

## Appendix 1. Reported prevalence of child and adolescent overweight and obesity

### Classification of obesity and overweight in children and adolescents

The reported prevalence of obesity and overweight will differ considerably when using different criteria or cut-off points for their definition, and these differences – between studies, between countries and at different times – should be kept in mind when evaluating the data presented in this Appendix.

At present, BMI is generally accepted as a valid indirect measure of adipose tissue in both children and adolescents (see the discussion on measuring body fat and defining overweight and obesity, in the section Assessment of Obesity, above). The use of BMI cut-off points of 25 and 30 to define adult overweight and obesity, respectively, has been recommended by the World Health Organization (WHO), but for children their BMI will normally change with age and vary by gender. Thus, age- and gender-specific BMI cut-offs are needed in order to be able to classify overweight and obesity in children and adolescents. A number of different BMI-for-age reference charts have been developed, including the well known American NCHS reference (1), the UK reference (2), and the French reference (3). Currently, the two most widely used international references are those of the WHO/NCHS and the IOTF.

### WHO/NCHS reference

The age-sex-specific BMI 85th and 95th percentiles were developed based on the US NHANES I data collected by the US National Center for Health Statistics (NCHS), Centers for Disease Control and Prevention in 1971–74 (1), and have been widely used in child and adolescent populations to classify overweight and obesity, respectively. A WHO expert committee also recommended these BMI cut-offs for international use to define ‘at risk of overweight’ for adolescents 10–19 years old (4).

For children under 10 years of age, the WHO expert committee suggested using weight-for-height Z-scores, with a value WHZ > 2 to classify ‘overweight’ based on the US NCHS reference (4). In the present Appendix tables this is referred to as ‘WHZ’.

Note that a Z-score of 2 corresponds to the 97.7th percentile, a Z-score of 1.65 to the 95th percentile, and 1.04 to the 85th percentile. Thus, it is not surprising if a

lower prevalence of obesity is recorded using the weight-for-height  $Z > 2$  as the reference, than using the 95th or even 85th BMI percentile.

### IOTF reference

To classify overweight and obesity in young people of 2–18 years of age, Cole *et al.* (5), supported by the IOTF, developed a series of age- and sex-specific BMI cut-off points based on data collected from Brazil, UK, Hong Kong, Singapore, the Netherlands, and the USA. These BMI cut-offs were derived from sex-specific BMI age curves that pass through a BMI of 25 and 30 (the cut-off points used in adults to define overweight and obesity, respectively) at 18 years of age, respectively.

### Notes

‘?’ indicates unknown or not available.

The figures given in column five are percentages and are in the form obesity/overweight, where overweight includes obesity. Thus ‘3/13’ indicates a finding of 3% obesity and 13% overweight including obesity, in the relevant population. All prevalence figures are rounded to the nearest whole number, unless otherwise shown.

Various definitions have been used in different surveys and these are noted in column four.

- ‘WHZ’ refers to the WHO report of 1995 (4) which suggested using standardized deviation (‘Z’) scores to define overweight and obesity. The US NHANES I (1971–74) population was suggested as the reference. In most surveys below we have taken a WHZ score of 1 or more above the mean to be overweight (including obese) and a WHZ of 2 or more to be obese, unless otherwise stated in the table.

- ‘85th and 95th BMI NCHS’ refers to the age-sex-specific BMI 85th and 95th percentiles based on the US NHANES I data collected in 1971–74, which have been widely used to classify overweight and obesity, respectively (1,4).

- ‘IOTF’ refers to the International Obesity TaskForce (IOTF) age-sex-specific BMI cut-offs that correspond to a BMI of 25 and 30 at age 18 for defining overweight and obesity, respectively, in children and adolescents aged 2–18 years (5).

Table A1 (1) Region of the Americas

Country	Date of survey	Age in years/ sample size	Definition	Prevalence (%) of obesity/overweight (including obesity)	Reference
<b>North America</b>					
Canada	1981 1996	7–13/2879 7–13/6277	IOTF	M: 2/11, F: 2/13 M: 10/33, F: 9/27	Tremblay <i>et al.</i> (6)
USA	1971–74 1988–94	6–18/4472 6–18/6108	IOTF overweight 1971–4  1988–94	Children: –/12 Adolescents: –/17 Children: –/22 Adolescents: –/27	Wang & Wang (7)
	1963–74 1988–94	0–5/? 0–5/291 749	WHZ > 2	2 5	De Onis & Blossner (8)
	1960–1994	6–17/NHES and NHANES national samples	>95th and >85th NCHS BMI centile 1960–65 1971–74 1976–80 1988–94  1960–65 1971–74 1976–80 1988–94	Boys 6–11y Boys 12–17y 5/15 5/15 7/18 5/15 8/20 5/16 11/22 13/22 Girls 6–11y Girls 12–17y 5/15 5/15 4/14 7/20 7/16 6/16 11/23 9/21	Troiano <i>et al.</i> (9)
	1963–2000	2–19/NHES & NHANES national samples	>95th 2000 CDC BMI centile 1963–70 1971–74 1976–80 1988–94 1999–2000 >85th 2000 CDC BMI centile 1999–2000	2–5y 6–11y 12–19y – 4 5 5 4 6 5 7 5 7 11 11 10 15 16 21 30 30	Ogden <i>et al.</i> (10)
	1960–1994	6–17/?	IOTF 1960–1970 1971–1974 1976–1980 1988–1994  1960–1970 1971–1974 1976–1980 1988–1994	Boys 6–11 Boys 12–17 2/10 3/15 2/12 3/16 4/14 3/16 7/22 8/28 Girls 6–11 Girls 12–17 3/14 4/15 2/13 6/20 4/14 4/16 8/25 8/28	Flegal <i>et al.</i> (11)
<b>South and Central America</b>					
Bolivia	1989 1997	2–5/? 2–5/?	WHZ > 2/WHZ > 1 5/23	2/16	Martorell <i>et al.</i> (12)
	1989 1998	0–5/? 0–5/57 737	WHZ > 2	5	De Onis & Blossner (8)
Brazil	1974 1997	6–18/56 295 6–18/4875	IOTF overweight (incl obese) 1974  1997	All: 4 6–9y: 5, 10–18y: 4 Urban: 5, Rural: 3 All: 14 6–9y: 17, 10–18y: 13 6–9y: 17, 10–18y: 13	Wang <i>et al.</i> (13)
	1986 1996	2–5/? 2–5/?	WHZ > 2/WHZ > 1	3/15 4/15	Martorell <i>et al.</i> (12)
	1975 1996	0–5/? 0–5/3815	WHZ > 2	8 5	De Onis & Blossner (8)

