

Bond University
Research Repository



Ethnic differences in body composition and anthropometric characteristics in Australian Caucasian and urban Indigenous children

Kagawa, Masaharu; Byrne, Nuala M.; King, Neil A.; Pal, Sebely; Hills, Andrew P.

Published in:
British Journal of Nutrition

DOI:
[10.1017/S0007114509311733](https://doi.org/10.1017/S0007114509311733)

Licence:
Other

[Link to output in Bond University research repository.](#)

Recommended citation(APA):
Kagawa, M., Byrne, N. M., King, N. A., Pal, S., & Hills, A. P. (2009). Ethnic differences in body composition and anthropometric characteristics in Australian Caucasian and urban Indigenous children. *British Journal of Nutrition*, 102(6), 938-946. <https://doi.org/10.1017/S0007114509311733>

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

For more information, or if you believe that this document breaches copyright, please contact the Bond University research repository coordinator.

1 **Title:** Ethnic differences in body composition and anthropometric characteristics in Australian
2 Caucasian and urban Indigenous children

3
4 **Authors:**

5 **Masaharu Kagawa**^{1,2}; **Nuala M. Byrne**^{1,2}; **Neil A. King**^{1,2}; **Sebely Pal**³; **Andrew P. Hills**^{1,2}

6
7 **Institution:**

8 ¹ ATN Centre for Metabolic Fitness, School of Human Movement Studies, Queensland University of
9 Technology, Brisbane, QLD.

10 ² Institute of Health and Biomedical Innovation, Queensland University of Technology.

11 ³ School of Public Health, Curtin University of Technology, Perth, WA.

12
13 **Correspondence and reprint requests should be addressed to:**

14 Dr. Masaharu Kagawa

15 Postdoctoral Research Fellow

16 ATN Centre for Metabolic Fitness, School of Human Movement Studies, Institute of Health and
17 Biomedical Innovation, Queensland University of Technology, 60 Musk Avenue, Kelvin Grove, Qld
18 4059, Australia

19 Phone: +61-7-3138-6091; Fax: +61-7-3138-6030, E-mail: m.kagawa@qut.edu.au

20
21 **Running head:**

22 Ethnic differences in body composition

23
24 **Key words:**

25 Children; ethnicity; body composition; anthropometry.

26

1 Abstract

2 **Objective:** To compare ethnic differences in anthropometry, including size, proportions and fat
3 distribution, and body composition in a cohort of 70 Caucasian (44 males, 26 females) and 74 urban
4 Indigenous (36 males, 38 females) children (9-15 years of age). **Methods:** Anthropometric measures
5 (stature, body mass, eight skinfolds, 13 girths, six bone lengths and five bone breadths) and body
6 composition assessment using dual energy x-ray absorptiometry (DXA: Lunar Prodigy) were
7 conducted. Body composition variables including total body fat percentage (%BF) and percentage
8 abdominal fat (%AF) were determined and together with anthropometric indices including body mass
9 index (BMI: kg/m²), abdominal-to-height ratio (AHtR) and sum of skinfolds, ethnic differences were
10 compared for each gender. **Results:** After adjustment for age, Indigenous girls showed significantly
11 ($p<0.05$) greater trunk circumferences and proportion of overweight/obesity than their Caucasian
12 counterparts. In addition, Indigenous children had a significantly greater proportion ($p<0.05$) of trunk
13 fat. The best model for total and android fat prediction included sum of skinfolds and age in both
14 genders (>93% of variation). Ethnicity was only important in girls where abdominal circumference
15 and AHtR were included and Indigenous girls showed significantly ($p<0.05$) smaller total/android fat
16 deposition than Caucasian girls at the given abdominal circumference or AHtR values. **Conclusion:**
17 Differences in anthropometric and fat distribution patterns in Caucasian and Indigenous children may
18 justify the need for more appropriate screening criteria for obesity in Australian children relevant to
19 ethnic origin.

20

Formatted: Font color: Auto

1 INTRODUCTION

2 Indigenous Australians have a higher risk of developing obesity-related health conditions [1, 2]. A
3 recent study reported that the average age of Aboriginal and Torres Strait Islanders diagnosed with
4 type 2 diabetes mellitus (T2DM) decreased by about two years in the period from 1999 to 2005 [3].
5 Considering the increasing financial burden for the Australian community from obesity and related
6 health problems [4], early screening and prevention strategies for the Indigenous population have
7 been recommended.

8
9 To apply effective strategies, a better understanding of morphology and its relationships with body
10 composition and metabolic markers in each ethnic group is essential. In adults, anthropometric
11 indices such as the BMI and waist circumference (WC) have been used as indicators of
12 cardiovascular disease risk [5]. Indigenous Australian adults have a different pattern of fat
13 distribution compared to non-Indigenous Australians [6], and, as reported in different ethnic groups
14 [7, 8], Aboriginal adults (aged 18 to 35) show different relationships between adiposity and fat
15 distribution to BMI compared to their European counterparts [9].

16
17 Comprehensive assessments of the physical characteristics of Indigenous children and adolescents
18 are few and dated [10], and it is important to clarify if screening using the same cut-off points for
19 Caucasian and Indigenous children is appropriate. A lack of understanding of ethnic differences in
20 body size, proportion and fat distribution patterns may lead to misuse or misinterpretation of results
21 obtained from anthropometric indices. Today, the number of Indigenous people living a more
22 traditional lifestyle is relatively small compared to the urban Indigenous population who have a more
23 mixed racial background and commonly live in lower socioeconomic circumstances compared to
24 most Australian Caucasians.

25
26 The aim of the current study was to characterize the anthropometry and body composition of
27 Caucasian and Indigenous children and adolescents living in an urban setting. Previous studies have

Field Code Changed

Field Code Changed

Field Code Changed

Formatted: Font color: Auto

Field Code Changed

Field Code Changed

Field Code Changed

Field Code Changed

Field Code Changed

1 referenced ethnic differences in relationships between commonly used anthropometric indices, such
2 as the BMI, and accumulated fat in adults [7, 8]. Due to the paucity of similar studies in children and
3 adolescents [11, 12], the present study also examined relationships between fat mass and
4 anthropometric indices in Caucasian and Indigenous children and adolescents.

Field Code Changed

Field Code Changed

6 METHODS

7 The study was approved by the Human Research Ethics Committee of Queensland University of
8 Technology and adhered to the principles of medical research established by the National Health and
9 Medical Research Council [13]. Participants were recruited from primary and secondary schools
10 located in the Brisbane metropolitan area with the majority of Indigenous children recruited through
11 the Aboriginal and Islander Independent Community School (Murri School). Participants were also
12 recruited through flyers, local newspapers and magazines. All participants and their
13 parents/caregivers were given information packages and consent forms were signed prior to
14 participation.

Field Code Changed

15
16 The study included 70 Caucasian (44 male, 26 female) and 74 Indigenous (36 male, 38 female)
17 children aged 9-15 years. The criteria for “Indigenous” were that a child had at least one parent of
18 “Indigenous” ancestry or that the Indigenous community recognized the child as a member of that
19 community. Selection criteria were similar to the definition of “Aboriginal” by Australian law
20 outlined in a previous study [9], that is, 1) Aboriginal descent; 2) self-identification as an Australian
21 Aboriginal; and 3) being accepted as such by the community in which he or she lives or has lived.
22 Children with chronic health problems or taking medication that may have influenced their physical
23 status were excluded from the study.

