

The emergence of obesity among Australian Aboriginal children

*Natalie Phillips¹, Maciej Henneberg^{1,2}, Nicholas Norgan³, Lincoln Schmitt⁴,
Caroline Potter¹, Stanley Ulijaszek¹*

¹Unit for Biocultural Variation and Obesity, School of Anthropology, University of Oxford, UK

²Biological Anthropology and Comparative Anatomy Research Unit, University of Adelaide, Australia

³Department of Human Science, Loughborough University, UK

⁴School of Anatomy, Physiology and Human Biology, University of Western Australia

ABSTRACT: Obesity is of significant and growing concern among Australian Aboriginal children, and is linked to patterns of child growth. The aim of this paper is to show diverse patterns of growth and obesity emergence among Australian Aboriginal children using historical anthropometric data. Child growth in height, weight and body mass index (BMI) is reanalysed for children aged 2 to 19 years in Australian Aboriginal communities spanning two distinct time periods (the 1950s and 1960s; and the 1990s and 2000s) and six different geographical locations: Yuendumu, Haast's Bluff, Beswick, Kalumburu, Gerard, and Raukkan. Comparisons of stature and BMI between the earlier and later years of measurement were made, and the proportion of children classified as overweight or obese by the International Obesity Task Force criteria estimated, to allow international comparison. Aboriginal children in the 1990s and 2000s were heavier, with higher BMI than those in the 1950s and 1960s, differences in height being less marked. While no children were classified as overweight or obese in the earlier period, 15% of males and 3% of females were classified so in the later period. The data suggests that the period of onset of the epidemic of overweight and obesity among rural Australian Aboriginal children was likely to have been between the 1960s and 1980s.

KEY WORDS: overweight, body mass index, stature, Australia, aboriginal childre

Introduction

Overweight and obesity are of significant and growing concern among Australian Aboriginal people. They contribute to the excess morbidity and mortality experienced by this group of Australians when compared to their non-Aboriginal coun-

terparts (Daniel et al. 2002; Thompson et al. 2003; Wang and Hoy 2003; Valery et al. 2009). Rates of overweight and obesity are significant among Australian Aboriginal children too. For example, Schultz (2012) found significant rates of overweight and obesity (ranging between

10 and 25%, relative to Australian body mass index (BMI) references) among remote-living Aboriginal children. Similarly, Webster et al. (2013) have shown rapid weight gain among urban Aboriginal infants, with 37% being classified as overweight or obese at the age of 24 months. The most important consequence of childhood obesity is its persistence into adulthood (Guo et al. 1994; Whitaker et al. 1997). The metabolic changes associated with excess weight carried from adolescence into adulthood have also been described for Australian aboriginal people (Braun et al. 1996; Mackerras et al. 2003). Concurrently, suboptimal growth relative to external reference values remains a problem in some groups (Mackerras et al. 2003; Paterson et al. 2001; Wang et al. 2000; Gracey and Sullivan 1988), and may co-exist alongside greater than expected rates of overweight and obesity (Mackerras et al. 2003; Henneberg et al. 2001). While there was no reported overweight and obesity among Aboriginal children in the 1970s (Gracey 2000), it is not clear when obesity and overweight emerged among these populations. In this paper we reanalyse child growth in height and body mass index

(BMI) in a number of Aboriginal communities between the 1950s and 1960s and the 1990s and 2000s to examine the emergence of childhood overweight and obesity in relation to stature. We also estimate the proportions of children that would be considered overweight or obese by the International Obesity Task Force criteria (Cole et al. 2000) during these two periods.

Methods

The Aboriginal groups included in this analysis span two distinct time periods (the 1950s & 1960s; and 1990s and 2000s) and six different geographical locations (Fig. 1). Data from the 1950s and 1960s were collected in the communities of Yuendumu, Haast's Bluff, Beswick, and Kalumburu. Most of these peoples lived traditional lifestyles, or had only recently been settled onto reservations by Europeans (Abbie 1974). These data were accessed by the first author at the library of the Australian Institute of Aboriginal and Torres Strait Islander Studies, Canberra, Australia. Ages were estimated from a combination of settlement records, dental eruption, bone