Table A1 (1) Continued

Country	Date of survey	Age in years/ sample size	Definition	Prevalence (%) of obesity/overweight (including obesity)	Reference
Chile	1987	6/166 891	WHZ > 2/WHZ > 1		Kain <i>et al.</i> (14)
	2000	6/199 444	1987	M: 7/22, F: 8/25	
			2000	M: 17/37, F: 19/40	
			IOTF		
	1987		1987	M: 2/12, F: 2/14	De Onis & Blossner (8)
	2000		2000	M: 7/26, F: 8/27	
	1986	0–6/?	WHZ > 2	11	Martorell <i>et al.</i> (12)
	1996	0–6/ > 1m		7	
Columbia	1986	2–5/?	WHZ > 2/WHZ > 1	4/18	De Onis & Blossner (8)
	1995	2–5/?		2/12	
	1986	0–3/?	WHZ > 2	5	De Onis & Blossner (8)
	1995	0–5/4408		3	
Costa Rica	1982	0–6/?	WHZ > 2	2	Martorell <i>et al.</i> (12)
	1996	1–7/1008		6	
Dominican Rep.	1986	2–5/?	WHZ > 2/WHZ > 1	3/12	De Onis & Blossner (8)
	1996	2–5/?		5/15	
	1986	0–3/?	WHZ > 2	3	Martorell <i>et al.</i> (12)
	1996	0–5/3481		5	
El Salvador	1988	2–5/?	WHZ > 2/WHZ > 1	1/7	De Onis & Blossner (8)
	1993	2–5/?		2/10	
Guatemala	1987	2–5/?	WHZ > 2, WHZ > 1	<1/5	Martorell <i>et al.</i> (12)
	1995	2–5/?	2	/10	
	1987	0–3/?	WHZ > 2	3	De Onis & Blossner (8)
	1995	0–5/7768		4	
Haiti	1978	0–5/?	WHZ > 2	<1	Martorell <i>et al.</i> (12)
	1994–95	0–5/2794		3	
Honduras	1987	2–5/?	WHZ > 2/WHZ > 1	1/7	De Onis & Blossner (8)
	1996	2–5/?		1/5	
	1987	0–5/?	WHZ > 2	2	Gurney & Gorstein (15)
	1996	1–5/1307		1	
Jamaica	Before 1988	0–5/?	WHZ > 2	10	De Onis & Blossner (8)
	1993	0–5/663	WHZ > 2	6	
Nicaragua	Before 1988	0–5/?	WHZ > 2	2	Gurney & Gorstein (15)
	1994	2–5/?	WHZ > 2/WHZ > 1	2/12	
	1998	2–5/?		3/14	
	1994	0–5/?	WHZ > 2	2	De Onis & Blossner (8)
	1998	0–5/3546		3	
Peru	Before 1988	0–5/?	WHZ > 2	4	Gurney & Gorstein (16)
	1992	2–5/?	WHZ > 2/WHZ > 1	4/21	
	1996	2–5/?		5/24	
	1991–92	0–5/?	WHZ > 2	5	De Onis & Blossner (8)
	1996	0–5/13 431		6	
Trinidad & Tobago	1976	0–5/?	WHZ > 2	5	De Onis & Blossner (8)
	1987	0–3/840	3		
	2000	5–10/5688	IOTF	2/9	Gulliford <i>et al.</i> (16)
Uruguay	2000?	9–12/886	>95th and >85th national reference centile	Urban: 9/26	Pisabarro (personal communication, 2003)
Venezuela	1981–82	0–5/?	WHZ > 2	3	De Onis & Blossner (8)
	1997	0–5/291 749		3	

Country/region	Dates of survey	Age in years/ sample size	Classification of obesity	Prevalence (%) of obesity/ overweight (including obesity)	Reference
Austria (Vienna)	2002–03	10–15/1 537	>97th/>90th local reference centiles	M: 9/18 F: 5/16	Widhalm & Dietrich (personal communication, 2003)
Bosnia & Herzegovina	2000	0–5/2569	WHZ > 3, WHZ > 2	M: 4/12, F: 5/15 Urban: 6/14 Rural: 4/13	UNICEF (17)
Croatia	1993–94 1995–96	1–6/? 1–6/26 036	WHZ > 2	4 6	De Onis & Blossner (8)
Czech Rep.	1991	?/? (national reference survey)	>97th/>90th Czech reference centiles	3/10	Bláha & Vignerová (18)
	2000	7–11/3345	>97th/>90th Czech reference centiles	6/13	
	2000	7–11/3345	IOTF	4/16	
Finland	1977–1999	12–18/66 211	IOTF (height and weight self-assessed) 1977 1999	M: 1/8, F: <1/5 M: 3/19, F: 1/11	Kautiainen <i>et al.</i> (19)
France	1980 1990	4–17/6697 4–17/5795	> 97th and >90th 1980 French BMI centiles	3/10 3/12	Rolland-Cachera <i>et al.</i> (20)
	2000	7–9/1582	IOTF >95th and >85th NCHS BMI centiles	4/18 (IOTF) 9/24 (NCHS)	Rolland-Cachera <i>et al.</i> (20)
Germany	1975 1995	7–14/2002 7–14/1901	>97th and >90th French BMI centiles	M: 5/10, F: 5/12 M: 8/16, F: 10/21	Kromeyer-Hauschild <i>et al.</i> (22)
	1982 1997	5–6/95 806	IOTF	2/10 3/15	Kalies <i>et al.</i> (23)
	1996–98	5–7/1350	>90th local BMI centile	19	Langnase <i>et al.</i> (24)
Greece	1992 1995 1998	6/1046 9/579 12/831	>95th and >85th NCHS BMI centiles 1992 1995 1998  1992 1995 1998	Boys 6y: 11/23 9y: 5/19 12y: 18/24 Girls 6 y: 9/29 9y: 5/18 12y: 5/19	Mamalakis <i>et al.</i> (25)
			IOTF 1992 1995 1998 2002  1992 1995 1998 2002	Boys 6y: 10/22 9y: 10/30 12y: 14/40 15y : 13/44 Girls 6 y: 7/28 9y: 9/36 12y: 9/37 15y: 9/27	Moschandreas, personal communication, 2002
	2000?	11–16/4299	IOTF, based on self- reported weight and height	11y M: 2/20, F: 1/13 13y M: 3/27, F: 1/10 15y M: 3/26, F: 1/8	Karayiannis <i>et al.</i> (26)
	2000	6–17/2458	IOTF	All: 4/22 (M: 5/26, F: 3/19) 6–10y: 6/25 (M: 7/27, F: 5/25) 11–17y: 3/19 (M: 4/25, F: 2/13)	Krassas <i>et al.</i> (27)