Field Code Changed

25 Anthropometry

26 Stature, body mass, eight skinfolds (triceps, subscapular, biceps, iliac crest, supraspinale, abdominal,
27 front thigh, and medial calf), 13 girths (head, arm [relaxed], arm [flexed and tensed], forearm, wrist,

Formatted: Font color: Auto

1 chest, waist [narrowest point], abdominal [the level of umbilicus], gluteal, thigh, mid-thigh, calf
2 [maximum] and ankle), six bone lengths (acromiale-radiale, radiale-stylion, midstylion-dactylion,
3 trochanterion-tibiale laterale, tibiale-height and foot length) and five bone breadths (biacromial,
4 biliocrystal, transverse chest, biepicondylar humerus and biepicondylar femur) of each participant
5 were measured using the standard protocol by the International Society for the Advancement of
6 Kinanthropometry (ISAK) [14]. All participants were asked to wear light clothing, such as shorts and
7 T-shirt, and stature and body mass were measured without shoes and socks. All landmarks and
8 measurements were conducted by a Level 3 (instructor) anthropometrist accredited by ISAK.
9 Intra-tester technical error of measurement (TEM) was calculated for all measures using 20 randomly
10 selected participants. The intra-tester TEM was no greater than 5.0% for all skinfold measurements
11 and no greater than 1.0% for other measurements, within the acceptable limits of intra-tester TEM
12 recommended by ISAK for a Level 3 anthropometrist [15].

13
14 From the measurements, BMI (body mass (kg)/stature² (m)), abdominal-to-height ratio (AHtR:
15 abdominal/stature), waist-to-hip ratio (WHR: waist/gluteal) were calculated. In addition, the sum of
16 eight skinfolds (Σ SF; triceps + subscapular + biceps + supraspinale + iliac crest + abdominal + front
17 thigh + medial calf) and sum of trunk skinfolds (Σ TrunkSF; supraspinale + iliac crest + abdominal)
18 were calculated to determine subcutaneous fat distribution pattern. Arm and leg lengths relative to
19 stature were calculated to observe ethnic differences in body proportion, and the physique of
20 participants was determined by calculating a somatotype score [16]. Somatotype is a representation
21 of one's physique and is a combination of endomorphy (relative plumpness), mesomorphy (relative
22 muscularity) and ectomorphy (relative linearity) components. Each component was calculated using
23 equations described in the literature [16].

Field Code Changed

Field Code Changed

24 25 *Body composition assessment*

26 Body composition was assessed using DXA (Lunar Prodigy Advance, enCORE 2005 version
27 9.30.044, GE Healthcare, Madison, WI, USA). Each whole-body DXA scan was completed within

1 approximately 6-10 minutes, depending on the size of the participant and information on bone
2 mineral content (BMC: in kg), bone mineral density (BMD: in g/cm^2), fat tissue mass, lean tissue
3 mass, total tissue mass (fat + lean tissue mass) of the whole body as well as android and gynoid
4 regions of interest (ROI) were obtained. The android ROI is defined as the “Lower boundary at pelvis
5 cut, upper boundary located at above pelvis cut by 20% of the distance between pelvis and neck cuts.
6 Lateral boundaries are the arm cuts.” The gynoid ROI is defined as “Upper boundary below the pelvis
7 cut line by 1.5 times the height of the android ROI. Gynoid ROI height equal to 2 times the height of
8 the android ROI. Lateral boundaries are the outer leg cuts”. The DXA scan also provides ratios of fat
9 mass, including: 1) total body fat percentage (%BF); 2) android fat percentage (%AF); 3) gynoid fat
10 percentage (%GF); 4) trunk to total fat ratio; 5) legs to total fat ratio; 6) limbs to total fat ratio and 7)
11 android to gynoid fat ratio. Further, the proportion of android fat relative to total fat mass (P_{Android} :
12 android fat/total fat \times 100) was calculated to compare fat deposition in the abdominal region between
13 the study groups.

14
15 All statistical analyses were conducted using SPSS software for Windows (version 14.0.0, 2005,
16 Chicago). Ethnic differences in body size (ie. stature, body mass) and also ratios calculated from
17 anthropometry (eg. BMI) and body composition measurements (eg. %BF) were determined using
18 age-adjusted ANCOVA for each gender. In order to control for the influence of body size, other
19 anthropometric and body composition variables, including Σ SF and total fat tissue mass, were
20 analyzed using age- and stature-adjusted ANCOVA. Anthropometric and body composition variables
21 were transformed to normalize the data prior to analysis wherever necessary using natural logarithm
22 (LN). The effect size for variables that showed significant differences between ethnic groups was also
23 calculated using Cohen’s d using the equation $(M_1 \times M_2 / \text{SD}_{\text{pooled}})$ where M = mean and SD = standard
24 deviation and $\text{SD}_{\text{pooled}} = \sqrt{[(\text{SD}_1^2 + \text{SD}_2^2) / 2]}$. Proportions of overweight and obesity were determined
25 using age- and gender-specific Cole et al. criteria [17] and ethnic differences in prevalence of
26 overweight/obesity were compared using the Chi-square test. Furthermore, ethnic differences in
27 relationships between body fat variables from DXA and selected anthropometric indices were

Formatted: Font color: Auto

Field Code Changed

determined using the general linear model (GLM). Body fat variables used in the analysis were: 1) total fat tissue mass and, 2) abdominal fat tissue mass which was derived from android ROI and anthropometric variables used in this analysis included body mass, BMI, Σ SF, Σ TrunkSF, abdominal circumference and AHtR. Age and ethnicity (1 for Indigenous and 0 for Caucasians) were included as covariates to examine their influences on the relationships. Considering a previous suggestion that application of ratios may not be useful to define obesity [18], relationships were assessed using absolute mass instead of %BF or %AF. The equations were proposed with adjusted correlation coefficients (R_{ad}^2) and standard error of estimates (SEE).

Field Code Changed

RESULTS

Table 1 shows demographic information of the study groups. Caucasian girls were significantly ($p < 0.05$) younger than their Indigenous counterparts however after controlling for age, no ethnic differences in mean stature, body mass, BMI and %BF were observed. After adjusting for age and stature, body composition variables obtained from DXA which included BMC, BMD and total and android fat tissues as well as Σ SF and Σ TrunkSF from anthropometry, were comparable between ethnic groups. However, using the Cole et al. (17) BMI criteria, a significantly greater proportion of Indigenous girls were classified as overweight (Caucasian: 7.7%; Indigenous: 39.5%) and obese (Caucasian: 0%; Indigenous: 23.7%). These differences were not evident in boys. The mean somatotype for Caucasian boys was balanced mesomorph and for Indigenous boys, endomorphic mesomorph, a physique with greater fat deposition in the latter group. In girls, both groups had a mean somatotype of mesomorphic endomorph, although Indigenous girls showed a greater endomorphy.

Formatted: Font color: Auto

Formatted: Font color: Auto

Formatted: Font color: Auto

Insert Table 1 about here

Ethnic differences in subcutaneous fat distribution and other anthropometric variables after adjustment for age and stature are shown in Figure 1-3. Despite a tendency for higher skinfold

measures in Indigenous children, the only significant difference was for subscapular skinfold thickness in girls ($p < 0.05$) (Figure 1). Indigenous girls also showed significantly greater ($p < 0.05$) trunk circumferences (Figure 2). Indigenous children also showed significantly greater ($p < 0.05$) forearm lengths (radiale-stylo and midstylo-dactylo) (Figure 3). The larger frame size of Indigenous girls was confirmed by longer acromiale-radiale measures and wider biacromial and biiliocrystal breadths ($p < 0.05$). All significant variables in Indigenous girls showed medium to large effect sizes, between 0.56 (midstylo-dactylo length) and 0.83 (subscapular skinfold and waist circumference) using Cohen's d . In boys, the effect size was smaller (Cohen's $d = 0.2$).