Table 1. The sample

District	Collection dates	Male				Female			
		No.	Age (years)			No.	Age (years)		
			Mean	Median	Range		Mean	Median	Range
Yuendumu	1951, 1955, 1963, 1964	197	9.4	9.5	2–16+	173	9.9	9.5	2–17+
Haast's Bluff	1956, 1957	44	9.5	8.0	2–17+	46	11.8	12.0	2–17+
Beswick	1961	16	9.3	8.5	2–17+	36	9.7	9.0	2–17+
Kalumburu (A)	1963	22	8.7	8.5	3–13+	21	9	7.5	2–17+
Kalumburu (S)	1993	42	10.7	10.5	6–16+	36	10	9.5	6–16+
Gerqard	1996–2002*	25	9.8	10.5	2–17+	33	10.9	10.5	2–17+
Raukkan	1996–2002*	34	9.2	9.5	2–16+	28	12.1	11.5	2–17+

age, and general parameters of physical development with estimation accuracy approximated to vary by ± 6 months to the age of 3, ± 1 year to the age of 12 years, and ± 2 years from 2 to 20 years of age (Abbie 1961). Children were also described as being in good physical health at the time of measurement. The data from some locations are of a mixed longitudinal nature, as some districts were visited on more than one occasion (Table 1). Measurements were taken and derived according to the methods described by Martin (Abbie 1974, 1975).

Three samples were included from the post-1990 period; children and adolescents from Kalumburu in a cross-sectional survey conducted in 1993; and children from Gerard and Raukkan, respectively. The mixed longitudinal sample of the latter (1996–2002) was converted into a single cross-sectional sample by selecting individuals at the age of oldest measurement. Ages were known exactly for all three samples. Kalumburu, in the northwest of Western Australia, became a permanent settlement in 1908 with the establishment of a mission. Formal separation of the mission and community occurred in 1980; the store, medical clinic and school there are now independent of the mission. The population totalled approximately 350 in the early 1990s. Gerard and Raukkan are two self-governing Aboriginal communities in the lower Murray region of South Australia of approximately 120 individuals each. They differ significantly in both their history and current socio-economic circumstances. Gerard, established in 1945 to receive Aboriginal people being moved from other locations, is the most disadvantaged in terms of community resources and socio-economic circumstances. There is no school there, and there is

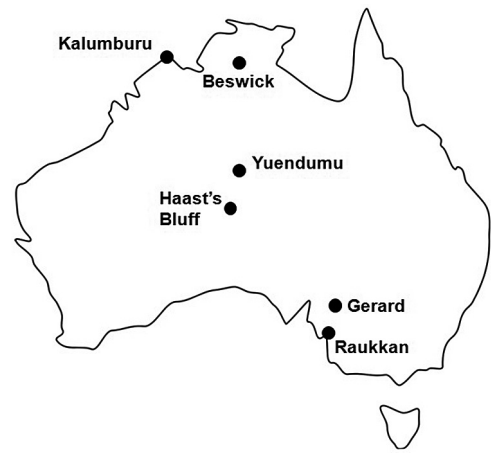


Fig. 1. Location of Aboriginal Australian communities of this study

poorer housing. There are few even partially-successful business ventures there. Founded in 1859 as a mission, Raukkan has since been a centre of Aboriginal life in the region. It has generally well maintained housing, a well-equipped primary school and owns a large, productive farm. Public consumption of alcoholic beverages is banned in Raukkan. Both Gerard and Raukkan have considerable in- and out-migration (Henneberg et al. 2001). The measurement techniques used in these communities also follow Martin's technique (Henneberg et al 2001).

For the present analysis, individuals aged between 2 and 18 years inclusive were considered. Ages were rounded down to the last whole year. Table 1 gives the age range and sample sizes of children observed in each community.

Kalumburu (A) refers to measurements collected from this community in 1963, while Kalumburu (S) refers to data collected in 1993. Heights and BMI were considered, with the latter calculated as weight (kg)/height (m)² (World Health Organisation 2000). Temporal groupings of the districts (1950s and

1960s against post-1990s data) were compared using the Statistical Package for the Social Sciences version 18. The numbers of individuals from each district lying above the international cut-off point for overweight were estimated. Very few individuals had BMI values greater than the international cut-off point for obesity, and the two categories were combined for the purpose of this analysis.