Table A1 (2) Continued

Country/region	Dates of survey	Age in years/ sample size	Classification of obesity	Prevalence (%) of obesity/ overweight (including obesity)	Reference
Italy	1992	4–12/1523	W/H > 120% of French standards.	M: 16/30, F: 11/22	Maffei <i>et al.</i> (28)
	2001	9/41 149	IOTF	All: 12/36 M: 13/36, F: 11/36	Caroli (personal communication, 2002)
	1994–2000	6–20/54 795	Locally-determined IOTF-method BMI cut-offs	Southern Italy M: 5/27, F: 4/19 Central-north Italy M: 2/17, F: 1/10	Cacciari <i>et al.</i> (24)
Netherlands	1980 1996–97	0–21/14 500	>90th 1980 Dutch BMI centile	10 14–22	Fredriks <i>et al.</i> (30) Oblacińska (31)
Poland	1994	6–17/2098 170	>97th/90th national reference centile	3/8	
	1996–1999	5–9.9/1333 10–17.9/1719	IOTF	M: 4/20, F: 4/20 M: 8/25, F: 1/12	Palczewska (personal communication, 2002)
	2000	7–9/2957	IOTF	M: 3/14, F: 3/14	Malecka-Tendera (personal communication, 2002)
Portugal	2002–2003	7–10/4503	IOTF	M: 9/28 F: 12/33	Padez <i>et al.</i> (32)
Russia	1992	6–18/6883	IOTF	Overweight (incl obese) All: 16 6–10 y: 26, 10–18 y: 12	Wang <i>et al.</i> (13)
	1998	6–18/2152		All: 9 6–10y: 10, 10–18y: 9	
Spain	1980	6–14/2864	IOTF	M: 2/12, F: 1/14	Moreno <i>et al.</i> (33)
	1995	6–14/1360		M: 2/20, F: 3/18	
	1985	6–15/90 997	>95th NCHS BMI centile	Children: M: 7, F: 10 Adolescents: M: 3, F: 1	Moreno <i>et al.</i> (34, 35)
	1995	6–15/106 284		Children M: 14, F: 18 Adolescents M: 6, F: 2	
	1985	6–15/1131	>95th and >85th	3/14	Rios <i>et al.</i> (36)
	1995	6–15/903	Spanish ref. BMI centiles	7/25	
Sweden	1997	12–18/2747	>98th and >91st 'on an international reference BMI curve'	M: 12y: 8/20 15y: 9/21 18y: 7/19 F: 12y: 5/12 15y: 4/10 18y: 4/9	Berg <i>et al.</i> (37)
	2000–01	10/6700	IOTF overweight	–/18	Mårild (personal communication, 2002)
Switzerland	1980	15–16/1866	>97th BMI French reference	M: 4, F: 3	Woringer & Schutz (38); Schutz & Woringer (39) Woringer & Schutz (37); Schutz & Woringer (38) Zimmermann <i>et al.</i> (40)
	1990	15–16/1212		M: 9, F: 5	
	1975	10/?	>97th BMI French reference	M: 4, F: 5	
	1985			M: 8, F: 9	
	1999	6–12/595	>95th and >85th NCHS BMI centiles	All: 10/24 M: 9/23, F: 10/25	
UK	England:		IOTF		Chinn and Rona (41)
	1974	4–11/8010		M: 1/6, F: 2/9	
	1984	4–11/6267		M: 1/5, F: 1/9	
	1994	4–11/5874		M: 2/9, F: 3/14	
	1998	7–11/1 198		M: 5/17, F: 4/24	Lobstein <i>et al.</i> (42)

Table A1 (2) Continued

Country/region	Dates of survey	Age in years/ sample size	Classification of obesity	Prevalence (%) of obesity/ overweight (including obesity)	Reference
	Scotland:				
	1974	4–11/2250		M: 2/5, F: 2/9	Chinn & Roma (41)
	1984	4–11/4246		M: 1/6, F: 2/10	
	1994	4–11/4108		M: 2/10, F: 3/16	
	1989	1–3 months/4263 3–4 yrs/2728	>95th and >85th UK BMI centiles	1–3 month: 3/11 3–4y: 5/15	Bundred <i>et al.</i> (43)
	1998	1–3 months/2881 3–4 yrs/2633		1–3 month: 4/12 3–4y: 9/24	
Yugoslavia	Before 1988	0–5/?	WHZ > 2	3	Gurney & Gorstein (15)
	1996	0–5/3228	WHZ > 2	13	Federal Republic of Yugoslavia (44)
	2000	0–5/1647		14	
	1998	9–10/6288	IOTF overweight	M: –/17, F: –/16	Pavlovic (personal communication, 2002)

