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Ethnicity and body fatness in New Zealanders

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Abstract

In light of alarming rises in the prevalence of obesity worldwide, tackling the obesity ‘epidemic’ is now a national health priority in many countries. Increasingly, population measures that provide accurate estimates of body fatness are required to assist public health organisations in identifying at-risk groups and developing appropriate preventative strategies. Body mass index (BMI) remains the most cost-effective and practical tool in this regard.

The World Health Organization (WHO) has issued universal BMI standards for defining ‘overweight’ and ‘obesity’ in adults (BMI =25 kg.m^{-2}, and =30 kg.m^{-2}, respectively) based on the risk of obesity-related disease in Europeans. Although widely used, there is mounting evidence suggesting that these standards are not appropriate for all populations. Research indicates that the associations between BMI, percent body fat (%BF), and health risks can vary across different ethnicities. Accordingly, ethnic-specific and country-specific BMI cut-offs for overweight and obesity may be necessary to attain valid prevalence estimates. In New Zealand, this area is largely unexplored in both young people and Asian populations. There is a need for large-scale longitudinal studies investigating the relationships between excessive body fatness and related health outcomes across all major ethnic groups in New Zealand.

The obesity epidemic

The prevalence of obesity has rapidly reached epidemic proportions in both developed and developing countries around the world. The World Health Organization (WHO) estimates that there are now more than 300 million obese people worldwide—an increase of 100 million since 1995.[1]

This rising level of obesity has increased the incidence of obesity-related morbidities, such as cardiovascular disease, Type 2 diabetes, and hypertension, thus imposing a major burden on healthcare systems and lowering the quality of life for those affected. Furthermore, it is predicted that rates of obesity in the next 20 years could be as high as 45–50% in the USA, and 30–40% in Australia and England.[2]

New Zealand is no exception to these trends. National survey results show an 88% increase in the number of obese adults since 1989,[3] to a stage where more than half of all adults are overweight and obesity-related illnesses cost the health care system an estimated $303 million each year.[4]

Maori and Pacific Island (PI) adults appear particularly susceptible, with obesity rates 1.9 and 2.5 times (respectively) higher than that of New Zealand Europeans.[5] Similar patterns have been observed in younger New Zealanders. Results from the 2002 National Children’s Nutrition Survey indicated that Maori and PI children were 3.0 and 5.3 times (respectively) more likely to be obese than children from other ethnicities.[7] Overall, 21.3% of New Zealand children aged 5-14 years were classified as overweight, with a further 9.8% obese.

Body Mass Index as a measure of obesity

Obesity is defined as a condition of excessive fat accumulation to the extent that health and wellbeing may be impaired.[8] In population research, body fatness (BF) is most commonly estimated using body mass index (BMI), a simple anthropometric measurement of weight (kg) divided by squared height (m^2), which tends to correlate well with both percent body fatness (%BF) and health-risk.[9–13] Although more accurate techniques are available; such as four compartment models that measure bone mineral content, body water, and body density independently; BMI remains the most cost-effective and practical tool in studies of this type.

In 1998, the WHO provided international BMI standards for classifying overweight and obesity in adults based on the risk of obesity-related disease for Europeans at each BMI category.[8] Overweight was defined as BMI =25 $kg.m^{-2}$ and obesity as BMI =30$kg.m^{-2}$, with the latter corresponding to approximately 25% and 35% BF in young European men and women, respectively.[14] An obvious limitation of this measure is its inability to distinguish between fat and fat-free mass. As such, standard BMI cut-offs for overweight and obesity may not represent the same levels of BF in populations that differ significantly from the typical European phenotype.