Results

Figures 2 and 3 show mean values for stature and BMI in males and females aged 2 to 18 years, according to temporal groupings of districts. There is no significant difference in stature or BMI between males and females. Nor is there significant difference in stature of either male or female children measured in the 1950s and 1960s and in the 1990s and 2000s. While males appear to have a slightly earlier pubertal growth spurt in stature in the 1990s and 2000s relative to boys in the 1950s and 1960s, the differences in height between boys aged 12 and 13 years of age at these two times of measurement are non-significant. The BMI increases significantly with age among all groups, and differs significantly between those measured in the 1950s and 1960s, and those measured in the 1990s and 2000s. The BMI difference between the 1950s and 1960s and the 1990s and 2000s is greater for females than for males. Table 2 shows the percentage of individuals falling above the international cut-off point for overweight. While the numbers are small, there is a significantly greater proportion of overweight children, most importantly among the males. Taken with the finding that females show greater increase in BMI than males between the 1950s and 1960s and

the 1990s and 2000s, this suggests that the secular trend in weight gain across this 40 year period differs between males and females, with the BMI distribution of females becoming more kurtotic in the later period relative to the earlier period, and relative to males at both periods.

Discussion

Aboriginal children in the 1990s and early 2000s have higher BMI than those in the 1950s and 1960s, but are no taller than the children measured in this earlier period. Thus, Aboriginal children have become heavier across this period without becoming much taller. The period of onset of the epidemic of overweight and obesity among rural Australian Aboriginal children was therefore likely to have been between the 1960s and 1980s. The rate of overweight and obesity for male and female children combined in the 1990s and 2000s was 9%, below the rates reported by Schultz (2012) for remote-living Aboriginal children. This suggests that rates of overweight and obesity among Australian Aboriginal children continue to rise, unlike rates among the general population of Australian children, where rates are either plateauing or showing a slight increase (Olds et al 2010). Furthermore, Webster et al (2013) recently showed rapid weight gain among urban Aboriginal infants, with 37% of their sample being classified as overweight or obese at the age of 24 months. Appreciating that caution that must be applied in collectively grouping Aboriginal peoples as a homogenous population, this weight-gain trend among Australian Aboriginal children is of great concern, given the excess weight related morbidity and mortality experienced by Aboriginal adults relative to the dominant population of Australia.