Table A1 (3) North African – Middle Eastern region

Country	Date of survey	Age in years/ sample size	Definition	Prevalence (%) of obesity/ overweight (including obesity)	Reference
Algeria	2003	6–17/850	IOTF	M: 0/6, F: 1/7	Abdel-Nacer (personal communication, 2003)
Bahrain	2002	12–17/506	IOTF	M: 15/30, F: 18/42	Al-Sendi <i>et al.</i> (45)
Cyprus	1999–2000	6–17/2467	>95th and >85th NCHS BMI centiles IOTF	M: 10/27, F: 9/22 M: 7/25, F: 6/23	Savva <i>et al.</i> (46)
Egypt	1978	0–5/?	WHZ > 2	2	De Onis & Blossner (8)
	1995–96	0–5/9766		3	
	1992	2–5/?	WHZ > 2/WHZ > 1	9/26	Martorell <i>et al.</i> (12)
	1996	2–5/?		8/25	
	1997	10–19/1999	>95th and >85th NCHS BMI centiles	4/14	Ibrahim <i>et al.</i> (47)
Iran	Before 1988	0–5/?	WHZ > 2	6	Gurney & Gorstein (15)
	1995	0–5/11 139	WHZ > 2	3	De Onis & Blossner (8)
	1995	14–21/1000	BMI > 25	F: 5	Janghorbani & Parvin (48)
	1995	2–5/4315	IOTF	M: 9/29, F: 10/32	Dorosty <i>et al.</i> (49)
Kuwait	1996–1997	0–5/12 376	WHZ > 2	6	De Onis & Blossner (8)
	Before 1998	0–5/7419	WHZ > 2	All: 8 M: 8, F: 9	Al-Isa & Moussa (50)
	Before 2000	6–10/8957	WHZ > 2	M: 16, F: 14	Al-Isa & Moussa (51)
Jordan	Before 1988	0–5/?	WHZ > 2	2	Gurney & Gorstein (15)
	1990	0–5/6601	WHZ > 2	6	De Onis & Blossner (8)
Morocco	1987	<5/?	?WHZ > 2	3	Benjelloun (52)
	1997			9	
	1987	0–5/?	WHZ > 2	3	De Onis & Blossner (8)
	1992	0–5/4532		7	
Saudi Arabia	1994–95	6–18/9061	Obesity > 120% median BMI Overweight > 110% median BMI	M: 16/28	al-Nuaim <i>et al.</i> (53)
	1994–98	1–18/12 701	IOTF	M: 6/17, F: 7/19	El-Hazmi and Warsy (54)
Tunisia	1973–75	0–6/?	WHZ > 2	1	De Onis & Blossner (8)
	1988	0–3/1996		4	
Yemen	1991–92	2–5/1452	WHZ > 2/WHZ > 1	4/11	Martorell <i>et al.</i> (12)
	1996	0–5/3833	WHZ > 2	4	De Onis & Blossner (8)

**Table A1 (4)** Asia-Pacific region

Country	Date of survey	Age in years/ sample size	Definition	Prevalence (%) of obesity/ overweight (including obesity)	Reference
Australia	1985 1995 1995	7–15/8492 7–15/1586 2–18/2962	IOTF	M: 1/11, F: 1/12 M: 5/20, F: 6/22 M: 5/20, F: 5/21	Magarey <i>et al.</i> (55)
Bangladesh	1982–83 1996–97	0–5/n/a 0–5/4787	WHZ > 2	<1 1	De Onis & Blossner (8)
China					
—Mainland	1992	0–17/27 000	For 0–5y, WHZ > 2 For 10–17y, 85th NCHS BMI centile	0–5y: rural 2, urban 4 10–17y: M: 5, F: 4	Ge (56)
	1991 1997	6–18/3014 6–18/2688	IOTF overweight (incl obese)		Wang <i>et al.</i> (13)
			1991	All 6 rural 6, urban 8 6–9y: 11, 10–18y: 5 All: 8 rural 6, urban 12 6–9y: 11, 10–18y: 6 All: 4/16 urban 2/15, rural 5/17 All: 6/16 urban 13/29, rural 5/12	
	1989	2–6/944	IOTF		Luo & Hu (57)
	1997	2–6/483			
—Hong Kong	1985 1995 1993	6–18/264 000 0–18/25 000	>120% median weight- for-height, local ref. >120% median weight- for-height, Hong Kong ref.	M: 3, F: 3 M: 8, F: 7 M: 13, F: 11	Ke-You and Da-Wei (58) Leung <i>et al.</i> (59)
	1998/99 1999/00 2000–01 2001/02	6–18/ 410 512 434 195 468 852 501 824	>120% median weight- for-height, Hong Kong ref. 1998/99 1999/00 2000/01 2001/02	13 14 14 14	Hong Kong Dept Health (60); Tsang (personal communication, 2002)
—Taiwan	1980–82 1994–96	12–15/1980 12–15/1366	Obesity > 120% 'ideal body weight' Overweight > 110% 'ideal body weight'	M: 12/25, F: 10/21 M: 16/28, F: 11/21	Chu (61)
India	'Pre-1988' 1992–93 1982–83	0–5/? 0–4/25 584 9–16/658 middle- class	WHZ > 2 WHZ > 2 >85th NCHS BMI centile	1 2 M: 5	Gurney & Gorstein (15) De Onis & Blossner (8) De Onis & Blossner (8)
	Before 2002	13–18/4700 urban	IOTF	M: 4/18, F: 3/16	Ramachandran <i>et al.</i> (62)
Indonesia	Before 1988 1990	0–5/? 0–5/9227	WHZ > 2 WHZ > 2	2 4	Gurney & Gorstein (15) De Onis & Blossner (8)
Japan	1974 1995	6–14/8817 6–14/6802	Obesity > 140% 'standard body weight' Overweight > 120% 'standard body weight'	6/7 11/14	Kotani <i>et al.</i> (63)
	1970 1996	6–14/? 6–14/?	>120% 'standard body weight'	M: 1–4, F: 2–9 M: 5–11, F: 5–9	Murata (64)
Malaysia	1994–95	7–16/6239	WHZ > 2/WHZ > 1	All: 4/10 M: 4/11, F: 3/8 7–9y : 6 10–12y: 21	Kasmini <i>et al.</i> (65)
	'Pre-2002'	7–12/11 203	For 7–9y, WHZ > 2 For 10–12y, >85th NCHS BMI centile		Lahti-Koski & Gill (personal communication, 2002)
	2002	7–10y/5995 urban	>95th NCHS BMI centile	M: 10, F: 7	Tee <i>et al.</i> (66)
Nepal	1975 1996	0–5/? 0–5/3705	WHZ > 2	<1 <1	De Onis & Blossner (8)