Insert Figure 1-3 about here

Ethnic differences in anthropometric and body composition ratios are shown in Table 2. As seen in Figure 3, Indigenous children had longer arms relative to stature compared to Caucasian children ($p < 0.05$; Cohen's d : boys = 1.0, girls = 0.63), and Indigenous girls had significantly ($p < 0.05$) greater AHtR and WHR, suggesting greater abdominal fat accumulation. However the effect size from the WHR was smaller (Cohen's $d = 0.22$) compared that for the AHtR (0.82). This finding of greater fat deposition in the trunk was consistent with DXA results (trunk-total fat mass ratio: $p < 0.05$; Cohen's d : boys = 0.67; girls = 0.99; limbs-trunk fat mass ratio: $p < 0.05$; Cohen's d : boys = 0.83; girls = 0.93). After adjustment for age, fat accumulation in the android ROI relative to total fat reached significance in boys (Caucasian boys: 6.2%, Indigenous boys: 6.8%. $p < 0.05$).

Insert Table 2 about here

The best predictive models (>93% of variation) for total and android fat in boys and girls were obtained from sum of skinfolds and age (Table 3). Other models which accounted for more than 70% of the variation included combinations of age, ethnicity (for girls not boys), AC, AHtR, body mass and BMI. The relationship between body composition variables and BMI was not influenced by age

1 and tended to be weaker than Σ SF, AC or AHtR. Despite the lack of ethnic influence in boys in
2 relationships involving total and android fat, relationships between abdominal circumference and
3 android fat tissue were consistent regardless of ethnicity in Indigenous girls who tended to have a
4 smaller amount of total fat tissue mass at a given abdominal circumference (Figure 4). Results also
5 indicated that Indigenous girls were likely to have a smaller total or android fat tissue at a given AHtR
6 calculated from the abdominal circumference.

7
8 *Insert Table 3 and Figure 4 about here*
9

10 **DISCUSSION**

11 To the best of our knowledge, this is the first study to undertake a comprehensive anthropometric and
12 body composition assessment on Caucasian and Indigenous children and adolescents living in an
13 urban Australian setting. The study confirmed a striking gender difference in body composition and
14 anthropometric indices between ethnic groups.

15
16 After adjustment for age, we found that Indigenous and Caucasian children were similar in stature
17 and body mass. However, these findings were inconsistent with previous studies that reported
18 significantly smaller body mass and stature in Aboriginal children (10, 18) which may in part be
19 attributed to a difference in geographical location of respective study cohorts. Previous studies used
20 Aboriginal children living in rural areas where growth retardation is common [19, 20] due to both
21 poor maternal nutrition [21] and food availability [22]. According to Barker's "fetal origin theory",
22 children who are born undernourished have a greater risk of developing obesity and related health
23 problems [23], considered one of the causes of poor health status in the Indigenous population. In the
24 current study, a greater proportion of Indigenous children were overweight or obese, consistent with
25 previous findings that children living in urban areas tend to be larger and have higher BMIs than those
26 living in rural areas [24]. There is also a higher prevalence of obesity among Indigenous adults of
27 high socioeconomic status [25] due to the nutrition transition experienced by the Indigenous

Field Code Changed

Field Code Changed

Field Code Changed

Field Code Changed

Field Code Changed

Formatted: Font color: Auto

Formatted: Font color: Auto

Field Code Changed

Formatted: Font color: Auto

Formatted: Font color: Auto

1 population in urban areas.

2
3 The current study also confirmed that ethnic differences in anthropometry are more significant in
4 girls than boys with Indigenous girls having greater relative trunk circumferences and indices
5 including AHtR and WHR. The mean value for AHtR suggests that Indigenous girls have an
6 abdominal circumference 10 cm greater than Caucasian girls for a given stature, indicative of a larger
7 proportion of abdominal fat. Tendency for a greater subcutaneous fat deposition (as measured as
8 skinfold thickness) among Indigenous children is also consistent with the higher deposition of
9 abdominal fat subcutaneously than Caucasian children. Previous studies have reported that
10 Caucasians and Asians are predisposed to greater visceral fat deposition than Africans [26-29], with
11 current results indicative of similarity in the pattern of abdominal fat distribution in Indigenous and
12 African populations. A significant ethnic difference in fat accumulation in the android ROI was only
13 found in boys which may be due to the small number of Caucasian girls and also the possibility that
14 Indigenous girls had greater fat deposition in both the abdomen and chest.

15
16 The study also revealed ethnic differences in fat distribution between the trunk and limbs with
17 Caucasian children showing a lower proportion of fat in the trunk despite no ethnic differences in
18 total tissue mass and %BF. Caucasian children also showed a greater fat deposition in their limbs
19 relative to trunk although Indigenous children have longer arms and also comparable total tissue mass.
20 Results also suggest that Indigenous children are likely to have a physique with leaner limbs and
21 greater fat accumulation in the trunk than Caucasians at a given total tissue mass, consistent with
22 results in previous studies [30, 31]. As effect size was calculated for ethnic differences in arm length
23 and fat distribution ratio between the limbs and the trunk, results may suggest biologically significant
24 physical differences.

25
26 In the current study, relationships between total and android fat tissue and commonly used
27 anthropometric indices were also examined. Results indicate that Σ SF and abdominal circumference

Formatted: Font color: Auto

Formatted: Font color: Auto

Formatted: Font color: Auto

Formatted: Font color: Auto

Formatted: Font color: Auto

Field Code Changed

Formatted: Font color: Auto

1 are useful measures of total or regional fat accumulation in both genders. These indices also showed
2 an influence of age, indicative that maturation significantly influences the increased fat deposition in
3 the study population. Caucasian and Indigenous girls had a comparable amount of android fat tissue
4 at a given abdominal circumference however Indigenous girls were likely to have significantly less
5 android fat when AHtR was calculated from measured abdominal circumference. It has been
6 suggested that AHtR or waist-to-height ratio may be a useful screening index for abdominal obesity
7 across age, gender and ethnicity [32-34], however, the ethnic difference in the current study (despite
8 no difference in body size) suggests caution in the use of this index in Indigenous children. Further
9 research on ethnic differences in AHtR and abdominal fat deposition/distribution pattern, along with
10 associations with metabolic health risks is warranted. Apart from abdominal circumference and
11 AHtR in girls, there were no ethnic differences in relationships between common anthropometric
12 indices, including BMI, and body composition variables in this study. Despite ethnic differences in
13 body fat distribution pattern it is possible to use the same cut-off points for anthropometric indices to
14 determine metabolic health risks in both Caucasian and Indigenous children. These findings differ
15 from an earlier study of adults [9] and another in which Caucasian, Maori and Pacific Islander
16 children living in New Zealand were compared [12].