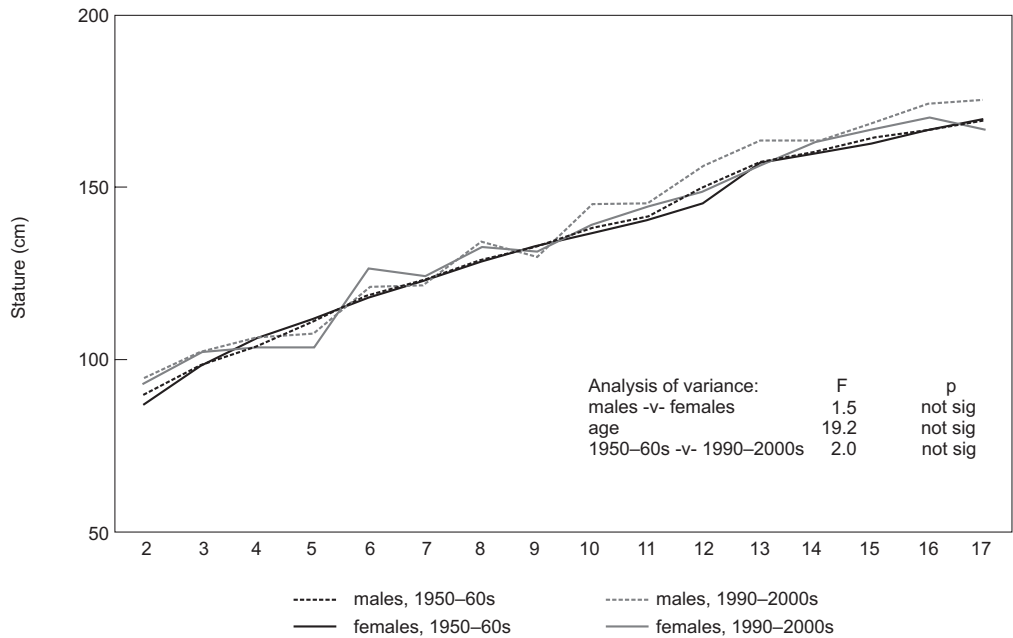


Fig. 2. Mean stature of aboriginal children 1950s to 2000s

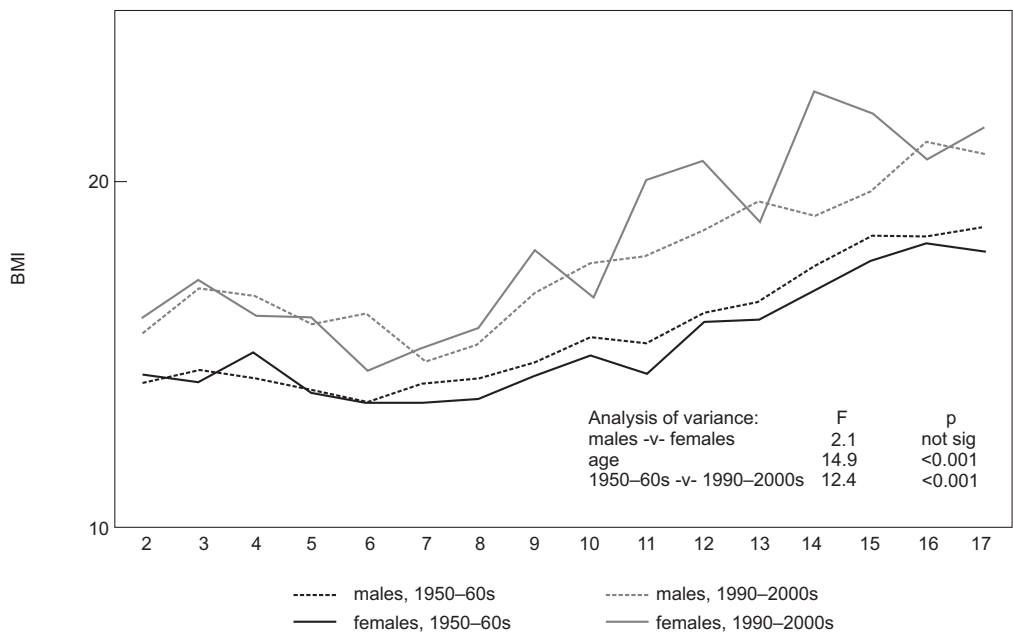


Fig. 3. Mean body mass index of aboriginal children 1950s to 2000s

Table 2. Number and proportions of overweight aboriginal children

Collection dates	Males		Females	
	Sample	Overweight n (%)	Sample	Overweight n (%)
1950–1960s	279	0	276	2 (0.7)
1990–2000s	101	15 (14.9)	97	3 (3.1)

Fisher exact probability test $p=0.05$

While both decline in physical activity and diet contribute to childhood overweight and obesity among Australian Aboriginal children, Gracey (2000) has highlighted the greater importance of diet relative to physical activity to the poor health of Australian Aboriginal children, stating that “Colonization had serious negative effects on Aboriginal society, well-being, and health, so much so that Aborigines are now the unhealthiest subgroup in Australian society. The change from active and lean hunter-gatherers to a more sedentary group of people whose diet is now predominantly Westernized has had, and continues to have, serious effects on their health, particularly in relation to cardiovascular disease and type 2 diabetes mellitus, which are highly prevalent among Aborigines. The contemporary diets of Australian Aborigines are energy rich and contain high amounts of fat, refined carbohydrates, and salt; they are also poor in fiber and certain nutrients, including folate, retinol, and vitamin E and other vitamins. Risks of development of cardiovascular disease and type 2 diabetes in this population probably develop during late childhood and adolescence”. Add to their poor diet and low physical activity low birth weight followed by catch-up growth (Rousham and Gracey 1997), and the conditions for overweight and obesity in childhood are well-prepared through the mechanism of developmen-

tal programming (Ong et al. 2000) for Australian Aboriginal people.

Author contribution

NPh collected data from different sources and performed original analysis. MH contributed to original data collection and interpreted results of the data analysis. NN contributed to data collection. LS contributed to original data collection. CP interpreted results of the data analysis. SU analysed data and wrote the manuscript.

Conflict of interests

The Authors declare that there is no conflict of interests.

Corresponding author

Stanley Ulijaszek, School of Anthropology, University of Oxford, 51 Banbury Road, Oxford OX2 6PF, UK
e-mail address:
stanley.ulijaszek@anthro.ox.ac.uk

References

- Abbie A. 1961. A preliminary survey of the growth patterns of central Australian Aboriginal males. *Oceania* 31:215–21.
- Abbie A. 1974. Physical standards of nomadic aboriginal children. *Med J Australia* 1:470–1.