Table A1 (4) Continued

Country	Date of survey	Age in years/ sample size	Definition	Prevalence (%) of obesity/ overweight (including obesity)	Reference
New Zealand	'Pre-2001'	5–11/2273	>95th NCHS BMI centile	14	Tyrrell <i>et al.</i> (67)
Pakistan	1977 1990–91 2000?	0–5/? 0–5/4056 5–17/1070	WHZ > 2  IOTF	4 3 All ages M: 5/13, F: 4/13 5–11 y M: 5/15, F: 7/18 12–17 y M: 5/11, F: 2/9	De Onis & Blossner (8)  Hakeem (personal communication, 2002)
Philippines	1971–75 1993 1998	0–6/? 0–5/4229 5–10.9 11–17.9	WHZ > 2  IOTF	<1 <1 5–10.9y M:<1/1 F <1/2 11–17.9y M:<1/1 F:<1/3	De Onis & Blossner (8)  Barba & Duante (personal communication, 2003)
Singapore	1970–77 1976–1980  1976  1983	0–6/9655 6–12/440 092  6–12/705 511	WHZ > 2 >120% 'ideal weight for height' >120% 'ideal weight for height'	<1 All: 4 M: 4, F: 3 M: 1, F: 1 6–7y: 1, 11–12y: 2 M: 8, F: 9 6–7y: 3, 11–12y: 12	De Onis & Blossner (8) Ho <i>et al.</i> (68)  Ho <i>et al.</i> (69)
Solomon Islands	1970 1989	0–5/? 0–5/3981	WHZ > 2	3 1	De Onis & Blossner (8)
South Korea	Before 2002?	5–16/54 813	Reference centiles (?)	3–11	Lahti-Koski & Gill (personal communication, 2002)
Sri Lanka	1977–78 1987	0–5/? 0–5/1994	WHZ > 2	<1 <1	De Onis & Blossner (8)
Thailand	1987 1987 1991 1993	0–3/1856 1–3/1352 6–13/2161	WHZ > 2 WHZ > 2/WHZ > 1 >120% 'ideal weight for height'	1 <1/2 12 16	De Onis & Blossner (8) Martorell <i>et al.</i> (12) Mo-Suwan <i>et al.</i> (70)
Vietnam	1992–93 1998	0–5/? 0–5/12 919	WHZ > 2	2 <1	De Onis & Blossner (8)



**Table A1 (5)** African region

Country	Date of survey	Age in years/ sample size	Definition used	Prevalence (%) of obesity/ overweight (including obesity)	Reference
Ghana	1987–88	0–5/?	WHZ > 2	1	De Onis & Blossner (8)
	1993–94	0–3/1819		2	
Madagascar	1983–84	0–2/?	WHZ > 2	2	De Onis & Blossner (8)
	1993–94	0–3/4240		2	
	1992	2–5/?	WHZ > 2/WHZ > 1	<1/2	Martorell <i>et al.</i> (12)
	1997	2–5/?		<1/2	
Mali	1987	2–5/?	WHZ > 2/WHZ > 1	<1/2	Martorell <i>et al.</i> (12)
	1996	2–5/?		<1/3	
	1987	0–3/?	WHZ > 2	1	De Onis & Blossner (8)
	1995–96	0–3/4678		1	
Mauritius	1985	0–5/?	WHZ > 2	6	De Onis & Blossner (8)
	1995	0–5/1537		4	
Niger	1992	2–5/?	WHZ > 2/WHZ > 1	<1/2	Martorell <i>et al.</i> (12)
	1997	2–5/?		<1/2	
	1992	0–5/?	WHZ > 2	1	De Onis & Blossner (8)
	1998	0–3/4052		<1	
Nigeria	1990	0–5/?	WHZ > 2	2	De Onis & Blossner (8)
	1993	0–6/2664		3	
	Before 1983	6–19/457	Weight for age Triceps skinfold thickness	M: 3, F: 5 M: 4, F: 3	Akesode & Ajibode (71)
	Before 2001	6–18/1005	>95th NCHS BMI centile	3	
Rwanda	1976	0–5 y/?	WHZ > 2	1	De Onis & Blossner (8)
	1992	0–5 y/4386		2	
Senegal	1986	0–3/?	WHZ > 2	2	De Onis & Blossner (8)
	1992–93	0–5/3865		3	
Seychelles	1999	4–18/5514	IOTF	4/16	Stettler <i>et al.</i> (73)
South Africa	1994	3–6/2467	WHZ > 2	7	Popkin <i>et al.</i> (74)
	1994–95	0–5/9807	WHZ > 2	7	De Onis & Blossner (8)
	1996	3–10/1336	>85th US NHANES II BMI centile	Rural: M: <1, F: 1	Monyeki <i>et al.</i> (75)
	2002	13–19/9144	IOTF	Boys: 2/7 Girls 5/25 Black: 4/17 White: 6/23 Indian: 10/25	
Tanzania	1991	2–5/?	WHZ > 2/WHZ > 1	2/8	Martorell <i>et al.</i> (12)
	1996	2–5/?		2/8	
	1991–92	0–6/?	WHZ > 2	3	De Onis & Blossner (8)
	1996	0–3/5344		3	
Togo	1976–77	0–5/?	WHZ > 2	<1	De Onis & Blossner (8) Martorell <i>et al.</i> (12)
	1988	0–3/1396		3	
	1988	2–5/?	WHZ > 2/WHZ > 1	<1/3	
	1998	2–5/?		<1/4	
Uganda	1988	2–5/?	WHZ > 2/WHZ > 1	2/11	Martorell <i>et al.</i> (12)
	1995	2–5/?		2/9	
	1988–89	0–5/?	WHZ > 2	2	De Onis & Blossner (8)
	1995	0–4/4775		3	
Zambia	1992	2–5/?	WHZ > 2/WHZ > 1	2/8	Martorell <i>et al.</i> (12)
	1997	2–5/?		2/11	
	1992	0–5/?	WHZ > 2	3	De Onis & Blossner (8)
	1996–97	0–5/5443		3	
Zimbabwe	1988	0–5/?	WHZ > 2	4	De Onis & Blossner (8)
	1994	0–3/2014		4	