Field Code Changed

Field Code Changed

Field Code Changed

17
18 The classification method used to identify ethnic background may also be an important factor to
19 consider. In the current study, identification of both parents/guardians and community recognition
20 was used to categorize the background of participants. The urban dwelling Indigenous population is a
21 diverse mix of different ethnic backgrounds, including Aboriginals, Torres Strait Islanders,
22 Caucasians, Asians and South Pacific Islanders. As a result, a major limitation of the current study,
23 and possibly one of the reasons for minimal ethnic differences in the majority of anthropometric
24 indices and body composition variables, may be the 'similarities' between groups. It is also important
25 to stress that only a small proportion of the Indigenous population has maintained their traditional
26 lifestyle. As the definition of "Aboriginal" used was consistent with that used by Australian law, we
27 can be confident that the current results are reflective of differences in the physical characteristics

1 between Caucasian and Indigenous children. In addition, the study provides confirmation of the
2 applicability of the same anthropometric cut-off points for the metabolic screening of Indigenous
3 children living in an urban setting.

4
5 Finally, this is the first study to provide comprehensive anthropometric and body composition
6 information of Indigenous compared with Caucasian children living in urban Australia. The results
7 confirmed the comparability of physical characteristics in boys and the presence of some distinct
8 differences between girls of different ethnic backgrounds, including the proportion of overweight and
9 obese. Results also indicated possible ethnic differences in fat distribution patterns including
10 visceral-subcutaneous and trunk-extremities. However, relationships between anthropometric indices
11 and selected body composition variables showed no ethnic influence in boys and minimal impact in
12 girls. The findings, despite the relatively modest sample size, tentatively confirm the appropriateness
13 of similar screening tools being used to prevent childhood obesity and children at-risk of future
14 metabolic complications. Due to the small sample size of the study as well as lack of information
15 about socioeconomic status and pubertal stages of the children, it is strongly recommended that future
16 research should be conducted on a larger cohort with inclusion of both social and biological
17 information.

Formatted: Font color: Auto

19 **ACKNOWLEDGEMENTS**

20 The authors would like to acknowledge the Aboriginal and Islander Independent Community School
21 (Murri School), particularly Mr. Victor Hart, the Manager of QUT's Oodgeroo Unit as well the
22 Deputy President of the Aboriginal and Islander Independent School (Murri School), for their
23 invaluable support in relation to engagement with the Murri School.

25 **STATEMENT OF NO CONFLICTS**

26 All co-authors have contributed in a preparation of the current manuscript. Dr. Kagawa contributed in
27 the project design, data collection, data analysis and preparation of the manuscript. Dr. Byrne, Dr.

1 King and Dr. Pal contributed in preparation of the manuscript and Prof. Hills contributed as a
2 supervisor and preparation of the manuscript. There were no conflicts of interest in this study between
3 authors. The study was supported by the ATN Centre for Metabolic Fitness grant.

REFERENCES

Field Code Changed

1. Trewin D. National Aboriginal and Torres Strait Islander Health Survey 2004-05. Canberra: Australian Bureau of Statistics 2006.
2. Craig ME, Femia G, Broyda V, Lloyd M, Howard NJ. Type 2 diabetes in Indigenous and non-Indigenous children and adolescents in New South Wales. *Med J Aust.* 2007;186(10):497-9.
3. McDermott RA, McCulloch BG, Campbell SK, Young DM. Diabetes in the Torres Strait Islands of Australia: better clinical systems but significant increase in weight and other risk conditions among adults, 1999-2005. *Med J Aust.* 2007;186(10):505-8.
4. Thorburn AW. Prevalence of obesity in Australia. *Obes Rev.* 2005;6(3):187-9.
5. Wang Z, Hoy WE. Waist circumference, body mass index, hip circumference and waist-to-hip ratio as predictors of cardiovascular disease in Aboriginal people. *Eur J Clin Nutr.* 2004;58:888-93.
6. Jones CO, White NG. Adiposity in aboriginal people from Arnhem Land, Australia: variation in degree and distribution associated with age, sex and lifestyle. *Ann Hum Biol.* 1994;21(3):207-27.
7. Deurenberg P, Yap M, van Staveren WA. Body mass index and percent body fat: a meta analysis among different ethnic groups. *Int J Obes.* 1998;22:1164-71.
8. Kagawa M, Kerr D, Uchida H, Binns CW. Differences in the relationship between BMI and percentage body fat between Japanese and Australian-Caucasian young men. *Br J Nutr.* 2006;95(5):1002-7.

9. Piers LS, Rowley KG, Soares MJ, O'Dea K. Relation of adiposity and body fat distribution to body mass index in Australians of Aboriginal and European ancestry. *Eur J Clin Nutr.* 2003;57(8):956-63.
10. Hitchcock NE, Gracey M, Maller RA, Spargo RM. Physical size of 1887 Aboriginal schoolchildren in the Kimberley region. *Med J Aust.* 1987;146:415-9.
11. Deurenberg P, Deurenberg-Yap M, Foo LF, Schmidt G, Wang J. Differences in body composition between Singapore Chinese, Beijing Chinese and Dutch children. *Eur J Clin Nutr.* 2003;57:405-9.
12. Rush EC, Puniani K, Valencia ME, Davies PSW, Plank LD. Estimation of body fatness from body mass index and bioelectrical impedance: comparison of New Zealand European, Maori and Pacific Island children. *Eur J Clin Nutr.* 2003;57:1394-401.
13. NHMRC. National Statement on Ethical Conduct in Research Involving Humans 1999.
14. ISAK. International standards for anthropometric assessment. Canberra: ISAK 2001.
15. Gore C, Norton K, Olds T, Whittingham N, Birchall K, Clough M, et al. Accreditation in anthropometry: an Australian model. In: Norton K, Olds T, eds. *Anthropometrica*. Sydney: University of New South Wales Press 1996:395-411.
16. Carter JEL, Heath BH. Somatotyping-Development and application. Cambridge: Cambridge University Press 1990.
17. Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. *BMJ.* 2000;320:1240-5.

18. Goran MI, Allison DB, Poehlman ET. Issues relating to normalization of body fat content in men and women. *Int J Obes.* 1995;19(9):638-43.
19. Ruben AR, Walker AC. Malnutrition among rural aboriginal children in the Top End of the Northern Territory. *Med J Aust.* 1995;162(8):400-3.
20. Rousham EK, Gracey M. Persistent growth faltering among aboriginal infants and young children in north-west Australia: a retrospective study from 1969 to 1993. *Acta Paediatr.* 1997;86(1):46-50.
21. Sayers S, Powers J. Risk factors for aboriginal low birthweight, intrauterine growth retardation and preterm birth in the Darwin Health Region. *Aust N Z J Public Health.* 1997;21(5):524-30.
22. Lee AJ, Darcy AM, Leonard D, Groos AD, Stubbs CO, Lawson SK, et al. Food availability, cost disparity and improvement in relation to accessibility and remoteness in Queensland. *Aust N Z J Public Health.* 2002;26(3):266-72.
23. Barker DJ, Clark PM. Fetal undernutrition and disease in later life. *Rev Reprod.* 1997;2(2):105-12.
24. Reyes ME, Tan SK, Malina RM. Urban-rural contrasts in the growth status of school children in Oaxaca, Mexico. *Ann Hum Biol.* 2003;30(6):693-713.
25. Lourenço AE, Santos RV, Orellana JD, Coimbra CEJ. Nutrition transition in Amazonia: obesity and socioeconomic change in the Suruí Indians from Brazil. *Am J Hum Biol.* 2008;20(5):564-71.