For young people, different BMI standards are required. The US Centers for Disease Control and Prevention issued age- and sex-specific BMI charts for defining overweight and obesity in those aged 2 to 20 years based on the 85th and 95th percentile of an American reference population.[15] Alternative thresholds have been provided by the International Obesity Task Force (IOTF) using the mean of the BMI-age curves from six major countries.[16] At a given age, individuals are classified as overweight or obese if they have a BMI greater than the mean BMI-age curve that passes through 25 $kg.m^{-2}$ or 30 $kg.m^{-2}$ (respectively) at age 18 years. The intention of these IOTF cut-offs was to establish a higher degree of international applicability, although the averaging of the six diverse datasets could be considered arbitrary.

Obesity and ethnicity

The WHO BMI thresholds for overweight and obesity are widely used in field research; however, their relevance to all populations is questionable. It is generally accepted that associations between BMI and BF are dependent on age and gender. More recently, these associations have been shown to vary with ethnicity. For example, Pacific Islanders tend to have lower levels of BF than Europeans at a given BMI.[17–19] Conversely, many Asian ethnic groups have higher levels of BF than Europeans at specific BMI, thus putting them at greater risk of obesity-related disease at relatively low BMI scores.[20–22]

Even at the same level of BF, risk profiles may differ between ethnic groups.[23] This may be explained by ethnic-specific variation in the patterns of fat distribution. Indeed, central fat accumulation (ie, an android fat pattern) appears to be a greater predictor of obesity-related health risks than overall fatness.[24,25]

Research indicates that, in general, Asian adults are more prone to visceral and central obesity than Europeans.[26,27] In particular, Hughes et al[28] found that Asian Indians had a greater predisposition for central obesity than Malay and Chinese Asians. Likewise, there is evidence that Asian children[29] and adolescents[30] have a greater central fat mass when compared with Europeans and other ethnic groups. In accordance with a higher %BF at a given body size, and a more centralised pattern of fat distribution, elevated disease risks have been observed in Asian populations at BMI scores well below the WHO thresholds defining overweight and obesity.

In response, the WHO released provisional recommendations that overweight and obese BMI cut-off points for Asian populations in the Asia-Pacific region be reduced to =23, and =25 $kg.m^{-2}$, respectively.[31] Although a good starting point, these guidelines do not take into consideration variance among different Asian populations.

More recently, a WHO expert consultation on BMI in Asian populations concluded that there is no single cut-off point appropriate for defining overweight or obesity in all Asian groups.[22] Recommendations from the consultation include: (1) retaining current WHO BMI cut-off points for international classification; (2) adding ‘action points’ of =23 and =27.5 $kg.m^{-2}$ (representing ‘increased’ and ‘high’ risk) as a trigger for public health action; (3) developing ethnic- and country-specific BMI action points; and (4) refining BMI action points with waist circumference in populations predisposed to central obesity.

Obesity in young people

Compared with adults, less is known about the body composition of children and adolescents. There is, however, evidence that BMI is not an equivalent measure of BF among young people from different ethnic groups. At a given BMI, Chinese[32] and Hispanic[33,34] youth have a higher level of BF than Europeans, who in turn have more BF than African-Americans,[35] and Maori and Pacific Islanders.[36] These disparities may evolve, or at least increase, during puberty. For example, Ellis et al[37] observed that ethnic differences in body composition between Hispanics, African-Americans, and Europeans were much less pronounced in children younger than 8 years of age (pre-puberty).

Sexual maturation processes (that occur during puberty) affect body composition, and can alter the associations between BMI and fat mass.[35,38–40] Thus, differences in body composition observed during childhood and adolescence may, in part, reflect ethnic-specific growth and development patterns.[41] In a 6-year follow-up study of Chinese children, Wang et al[42] noted that overweight prevalence (defined according to IOTF age- and sex-specific BMI cut-off points) decreased as children became adolescents. This apparent reduction in overweight may be due to different BMI-age relationships between the study and the IOTF reference populations.

Although the authors did not determine pubertal stage, they suggested that Chinese adolescents tend to mature later than the IOTF reference populations, thereby causing them to be misclassified. Consequently, the IOTF cut-offs may not be appropriate for these populations. For future studies, consideration of sexual maturation may be beneficial.