## Sources for Appendix 1, Tables A1(1–5)

1. Must A, Dallal GE, Dietz WH. Reference data for obesity. 85th and 95th percentiles of body mass index (wt/ht<sup>2</sup>) and triceps skinfold thickness. *Am J Clin Nutr* 1991; 53: 839–846 (See also correction. *Am J Clin Nutr* 1991; 54: 773).
2. Cole TJ, Freeman JV, Preece MA. Body mass index reference curves for the UK 1990. *Arch Dis Child* 1995; 73: 25–29.
3. Rolland-Cachera MF, Cole TJ, Sempe M, Tichet J, Rossignol C, Charraud A. Body Mass Index variations: centiles from birth to 87 years. *Eur J Clin Nutr* 1991; 45: 13–21.
4. World Health Organization. *Report of a WHO Expert Committee. Physical status: the use and interpretation of anthropometry*. Technical Report Series no. 854. WHO: Geneva 1995.
5. Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. *BMJ* 2000; 320: 1240–1243.
6. Tremblay MS, Katzmarzyk PT, Willms JD. Temporal trends in overweight and obesity in Canada 1981–1996. *Int J Obes Relat Metab Disord* 2002; 26: 538–543.
7. Wang Y, Wang JQ. A comparison of international references for the assessment of child and adolescent overweight and obesity in different populations. *Eur J Clin Nutr* 2002; 56: 973–982.
8. de Onis M, Blossner M. Prevalence and trends of overweight among preschool children in developing countries. *Am J Clin Nutr* 2000; 72: 1032–1039.
9. Troiano RP, Flegal KM, Kuczmarski RJ, Campbell SM, Johnson CL. Overweight prevalence and trends for children and adolescents. The National Health and Nutrition Examination Surveys 1963–91. *Arch Pediatr Adolesc Med* 1995; 149: 1085–1091.
10. Ogden CL, Flegal KM, Carroll MD, Johnson CL. Prevalence and trends in overweight among US children and adolescents 1999–2000. *JAMA* 2002; 288: 1728–1732.
11. Flegal KM, Ogden CL, Wei R, Kuczmarski RL, Johnson CL. Prevalence of overweight in US children. comparison of US growth charts from the Centers for Disease Control and Prevention with other reference values for body mass index. *Am J Clin Nutr* 2001; 73: 1086–1093.
12. Martorell R, Kettel Khan L, Hughes ML, Grummer-Strawn LM. Overweight and obesity in preschool children from developing countries. *Int J Obes* 2000; 24: 959–967.
13. Wang Y, Monteiro C, Popkin BM. Trends of obesity and underweight in older children and adolescents in the United States, Brazil, China, and Russia. *Am J Clin Nutr* 2002; 75: 971–977.
14. Kain J, Uauy R, Vio F, Albala C. Trends in overweight and obesity prevalence in Chilean children: comparison of three definitions. *Eur J Clin Nutr* 2002; 56: 200–204.
15. Gurney M, Gorstein J. The global prevalence of obesity – an initial overview of available data. *World Health Stat Q* 1988; 41: 251–254.
16. Gulliford MC, Mahabir D, Locke B, Chinn S, Rona R. Overweight, obesity and skinfold thicknesses of children of African or Indian descent in Trinidad and Tobago. *Int J Epidemiol* 2001; 30: 989–998.
17. UNICEF Bosnia and Herzegovina (December 2000). *National Report on Follow-up to the World Summit for Children, Bosnia & Herzegovina*. [WWW document] URL: <http://www.unicef.org/bosnia/Download/edr-all.pdf>, and Table 16 of the BIH MICS tables URL: <http://www.unicef.org/bosnia/Download/tables.pdf>.
18. Bláha P, Vignerová J (eds). *Investigation of the Growth of Czech Children and Adolescents: Normal, Underweight and Overweight*. National Institute of Public Health: Prague, 2002, Table II.3-2.
19. Kautiainen S, Rimpelä A, Vikat A, Virtanen SM. Secular trends in overweight and obesity among Finnish adolescents in 1977–1999. *Int J Obes* 2002; 26: 544–552.
20. Rolland-Cachera MF, Bellisle F, Deheeger M. Nutritional status and food intake in adolescents living in Western Europe. *Eur J Clin Nutr* 2000; 54(Suppl. 1): 41S–46S. Review.
21. Rolland-Cachera MF, Castetbon K, Arnault N, Bellisle F, Romano MC, Lehingue Y, Frelut ML, Hercberg S. Body mass index in 7–9-y-old French children: frequency of obesity, overweight and thinness. *Int J Obes* 2002; 26: 1610–1616.
22. Kromeyer-Hauschild K, Zellner K, Jaeger U, Hoyer H. Prevalence of overweight and obesity among school children in Jena (Germany). *Int J Obes* 1999; 23: 1143.
23. Kalies H, Lenz J, von Kries R. Prevalence of overweight and obesity and trends in body mass index in German pre-school children. *Int J Obes* 2002 1982–97; 26: 1211–1217.
24. Langnase K, Mast M, Muller MJ. Social class differences in overweight of prepubertal children in northwest Germany. *Int J Obes Relat Metab Disord* 2002; 26: 566–572.
25. Mamalakis G, Kafatos A, Manios Y, Anagnostopoulou T, Apostolaki I. Obesity indices in a cohort of primary school children in Crete: a six year prospective study. *Int J Obes* 2000; 24: 765–771.
26. Karayiannis D, Yannakoulia M, Terzidou M, Sidossis LS, Kokkevi A. Prevalence of overweight and obesity in Greek school-aged children and adolescents. *Eur J Clin Nutr* 2003; 57: 1189–1192.
27. Krassas GE, Tzotzas T, Tsamietis C, Konstantinidis T. Prevalence and trends in overweight and obesity among children and adolescents in Thessaloniki, Greece. *J Pediatr Endocrinol Metab* 2001; 14: 1319–1326.
28. Maffei C, Schutz Y, Piccoli R, Gonfiantini E, Pinelli L. Prevalence of obesity in children in north-east Italy. *Int J Obes* 1993; 17: 287–294.
29. Cacciari E, Milani S, Balsamo A, Dammacco F, De Luca F, Chiarelli F, Pasquino AM, Tonini G, Vanelli M. Italian cross-sectional growth charts for height, weight and BMI (6–20y). *Eur J Clin Nutr* 2002; 56: 171–180.
30. Fredriks AM, van Buuren S, Wit JM, Verloove-Vanhorick SP. Body index measurements in 1996–7 compared with. *Arch Dis Child* 2000 1980; 82: 107–112.
31. Oblacińska A, Wroclawska M, Woynarowska B. Frequency of overweight and obesity in the school-age population in Poland and health care for pupils with these disorders. *Pediatrics Polska* 1997; 72: 241–245.
32. Padez C, Fernandes T, Marques V, Moreira P, Mourao I. Portuguese prevalence study of obesity in childhood: the role of socio-demographic factors. *Symposium on Childhood Obesity*, Loughborough, UK, December 2003.
33. Moreno LA, Sarria A, Fleta J, Rodríguez G, Pérez-González JM, Bueno M. Sociodemographic factors and trends on overweight prevalence in children and adolescents in Aragón (Spain) from 1985 to 1995. *J Clin Epidemiol* 1985; 54: 921–927.
34. Moreno LA, Fleta J, Sarria A, Rodríguez G, Bueno M. Secular increases in body fat percentage in male children of Zaragoza 1980–1995. *Spain Prev Med* 2001; 33: 357–363.
35. Moreno LA, Sarria A, Fleta J, Rodríguez G, Bueno M. Trends in body mass index and overweight prevalence among children and adolescents in the region of Aragón (Spain) from 1985 to 1995. *Int J Obes* 2000; 24: 925–931.
36. Rios M, Fluiters E, Perez Mendez LF, Garcia-Mayor EG, Garcia-Mayor RV. Prevalence of childhood overweight in Northwestern Spain. a comparative study of two periods with a ten year interval. *Int J Obes* 1999; 23: 1095–1098.