26. Deurenberg P, Bhaskaran K, Lian PL. Singaporean Chinese adolescents have more subcutaneous adipose tissue than Dutch Caucasians of the same age and body mass index. *Asia Pacific J Clin Nutr.* 2003;12(3):261-5.
27. Lovejoy JC, de la Bretonne JA, Klemperer M, Tulley R. Abdominal fat distribution and metabolic risk factors: effects of race. *Metabolism.* 1996;45(9):1119-24.
28. Tanaka S, Horimai C, Katsukawa F. Ethnic differences in abdominal visceral fat accumulation between Japanese, African-Americans, and Caucasians: a meta-analysis. *Acta Diabetol.* 2003;40:S302-S4.
29. Kadowaki T, Sekikawa A, Murata K, Maegawa H, Takamiya T, Okamura T, et al. Japanese men have larger areas of visceral adipose tissue than Caucasian men in the same levels of waist circumference in a population-based study. *Int J Obes.* 2006;30(7):1163-5.
30. He Q, Horlick M, Thornton J, Wang J, Pierson RNJ, Heshka S, et al. Sex and race differences in fat distribution among Asian, African-American, and Caucasian prepubertal children. *J Clin Endocrinol Metab.* 2002;87(5):2164-70.
31. Byrne NM, Weinsier RL, Hunter GR, Desmond R, Patterson MA, Darnell BE, et al. Influence of distribution of lean body mass on resting metabolic rate after weight loss and weight regain: comparison of responses in white and black women. *Am J Clin Nutr.* 2003;77(6):1368-73.
32. Ashwell M, Hsieh SD. Six reasons why the waist-to-height ratio is a rapid and effective global indicator for health risks of obesity and how its use could simplify the international public health message on obesity. *Int J Food Sci Nutr.* 2005;56(5):303-7.

33. McCarthy HD, Ashwell M. A study of central fatness using waist-to-height ratios in UK children and adolescents over two decades supports the simple message-'keep your waist circumference to less than half your height'. *Int J Obes.* 2006;30(6):988-92.
34. Kagawa M, Hills AP, Binns CW. The usefulness of the waist-to-height ratio to predict trunk fat accumulation in Japanese and Australian Caucasian young males living in Australia. *Int J Body Comp Res.* 2007;5(2):57-63.

Tables

Table 1. Physical characteristics of Caucasian and Indigenous children

Gender	Boys						Girls					
	Caucasian			Indigenous			Caucasian			Indigenous		
Ethnicity	Caucasian			Indigenous			Caucasian			Indigenous		
Sample size	44			36			26			38		
	Mean	SE	Range	Mean	SE	Range	Mean	SE	Range	Mean	SE	Range
Age (years)	12.1	0.2	10-15	12.1	0.3	9-15	11.4*	0.3	10-15	12.2	0.3	10-15
Stature (cm)	155.1	1.7	132.1-179.5	154.7	2.0	128.2-180.6	152.9	2.1	135.0-177.7	154.5	1.6	127.7-169.3
Body mass (kg)	49.2	2.1	27.1-103.8	50.7	2.7	26.2-91.7	47.0	1.9	32.4-66.5	56.7	2.9	25.6-88.1
Body Mass Index (kg/m ²)	20.1	0.6	13.7-32.2	20.9	0.9	14.9-34.9	20.0	0.5	16.1-25.7	23.3	0.9	14.5-34.0
Total body fat percentage (%)	22.2	1.5	5.8-45.7	23.4	1.9	5.3-46.1	29.2	1.6	12.6-43.0	33.2	1.7	13.6-48.2
Total tissue mass (kg)	47.1	2.1	25.7-100.1	48.4	2.6	24.8-87.9	44.4	1.9	28.6-63.6	54.2	2.8	24.2-84.7
Total fat tissue mass (kg)	11.6	1.2	1.6-35.3	12.7	1.6	3.0-38.6	14.0	1.1	5.1-28.3	20.3	1.9	5.1-39.8
Android fat tissue mass (kg)	0.8	0.1	0.07-2.9	0.9	0.1	0.2-3.5	1.0	0.1	0.2-2.5	1.6	0.2	0.3-3.7
Bone mineral content (kg)	1.8	0.1	1.2-3.3	1.9	0.1	0.9-3.4	1.8	0.1	1.1-2.9	2.0	0.1	0.8-3.4
Bone density (g/cm ²)	1.00	0.01	0.85-1.19	1.01	0.02	0.86-1.25	1.01	0.01	0.89-1.26	1.02	0.02	0.83-1.31
Sum of skinfolds (mm) [†]	108.5	9.2	29.8-270.2	115.9	11.8	43.4-275.6	153.7	10.7	56.7-237.0	181.8	12.1	62.1-293.7
Sum of trunk skinfolds (mm) [†]	14.4	1.5	3-38.0	16.7	1.9	4.8-38.0	19.2	1.6	5.6-8.2	25.0	1.8	7.6-42.4
Proportion of overweight (%)	25.0			30.6			7.7*			39.5		
Proportion of obese (%)	9.1			13.9			0.0*			23.7		
Somatotype	3.4-5.1-2.9			3.9-5.2-2.8			4.5-4.4-2.6			5.6-4.7-1.8		

* Significant ethnic differences between Caucasian and Indigenous groups at the 0.05 level after controlling for effects of age and stature.

Formatted	... [1]
Formatted	... [2]
Formatted	... [3]
Formatted	... [4]
Formatted	... [5]
Formatted	... [6]
Formatted	... [7]
Formatted	... [8]
Formatted	... [9]
Formatted	... [10]
Formatted	... [11]
Formatted	... [12]
Formatted	... [13]
Formatted	... [14]
Formatted	... [15]
Formatted	... [16]
Formatted	... [17]
Formatted	... [18]
Formatted	... [19]
Formatted	... [20]
Formatted	... [21]
Formatted	... [22]
Formatted	... [23]
Formatted	... [24]
Formatted	... [25]
Formatted	... [26]
Formatted	... [27]
Formatted	... [28]
Formatted	... [29]
Formatted	... [30]
Formatted	... [31]
Formatted	... [32]
Formatted	... [33]
Formatted	... [34]
Formatted	... [35]
Formatted	... [36]
Formatted	... [37]
Formatted	... [38]
Formatted	... [39]
Formatted	... [40]

† One Caucasian boy declined to have his iliac crest skinfold thickness measured, therefore the number of Caucasian boys included in sum of skinfolds and sum of trunk skinfolds was 43.

Table 2. Ethnic differences in anthropometric and body composition indices

	Boys				Girls			
	Caucasian		Indigenous		Caucasian		Indigenous	
	44	36	26	38	Mean	SE	Mean	SE
Sample size								
Arm lengths relative to stature	0.45*	0.002	0.46	0.002	0.45*	0.004	0.46	0.002
Leg lengths relative to stature	0.54	0.002	0.55	0.003	0.54	0.004	0.54	0.002
Abdominal-to-Height ratio	0.48	0.01	0.50	0.015	0.50*	0.01	0.56	0.01
Waist-to-Hip ratio	0.82	0.006	0.83	0.008	0.79*	0.008	0.80	0.008
Percentage android fat (%)	24.3	2.0	27.4	2.5	33.7	2.3	39.6	2.2
Percentage gynoid fat (%)	31.8	1.5	32.2	1.9	39.9	0.3	42.7	1.3
Android fat relative to total fat (%)	6.2*	0.2	6.8	0.2	6.8	0.3	7.5	0.2
Trunk – Total fat mass ratio	0.39*	0.009	0.43	0.01	0.43*	0.01	0.48	0.008
Legs – Total fat mass ratio	0.47*	0.009	0.43	0.008	0.43	0.01	0.40	0.008
Limbs – Trunk fat mass ratio	1.49*	0.06	1.21	0.05	1.26*	0.05	1.04	0.03
Android – Gynoid fat ratio	0.71	0.03	0.79	0.006	0.81	0.007	0.89	0.03

* Significant ethnic differences between Caucasian and Indigenous groups at the 0.05 level after controlling for the effect of age.