Explaining ethnic-specific relations between Body Mass Index and percentage of body fatness

Several factors have been proposed to help explain the dependency of the BMI/%BF relation on ethnicity. First, body build/frame size (as measured by wrist and knee girths) tends to vary among different ethnic groups. A number of studies have noted that ethnic populations with relatively high levels of BF at a given BMI also have a more slender build.[43,44] Furthermore, Deurenberg et al[45] found that correcting for body build eliminated most of the ethnic-specific differences associated with %BF prediction equations for bioelectrical impedance analysis (BIA) in Chinese, Malay, and Indian Singaporeans.

In contrast, earlier research concluded that the prediction of %BF from BMI was only slightly improved by the inclusion of body build parameters.[46,47] It is possible that the effects of body build were not observed in these studies due to low inter-group and/or high intra-group variability.[44]

A second factor that may contribute to ethnic-specific relationships between BMI and %BF is variation in sitting height relative to total height. Individuals with long legs (low sitting height) generally have a lower BMI and, as such, %BF may be underestimated from BMI.[48] Relative sitting height tends to be higher in Asian ethnic groups, although the effects on BMI are inconclusive—most likely due to the large intra-group variation in this parameter.[43,44]

Given that differences in body build may explain a large proportion of the ethnic variation in relationships between BMI and %BF, frame size represents an alternative criterion to ethnicity on which to base BMI cut-offs. As ethnicity is self-identified, individuals may affiliate with an ethnic group with which they have no genetic relation. As such, classification according to body build (rather than ethnic group) may help control for inaccuracies when defining ethnicity. However, it is unlikely that collecting data on frame size will be practical in population studies.

Finally, there may be differences in physical activity level among ethnic groups. More active individuals are likely to have a higher proportion of muscle mass, and therefore the potential for overestimation of %BF from BMI.[44] Such a tendency may only be observable in athletes performing high levels of activity. Nevertheless, future studies should include anthropometric measures of body build and physical activity levels in order to increase our understanding of differences in the BMI/%BF relationship among ethnic groups.

New Zealand’s issues regarding body fatness and ethnicity

New Zealand has an ethnically diverse population comprising mainly New Zealand Europeans (80.0%), Maori (14.7%), Asians (6.6%), and Pacific Islanders (6.5%).[49] Despite this diversity, ethnic variation in BF and other body composition variables has yet to be investigated in all major ethnic groups.

However, researchers have compared ethnic differences in BMI and %BF among Maori, PI, and European populations. Several studies have found that Maori and PI adults tend to be leaner (ie, have a lower %BF, and higher fat-free mass) than New Zealand Europeans of the same body size.[17-19]

Similar results have been observed in children. Rush et al[36] noted that Maori and PI girls have (on average) 3.7% less BF than New Zealand European girls of the same body size. Furthermore, a related study by Tyrell et al[6] found a small, but statistically significant, difference in the relationship between BMI and %BF in New Zealand European, Maori, and PI schoolchildren aged 5–10 years; although they suggested that the effects of ethnicity were not clinically relevant.

Even though Maori and Pacific Islanders tend to have a higher proportion of lean mass to fat mass than New Zealand Europeans at a given BMI, as a population they maintain a greater absolute fat mass. Indeed, when higher BMI thresholds are applied to Maori and PI peoples to counteract the high lean-to-fat mass ratio (26 $kg.m^{-2}$ and 32 $kg.m^{-2}$ for ‘overweight’ and ‘obesity’, respectively), these two groups remain twice as likely to be obese than the ‘European and Other’ group.[5] Not surprisingly, Maori and PI populations also have a much higher prevalence of type 2 diabetes when compared to Europeans.[50] However, it is noteworthy that the prevalence of type 2 diabetes among New Zealand Indians exceeds that seen in Maori and Pacific Islanders.