37. Berg IM, Simonsson B, Brantefor B, Ringqvist I. Prevalence of overweight and obesity in children and adolescents in a county in Sweden. *Acta Paediatr* 2001; **90**: 671–676.
38. Woringer W, Schutz Y. What is the evolution of body mass index (BMI) in Swiss children from five to sixteen years, measured one decade apart? *Int J Obes* 1998; **22**: S209.
39. Schutz Y, Woringer V. Obesity in Switzerland: a critical assessment of prevalence in children and adults. *Int J Obes* 2002; **26**: S3–S11.
40. Zimmermann MB, Hess SY, Hurrell RF. A national study of the prevalence of overweight and obesity in 6–12-year-old Swiss children: body mass index, body-weight perceptions and goals. *Eur J Clin Nutr* 2000; **54**: 568–572.
41. Chinn S, Rona RJ. Prevalence and trends in overweight and obesity in three cross sectional studies of British children, 1974–94. *BMJ* 2001; **322**: 24–26.
42. Lobstein TJ, James WPT, Cole TJ. Increasing levels of excess weight among children in England. *Int J Obes* 2003; **27**: 1136–1138.
43. Bundred P, Kitchiner D, Buchan I. Prevalence of overweight and obese children between 1989 and 1998: population based series of cross sectional studies. *BMJ* 2001; **322**: 1–4.
44. UNICEF. Federal Republic of Yugoslavia. *Unicef National Report on the Follow-up to the World Summit for Children*. Belgrade, February 2001.
45. Al-Sendi AM, Shetty P, Musaiger AO. Prevalence of overweight and obesity among Bahraini adolescents. a comparison between three different sets of criteria. *Eur J Clin Nutr* 2003; **57**: 471–474.
46. Savva SC, Kourides Y, Tornaritis M, Epiphaniou-Savva M, Chadjigeorgiou C, Kafatos A. Obesity in children and adolescents in Cyprus. Prevalence and predisposing factors. *Int J Obes* 2002; **26**: 1036–1045.
47. Ibrahim B, Sallam S, Tawila S EI, Gibaly O EI, Sahn F EI. *Transitions to Adulthood, a National Survey of Egyptian Adolescents*. The Population Council: New York, 2000, pp. 25–30.
48. Janghorbani M, Parvin F. Prevalence of overweight and thinness in high-school girls in Kerman, Iran. *Int J Obes* 1998; **22**: 629–633.
49. Dorosty AR, Siassi F, Reilly JJ. Obesity in Iranian children. *Arch Dis Child* 2002; **87**: 388–391.
50. Al-Isa AN, Moussa MA. Obesity among Kuwaiti pre-school children aged 0–5 years: prevalence and comparison with the NCHS/CDC reference population. *Nutr Health* 1998; **12**: 235–246.
51. Al-Isa AN, Moussa MA. Nutritional status of Kuwaiti elementary school children aged 6–10 years: comparison with the NCHS/CDC reference population. *Int J Food Sci Nutr* 2000; **51**: 221–228.
52. Benjelloun S. Nutrition transition in Morocco. *Public Health Nutr* 2002; **5**: 135–140.
53. Al-Nuaim AR, Bamgboye EA, al-Herbish A. The pattern of growth and obesity in Saudi Arabian male school children. *Int J Obes* 1996; **20**: 1000–1005.
54. El-Hazmi MA, Warsy AS. A comparative study of prevalence of overweight and obesity in children in different provinces of Saudi Arabia. *J Trop Pediatr* 2002; **48**: 172–177.
55. Magarey AM, Daniels LA, Boulton TJ. Prevalence of overweight and obesity in Australian children and adolescents: reassessment of 1985 and 1995 data against new standard international definitions. *Med J Aust* 2001; **174**: 561–564.
56. Ge K. *The Dietary and Nutritional Status of Chinese Population—Children and Adolescents*. (1992 National Nutrition Survey). People's Medical Publishing House: Beijing, 1999.
57. Luo J, Hu FB. Time trends of obesity in pre-school children in China from 1989 to 1997. *Int J Obes* 2002; **26**: 553–558.