- Abbie A. 1975. *Studies in Physical Anthropology: The Aboriginal Growth Pattern*. Canberra: Australian Institute of Aboriginal Studies.
- Braun B, Zimmermann M, Kretchmer N, Spargo R, Smith R, Gracey M. 1996. Risk factors for diabetes and cardiovascular disease in young Australian Aborigines. A five year followup study. *Diab Care* 19:472–9.
- Cole T, Bellizzi M, Flegal K, Dietz W. 2000. Establishing a standard definition for child overweight and obesity worldwide: international survey. *BMJ* 320:1–6.
- Daniel M, Rowley K, McDermott R, O'Dea K. 2002. Diabetes and impaired glucose tolerance in aboriginal australians: prevalence and risk. *Diab Res Clin Prac* 57:23–33.
- Gracey M. 2000. Historical, cultural, political, and social influences on dietary patterns and nutrition in Australian aboriginal children. *Am J Clin Nutr* 72 (suppl):1361S–7S.
- Gracey M, Sullivan H. 1988. Growth of Aboriginal infants in the first year of life in remote communities of North West Australia. *Ann Hum Biol* 15:375–82.
- Guo S, Roche A, Chumlea W, Gardner J, Siervogel R. 1994. The predictive value of childhood body mass index values for overweight at the age of 35y. *Am J Clin Nutr* 59: 810–9.
- Henneberg M, Schilitz A, Lambert K. 2001. Assessment of the growth of children and physical status of adults in two aboriginal communities in South Australia. *Am J Hum Biol* 13:603–11.
- Mackerras D, Reid A, Sayers S, Singh G, Bucens I, Flynn K. 2003. Growth and Morbidity in children in the Aboriginal birth cohort study: The urban-remote differential. *Med J Australia* 178:56–60.
- Olds TS, Tomkinson GR, Ferrar KE, Maher CA. 2010. Trends in the prevalence of childhood overweight and obesity in Australia between 1985 and 2008. *Int J Obes* 34:57–66.
- Ong KKL, Ahmed ML, Emmett PM, Preece MA, Dunger DB. 2000. Association between postnatal catch-up growth and obesity in childhood: prospective cohort study. *Br Med J* 320:967–71.
- Paterson B, McKinnon C, Edmond K. 2001. A review of annual growth screening in Aboriginal schoolchildren in Australia. *J Paediatr Child Health* 37:18–23.
- Rousham EK, Gracey M. 1997. Persistent growth faltering among Aboriginal infants and young children in north-west Australia: a retrospective study from 1969 to 1993. *Acta Paediatr* 86:456–50.
- Schultz R. 2012. Prevalences of overweight and obesity among children in remote Aboriginal communities in central Australia. *Rural and Remote Health* 12:1872.
- Thompson P, Bradshaw P, Veroni M, Wilkes E. 2003. Cardiovascular risk among urban Aboriginal people. *Med J Australia* 179:143–6.
- Valery PC, Moloney A, Cotterill A, Harris M, Sinha AK, Green AC. 2009. Prevalence of obesity and metabolic syndrome in Indigenous Australian youths. *Obesity Rev* 10:255–61.
- Wang Z, Hoy W. 2003. Hypertension, dyslipidaemia, body mass index, diabetes and smoking status in Aboriginal Australians in a remote community. *Ethn Dis* 13:324–40.
- Wang Z, Hoy W, McDonald S. 2000. Body Mass Index in Aboriginal Australians in remote communities. *Australian New Zealand J Publ Health* 24: 570–5.
- Webster V, Denney-Wilson E, Knight J, Comino E, the Gudaga Research Team. 2013. Describing the growth and rapid weight gain of urban Australian aboriginal infants. *J Paediatr Child Health* 49:303–8.
- Whitaker R, Wright J, Pepe M, Seidel K, Dietz W. 1997. Predicting obesity in Young Adulthood from childhood and parental obesity. *New Engl J Med* 337:869–73.
- World Health Organisation. 2000. WHO consultation on Obesity. *Obesity: Preventing and Managing the Global Epidemic. Technical Report number 894*. Geneva: World Health Organisation.