The high prevalence of diabetes among Indians is in line with the elevated levels of BF at a given body size seen among Asian populations overseas. This is an issue of increasing importance to New Zealand given that Asian people make up the fastest growing ethnic group, more than doubling in number between 1991 and 2001.[49] Furthermore, Asians are projected to account for 13% of New Zealand’s population by 2021.

In spite of their population growth, Asian ethnic groups have been largely neglected by New Zealand health and research policies. For example, only Maori and PI children were over-sampled in the 2002 National Children’s Nutrition Survey. In addition, Maori and PI children were analysed separately, whereas children of Asian decent were grouped with New Zealand Europeans. This is a common theme in national surveys by government organisations; such as the Ministry of Health, and Sport and Recreation New Zealand. In order to understand the public health needs of Asian populations in New Zealand, and to tailor preventative health strategies, it is vital that future surveys distinguish between these ethnic groups.

At present, standard BMI thresholds for ‘overweight’ and ‘obesity’ are applied to Asian populations as there are no robust New Zealand data available on the relationship between BMI and body composition variables in this ethnic group. Consequently, Asian groups at risk for health complications (accompanying their overweight and obesity conditions) may not be targeted in interventions to prevent/treat obesity. The only evidence available is from a study by Tyrell et al[6] that included two small groups of Asian children in their investigation of the relationship between BMI and body composition in Maori, Pacific Islanders, and New Zealand Europeans. Although results were not presented, the authors commented that Asian Indian children tended to have a higher %BF at a given BMI compared with New Zealand Europeans. However, caution must be taken when interpreting this statement given the small sample size and the fact that %BF was estimated from bioelectrical impedance analysis using a prediction equation that was not specifically developed for Asian Indian children.

The recommendations put forward by the recent WHO expert consultation[22] offer promise for the classification of overweight and obesity in New Zealand's multiethnic society. For clinicians assessing the health status of individuals, BMI thresholds should be refined by consideration of ethnicity and other risk factors such as waist circumference. At a population level, implementation of additional BMI action points will better reflect the continuum of BF and associated health risk. However, valid comparisons with overseas statistics will only be possible if the criteria used to define overweight and obesity are consistent. In these instances, the retention of the standard WHO cut-offs (25 and 30 $kg.m^{-2}$) is advisable. Ultimately, national BMI action points should be developed for all major ethnic groups in New Zealand based on large-scale population studies of BMI, BF, and health risk.

Conclusions

Accurate assessment of overweight and obesity is vital to assist public health organisations in identifying at-risk groups and to facilitate development of appropriate preventative strategies. At a population level, BF is most commonly assessed using BMI. Although WHO established universal BMI standards for defining overweight and obesity, studies have shown that these BMI thresholds do not provide an equivalent measure of BF and associated health risk across different ethnic groups. Consequently, WHO recently recommended the use of additional BMI cut-offs as public health action points, such as ethnic- and country-specific BMI cut-offs for overweight and obesity.

In New Zealand, knowledge of the ethnic variation in BF and other body composition variables is restricted to New Zealand European, Maori, and PI ethnic groups. New Zealand Asians are of particular interest because of their rapid population growth, and the lack of published data on their BMI/%BF relationships. Furthermore, compared with Europeans, Asians from other countries show elevated levels of BF and greater morbidity and mortality at a given BMI.

In conclusion, large-scale studies are needed to determine the relations between BMI, %BF, BF distribution, and health risk across all major ethnic groups in New Zealand. For young people, these studies should also consider maturational stage. Resulting data will enable development of ethnic-specific BMI thresholds for overweight and obesity—however this is only a starting point.

There is also a clear lack of knowledge concerning ethnic variation in other areas, such as physical activity and diet. An understanding of these issues is imperative for tailoring preventative interventions that will counteract the burgeoning epidemic of obesity in New Zealand.

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