58. Ke-You G, Da-Wei F. The magnitude and trends of under- and over-nutrition in Asian countries. *Biomed Environ Sci* 2001; **14**: 53–60.
59. Leung SS, Lau JT, Tse LY, Oppenheimer SJ. Weight-for-age and weight-for-height references for Hong Kong children from birth to 18 years. *J Paediatr Child Health* 1996; **32**: 103–109.
60. Hong Kong Department of Health (HKDH) (2002). *Obesity Among Hong Kong Schoolchildren is Rising*. [WWW document]. URL <http://news.sohu.com/79/98/news204679879.shtml>.
61. Chu NF. Prevalence and trends of obesity among school children in Taiwan – the Taipei Children Heart Study. *Int J Obes* 2001; **25**: 170–176.
62. Ramachandran A, Snehalatha C, Vinitha R, Thayyil M, Kumar CK, Sheeba L, Joseph S, Vijay V. Prevalence of overweight in urban Indian adolescent school children. *Diabetes Res Clin Pract* 2002; **57**: 185–190.
63. Kotani K, Nishida M, Yamashita S, Funahashi T, Fujioka S, Tokunaga K, Ishikawa K, Tarui S, Matsuzawa Y. Two decades of annual medical examinations in Japanese obese children: do obese children grow into obese adults? *Int J Obes* 1997; **21**: 912–921.
64. Murata M. Secular trends in growth and changes in eating patterns of Japanese children. *Am J Clin Nutr* 2000; **72**: 1379S–1383S.
65. Kasmini K, Idris MN, Fatimah A, Hanafiah S, Iran H, Asmah Bee MN. Prevalence of overweight and obese school children aged between 7 and 16 years amongst the major 3 ethnic groups in Kuala Lumpur, Malaysia. *Asia Pacific J Clin Nutr* 1997; **6**: 172–174.
66. Tee ES, Khor SC, Ooi HE, Young SI, Zakariah O, Zulkafli H. Regional study of nutritional status of urban primary schoolchildren. 3 Kuala Lumpur, Malaysia. *Food Nutr Bull* 2002; **23**: 41–47.
67. Tyrrell VJ, Richards GE, Hofman P, Gillies GF, Robinson E, Cutfield WS. Obesity in Auckland school children: a comparison of the body mass index and percentage body fat as the diagnostic criterion. *Int J Obes* 2001; **25**: 164–169.
68. Ho TF, Chay SO, Yip WC, Tay JS, Wong HB. The prevalence of obesity in Singapore primary school children. *Aust Paediatr J* 1983; **19**: 248–250.
69. Ho TF. Eleventh Haridas memorial lecture. Childhood obesity in Singapore primary school children: epidemiological review and anthropometric evaluation. *J Singapore Paediatr Soc* 1985; **27**: 5–40.
70. Mo-suwan L, Junjana C, Puetpaiboon A. Increasing obesity in school children in a transitional society and the effect of the weight control program. *Southeast Asian J Trop Med Public Health* 1993; **24**: 590–594.
71. Akesode FA, Ajibode HA. Prevalence of obesity among Nigerian school children. *Soc Sci Med* 1983; **17**: 107–111.
72. Ansa VO, Odigwe CO, Anah MU. Profile of body mass index and obesity in Nigerian children and adolescents. *Niger J Med* 2001; **10**: 78–80.
73. Stettler N, Bovet P, Shamlaye H, Zemel BS, Stallings VA, Paccaud F. Prevalence and risk factors for overweight and obesity in children from Seychelles, a country in rapid transition: the importance of early growth. *Int J Obes* 2002; **26**: 214–219.
74. Popkin BM, Richards MK, Montiero CA. Stunting is associated with overweight in children of four nations that are

undergoing the nutrition transition. *J Nutr* 1996; **126**: 3009–3016.

75. Monyeki KD, van Lenthe FJ, Steyn NP. Obesity: does it occur in African children in a rural community in South Africa? *Int J Epidemiol* 1999; **28**: 287–292.

76. Reddy SP, Panday S, Swart D, Jinabhai CC, Amosun SL, James S, Monyeki KD, Stevens G, Morejele N, Kambaran NS, Omdien RG, Van den Borne HW. *Umtshethe Uhlaba Usamila – the South African Youth Risk Assessment Survey 2002*. South African Medical Research Council: Cape Town, 2003, table 22.