Formatted	... [53]
Formatted	... [54]
Formatted	... [55]
Formatted	... [56]
Formatted	... [57]
Formatted	... [58]
Formatted	... [59]
Formatted	... [60]
Formatted	... [61]
Formatted	... [62]
Formatted	... [63]
Formatted	... [64]
Formatted	... [65]
Formatted	... [66]
Formatted	... [67]
Formatted	... [68]
Formatted	... [69]
Formatted	... [70]
Formatted	... [71]
Formatted	... [72]
Formatted	... [73]
Formatted	... [74]
Formatted	... [75]
Formatted	... [76]
Formatted	... [77]
Formatted	... [78]
Formatted	... [79]
Formatted	... [80]
Formatted	... [81]
Formatted	... [82]
Formatted	... [83]
Formatted	... [84]
Formatted	... [85]
Formatted	... [86]
Formatted	... [87]
Formatted	... [88]
Formatted	... [89]
Formatted	... [90]
Formatted	... [91]
Formatted	... [92]
Formatted	... [93]
Formatted	... [94]
Formatted	... [95]
Formatted	... [96]
Formatted	... [97]
Formatted	... [98]
Formatted	... [99]
Formatted	... [100]

Table 3. Prediction of total and android fat using selected anthropometric indices † ‡ §

Gender	Dependent variable	Anthropometric Index	Regression equations	R _{ad} ²	SEE
Boys	Ln Total fat (g)	ΣSF	$3.025 + 1.194 \times \text{Ln}(\Sigma\text{SF}) + 0.058 \times \text{Age}$	0.943	0.161
		AC	$-7.510 + 4.068 \times \text{Ln}(\text{AC}) - 0.072 \times \text{Age}$	0.901	0.213
		AHtR	$11.111 + 4.101 \times \text{Ln}(\text{AHtR}) + 0.085 \times \text{Age}$	0.831	0.278
		BMI	$0.194 + 2.996 \times \text{Ln}(\text{BMI})$	0.819	0.288
		BM	$9.152 + 0.045 \times \text{BM} - 0.181 \times \text{Age}$	0.707	0.367
	Ln Android fat (g)	ΣTSF	$6.153 + 1.232 \times \text{Ln}(\Sigma\text{TSF})$	0.947	0.197
		AC	$-14.540 + 5.103 \times \text{Ln}(\text{AC}) - 0.089 \times \text{Age}$	0.899	0.270
		AHtR	$8.795 + 5.101 \times \text{Ln}(\text{AHtR}) + 0.108 \times \text{Age}$	0.814	0.367
		BMI	$-4.750 + 3.725 \times \text{Ln}(\text{BMI})$	0.802	0.379
		BM	$6.364 + 0.056 \times \text{BM} - 0.226 \times \text{Age}$	0.706	0.462
Girls	Ln Total fat (g)	ΣSF	$3.050 + 1.137 \times \text{Ln}(\Sigma\text{SF}) + 0.079 \times \text{Age}$	0.951	0.133
		AC	$-5.115 + 3.366 \times \text{Ln}(\text{AC}) - 0.131 \times \text{Ethnicity}$	0.951	0.132
		AHtR	$10.928 + 3.592 \times \text{Ln}(\text{AHtR}) + 0.091 \times \text{Age} - 0.196 \times \text{Ethnicity}$	0.905	0.185
		BM	$8.256 + 0.040 \times \text{BM} - 0.061 \times \text{Age}$	0.878	0.210
		BMI	$1.924 + 2.510 \times \text{Ln}(\text{BMI})$	0.864	0.221
	Ln Android fat (g)	ΣTSF	$5.317 + 1.233 \times \text{Ln}(\Sigma\text{TSF}) + 0.067 \times \text{Age}$	0.934	0.194
		AC	$-11.341 + 4.276 \times \text{Ln}(\text{AC}) - 0.042 \times \text{Age}$	0.922	0.211
		AHtR	$9.024 + 4.632 \times \text{Ln}(\text{AHtR}) + 0.084 \times \text{Age} - 0.196 \times \text{Ethnicity}$	0.884	0.258
		BMI	$-2.452 + 3.074 \times \text{Ln}(\text{BMI})$	0.813	0.327
		BM	$5.515 + 0.05 \times \text{BM} - 0.098 \times \text{Age}$	0.811	0.329

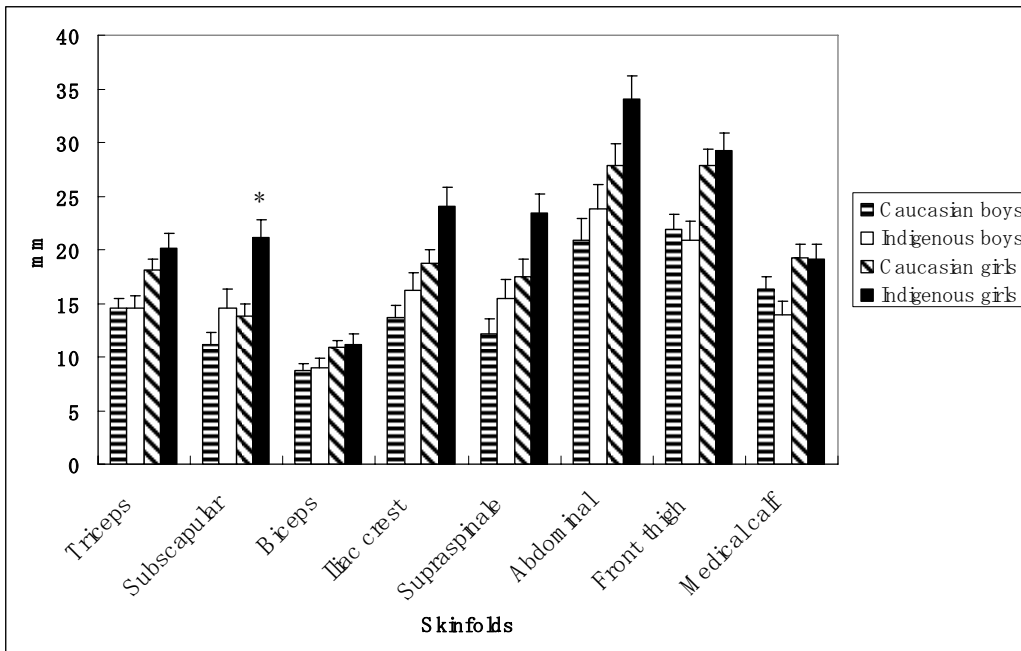
† One Caucasian boy declined to have his iliac crest skinfold thickness measured and therefore the number of Caucasian boys available for Σ SF and Σ TrunkSF was 43.

‡ Ethnicity 1 = Indigenous, 0 = Caucasian.

§ Independent variables: age, ethnicity, body mass (BM), body mass index (BMI), sum of eight skinfolds (Σ SF), sum of trunk skinfolds (Σ TrunkSF), abdominal circumference (AC) and abdominal-to-stature ratio (AHiR).

