-74	-	5			-	5		
Switzerland	2002	15-100	8843	7.9	29.5	3.7	10629	7.5	59.6	7.4
	1992-1993	15-100	6749	6.1			8150	4.7		
UK	2002	15-84	-	22.3	-10.8	-10.8	-	23	15.0	15.0
	2000-2001	19-64	864	25			923	20		
USA	2003-2004	20-100	2237	31.1	190.7	4.8	2194	33.2	106.2	2.7
	1960-1962	20-74	2895	10.7			3231	16.1		

Supplementary Table 4. Rate of Change in Prevalence of Obesity in Developing Countries[3]

			Males				Females			
Country	**Year**	**Age range**	**Sample size**	**% obese**	**% change**	**% average annual change**	**Sample size**	**% obese**	**% change**	**% average annual change**
Brazil	2002-2003	20-100	46299	8.90	102.3	34.1	49255	13.10	7.4	2.5
	1996-1997	20-100	2126	4.40			2793	12.20		
Cambodia	2005-2006	15-49	-	-	-	-	7799	1.2	71.4	17.9
	2000	15-49	-	-			6797	0.7		
Czech Republic	2002	16-100	1142	13.66	31.3	3.9	1284	16.28	33.4	4.2
	1993	15-100	-	10.40			-	12.20		
Estonia	2004	16-64	1299	13.7	90.3	11.3	1734	14.9	0.7	0.1
	1994	16-64	532	7.2			696	14.8		
Hungary	2003-2004	18-100	473	17.10	41.6	3.0	706	18.20	-0.7	-0.1
	1985-1988	15-100	6402	12.08			9143	18.33		
India	2005-2006	15-49	65742	1.30	-	-	111781	2.80	21.7	4.4
	1998-1999	15-49	-	-			75787	2.30		
Lao's People Democratic Republic	2000	15-100	-	0.7	0.0	0.0	-	1.6	14.3	2.9
	1994	18-100	3317	0.7			3821	1.4		
Latvia	2004	15-64	742	11.90	25.3	4.2	1014	19.50	12.1	2.0
	1997	19-100	1062	9.50			1230	17.40		
Mexico	2000	20-100	13374	18.60	24.7	4.1	29375	28.10	12.2	2.0
	1993	20-69	5930	14.91			8462	25.05		
Poland	2000-2001	19-100	1255	15.70	52.4	17.5	1570	19.90	60.5	20.2
	1996	15-100	-	10.30			-	12.40		
Saudi Arabia	1995-2000	30-70	8215	26.40	65.0	32.5	9008	44.00	70.5	35.3
	1987-1992	18-100	2625	16.00			3585	25.80		