Figures

Figure 1. Ethnic differences in age- and stature-corrected skinfolds ^{†,‡}

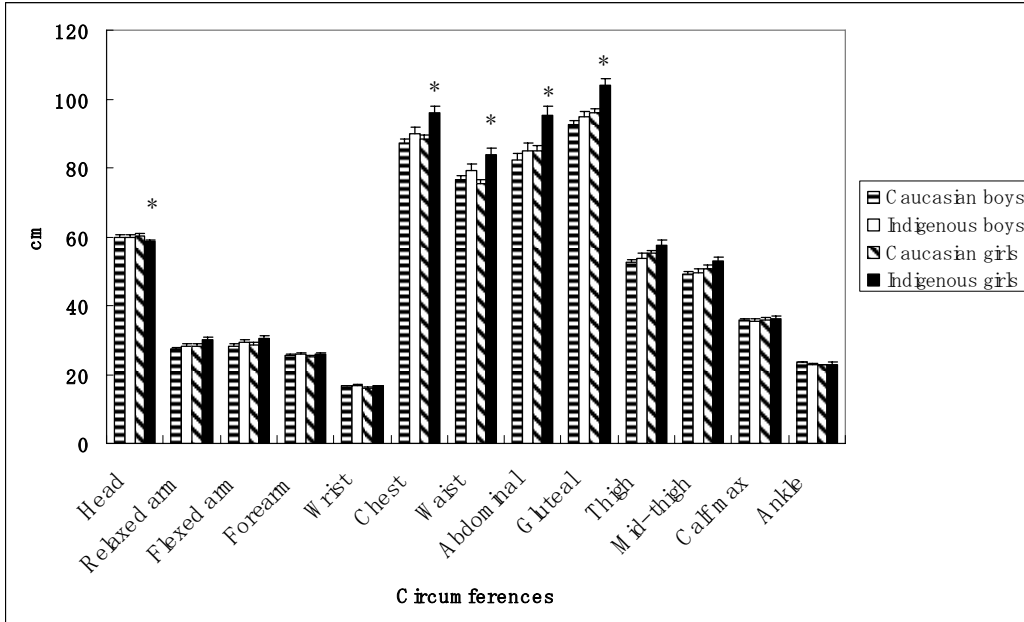


* Significant ethnic differences between Caucasian and Indigenous groups at the 0.05 level after controlling for the effect of age and stature.

[†] One Caucasian boy declined to have his iliac crest skinfold thickness measured and therefore the number of Caucasian boys for sum of skinfolds and sum of trunk skinfolds was 43.

[‡] Error bars indicate standard error.

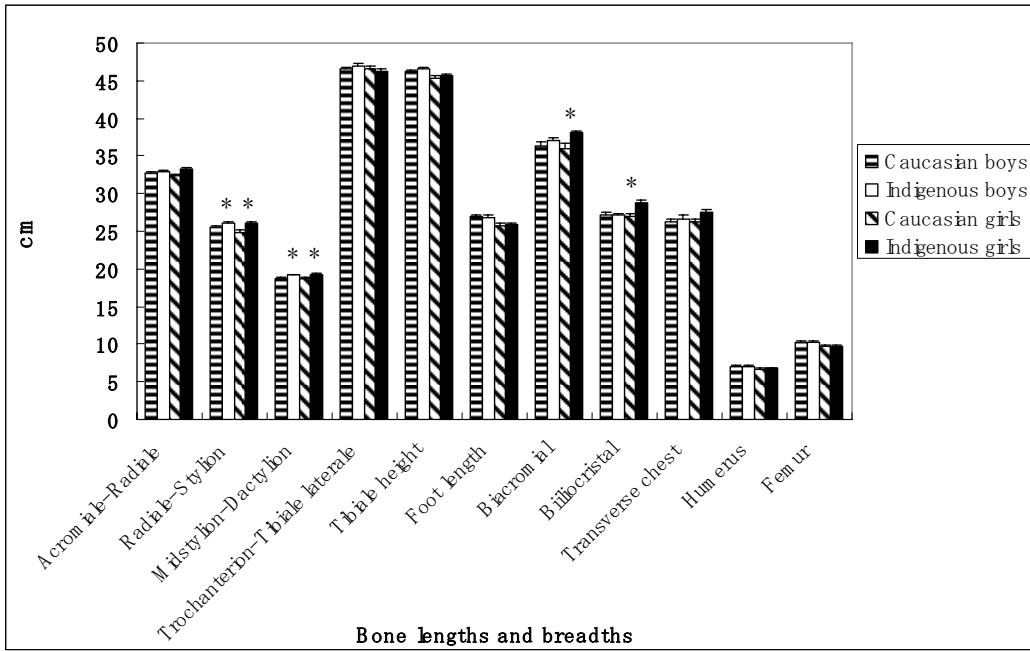
Figure 2. Ethnic differences in age- and stature-corrected circumferences †



* Significant ethnic differences between Caucasian and Indigenous groups at the 0.05 level after controlling for the effect of age and stature.

† Error bars indicate standard error.

Figure 3. Ethnic differences in age- and stature-corrected lengths and bone breadths †

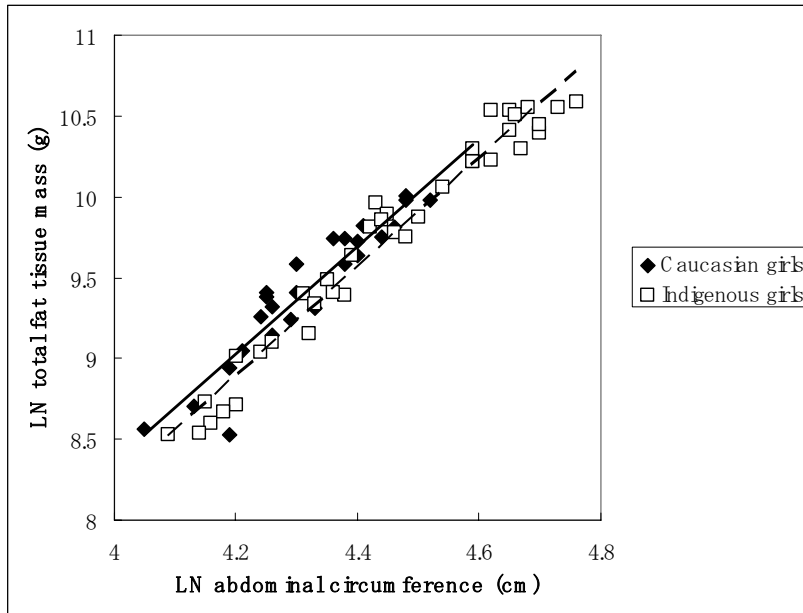


* Significant ethnic differences between Caucasian and Indigenous groups at the 0.05 level after controlling for the effect of age and stature.

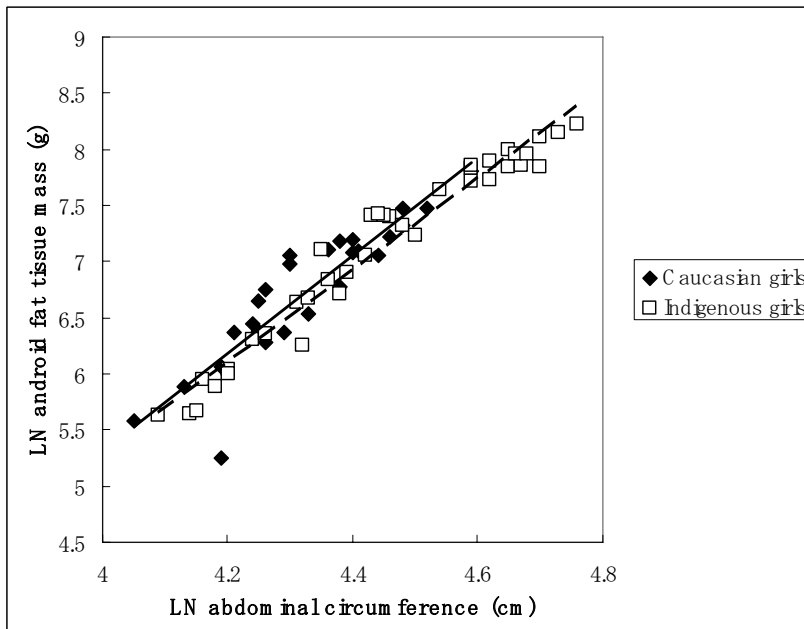
† Error bars indicate standard error.

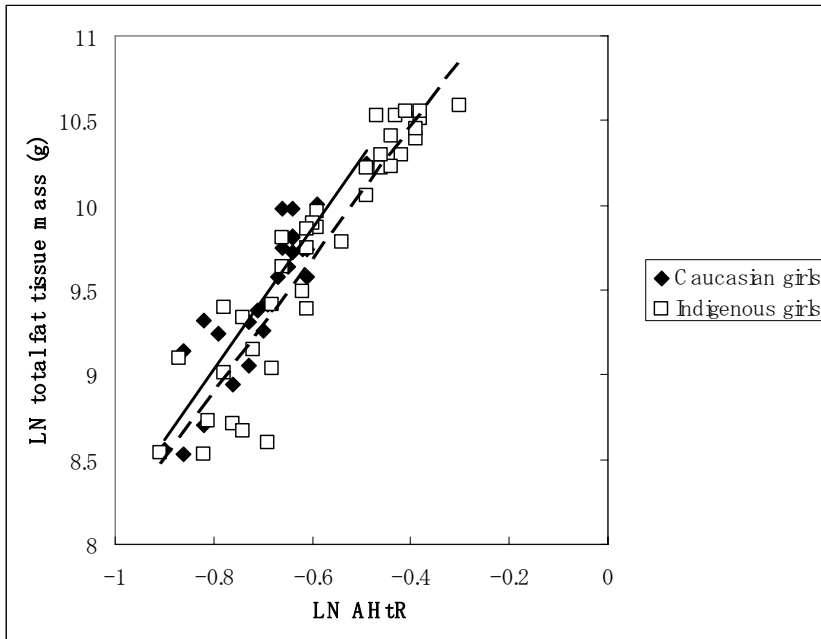
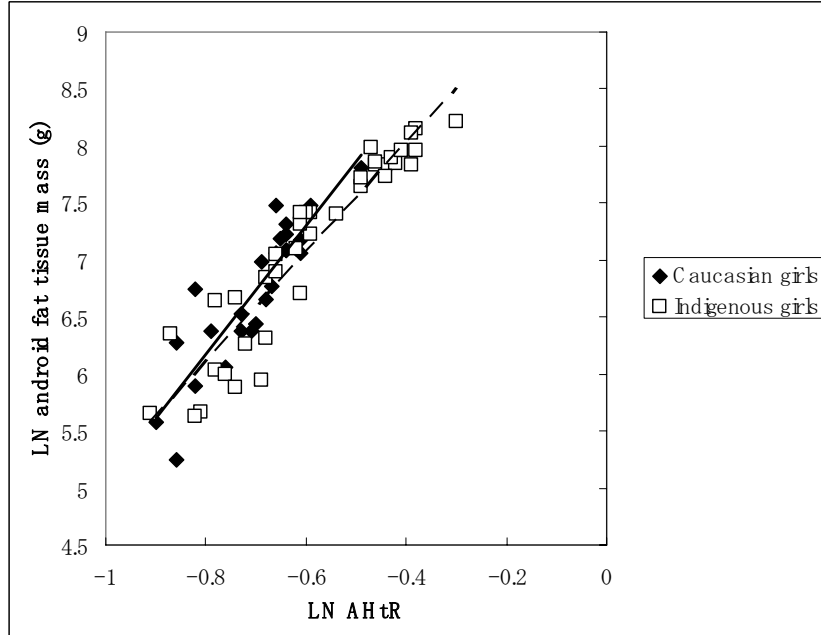
Figure 4. Scatter plots of 1) abdominal circumference and 2) AHtR using a) total fat and b) android fat tissues in girls

1a) Relationship between abdominal circumference and total fat tissue



1b) Relationship between abdominal circumference and android fat tissue



2a) Relationship between AHtR and total fat tissue**2b) Relationship between AHtR and android fat tissue**

Titles and legends to figures

Figure 1. Ethnic differences in age- and stature-corrected skinfolds

A significant ethnic difference was observed in subscapular skinfold thickness for girls.

Figure 2. Ethnic differences in age- and stature-corrected circumferences

Significant ethnic differences were observed in trunk circumferences, including chest, waist, abdominal and gluteal (hip). No ethnic differences were observed in boys.

Figure 3. Ethnic differences in age- and stature-corrected lengths and bone breadths

Indigenous children showed longer radiale-styilion and mid-styilion-dactylion bone lengths compared to Caucasians. In addition, Indigenous girls showed significantly longer acromiale-radiale length as well as biacromial and biiliocrystal bone breadths than Caucasian girls.

Figure 4. Scatter plots of 1) abdominal circumference and 2) AHtR using a) total fat and b) android fat tissues in girls

While no ethnic difference in the relationship between abdominal circumference and android fat tissue was observed, Indigenous girls showed a smaller amount of total body fat at given abdominal circumference ($p<0.05$). Similarly, Indigenous girls showed a smaller amounts of both total and android fat tissues at the given AHtR compared to Caucasian girls ($p<0.05$).

Page 19: [1] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [2] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [3] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [4] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [5] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [6] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [7] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [8] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [9] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [10] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [11] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [12] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [13] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [14] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [15] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [16] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [17] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [18] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [19] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [20] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [21] Formatted	schuberr	12/11/2009 3:29:00 PM

Page 19: [22] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [23] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [24] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [25] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [26] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [27] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [28] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [29] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [30] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [31] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [32] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [33] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [34] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [35] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [36] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [37] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [38] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [39] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [40] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [41] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [42] Formatted	schuberr	12/11/2009 3:29:00 PM

Page 19: [43] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [44] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [45] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [46] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [47] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [48] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [49] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [50] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [51] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 19: [52] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [53] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [54] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [55] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [56] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [57] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [58] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [59] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [60] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [61] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [62] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [63] Formatted	schuberr	12/11/2009 3:29:00 PM

Page 21: [64] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [65] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [66] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [67] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [68] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [69] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [70] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [71] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [72] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [73] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [74] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [75] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [76] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [77] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [78] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [79] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [80] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [81] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [82] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [83] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [84] Formatted	schuberr	12/11/2009 3:29:00 PM

Page 21: [85] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [86] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [87] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [88] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [89] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [90] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [91] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [92] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [93] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [94] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [95] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [96] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [97] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [98] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [99] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		
Page 21: [100] Formatted	schuberr	12/11/2009 3:29:00 PM
Font color: Auto		