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Body Mass Index Among Melanesian and Indian Fijians Aged ≥ 40 Years Living in Fiji

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Abstract

To determine the distribution and sociodemographic associations of body mass index (BMI; kg/m^2) among Melanesian and Indian Fijians aged ≥40 years living in Fiji, a population-based cross-sectional survey with multistage random sampling was conducted in 2009. Melanesians were more likely to have BMI ≥25 (odds ratio [OR] = 4.73; 95% confidence interval [CI] = 3.57-6.28; $P < .001$) and BMI ≥30 (OR = 3.84; 95% CI = 2.94-5.03; $P < .001$). Among Melanesians, gender and educational attainment were predictive of BMI ≥25 on multivariate analysis. Women were more likely to be overweight (OR = 2.03; 95% CI = 1.34-3.06) or obese (OR = 1.92; 95% CI = 1.43-2.59). Among Indians, gender and age were predictive of BMI ≥25. Again, women were more likely to be overweight (OR = 2.51; 95% CI = 1.69-3.73) or obese (OR = 3.71; 95% CI = 2.19-6.29). Gender–age–domicile-adjusted, and extrapolating across Fiji, 0.3%, 84.5%, and 51.7% of Melanesians aged ≥40 years had BMI <18.5, ≥25, and ≥30, respectively. Among Indians, these values were 5.8%, 54.2%, and 21.2%, respectively.

Keywords

body mass index, Fiji, Fijian, Indian, Melanesian

Introduction

Body mass index (BMI; kg/m^2) is used for comparison between countries and longitudinal comparison within countries, of the body fat profile of populations. Traditionally, these assessments have been based on the widely accepted World Health Organization (WHO) classification of

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underweight (BMI <18.5), normal weight (BMI ≥18.5 but <25.0), overweight (BMI ≥25.0) and obese (BMI ≥30.0) for adults. However, there has been growing debate about the appropriateness of using these standardized BMI thresholds for disparate, particularly Asian, populations.[1-4]

The WHO international classification cut-points were examined by an Expert Consultation in 2002.[2] It was recommended, given the evidence available, that the WHO thresholds should be retained. However, as in Singapore,[5] there is a move toward ethnicity-specific cut-points, based on changing health risk associated with increasing BMI. Therefore, to accommodate increasing variation at a country level while retaining capacity for international comparison, it was also suggested that reporting cut-offs of BMI 18.5, 23.0, 25.0, 27.5, 30.0, 32.5, 35.0, 37.5, and 40.0 should be used.

Fiji is a South Pacific island nation of 837 300 people (240 700 aged ≥40 years, being 50.0% female, 51.5% indigenous Melanesian, 42.6% Asian Indian, 5.8% other ethnicity, and 50.6% rural dwellers). It has a medium human development index rating, which decreased in 2007, and is ranked 108/182 countries.[6] There is continuing high morbidity from infectious disease, and noncommunicable "lifestyle" diseases are becoming more prevalent.[7,8]

The Fiji Eye Health Survey 2009 (FEHS 2009) was a population-based survey of the prevalence, causes, and impact of vision impairment and blindness, with particular emphasis on diabetes and diabetic eye disease, for adults aged ≥40 years in Fiji. This article reports BMI data from that survey. Contemporaneous comparison of the distribution of BMI was made between Melanesian and Indian Fijians, with the suggested extended suite of BMI cut-points used to assist comparison with elsewhere.

Methods

Sampling Plan

The sample frame (188 800 people aged ≥40 years; 50.3% female; 49.4% Melanesian Fijian, 44.9% Indo-Fijian, and 5.7% of other ethnicity; 43.2% rural dwellers) included all 8 provinces of Viti Levu, Fiji's main island, where 79.1% of the total population resides. Using an anticipated prevalence of vision impairment of 11.0% in the target population (actual was 11.4%; 95% confidence interval [CI] = 9.9% to 13.2%), absolute precision of ±2.2% (20% relative difference), with 95% confidence, a design effect of 1.4 and a response rate of 80%, the sample size was determined to be 1354 persons. From the sample frame, 34 clusters of 40 people were required. Across Viti Levu, the clusters were selected through probability proportionate to size sampling, using national census data.

Pilot

A pilot study was undertaken (40 participants from 2 clusters, representative of the population to be screened in the main survey) to refine and validate the enquiry, and investigate test–retest reliability. These data were not included in the final survey analysis.

Enumeration

A single survey team visited all clusters during September to November, 2009. Using a random process, the team leader identified the first household to be targeted in each cluster. Thereafter, consecutive households were approached and eligible people enumerated by trained local fieldworkers until the 40 participants for that cluster were enrolled. If an eligible person was absent, with no prospect of returning during the team's time in the cluster, the absentee's demographic and

socioeconomic data were elicited from an available relative in the household or a knowledgeable adult in an adjacent household.

Questionnaire and Examination

Enumerated residents amenable to participating attended a local central facility, typically a community hall.

An interview-based questionnaire, developed in English, translated into Fijian and Hindi, and back-translated to ensure veracity, was used to collect demographic, socioeconomic, and health data.

Participant barefoot stretch stature height was measured to the nearest centimeter using a portable stadiometer. Weight, in light tropical clothing and without shoes, was measured to the nearest 0.1 kg using portable scales.

Data Analysis

Data were de-identified and entered into a specifically designed database during the survey, with subsequent extensive but random checking for entry integrity. Prior to analysis, missing and outlier data were checked against the survey forms.

Analysis involved univariate comparisons of the prevalence of overweight and obesity based on BMI cut-points by key sociodemographic variables, followed by multivariate logistic regression models to estimate relative differences in risk between sociodemographic groups. This was conducted using PASW/SPSS Statistics 18.0 (SPSS Inc, Chicago, IL) and OpenEpi 2.3 (http://www.openepi.com). Statistical significance was accepted at $P < .05$.

Ethical Considerations

The Fiji National Research Ethics Review Committee convened by the Fiji Ministry of Health approved this study and its methodology.

Consent was obtained from village chiefs prior to survey commencement in each cluster. Participants provided written acknowledgement of informed consent prior to data collection and examination. Communications occurred in English, Fijian, or Hindi, depending on the participant's preference.

Referral to permanent health care services was organized for any participant requiring refraction and spectacles, ocular investigation or treatment, or management of diagnosed or suspected diabetes.

Results

Of the 1892 eligible people enumerated, 1381 participated (73.0%). However, 27.2% (139/511) of nonparticipants were from just 5 (14.7%) clusters. Most (63.6%; 325/511) nonparticipants were not at home, with 39.7% (129/325) of these were away for work. Immobility or illness prevented 5.5% (28/511) attending. Others refused to participate because their eye or vision problem was already being managed (2.3%; 12/511) or because there was no perceived problem (1.6%; 8/511). Data from the 511 nonparticipants were not included in the survey analysis.

Of the 1334 indigenous Melanesian Fijian (n = 832) and Indo-Fijian (n = 502) participants, height and/or weight measurements were not recorded for 18.

The mean heights (±standard deviation) for indigenous Fijian men (n = 359) and women (n = 461) were 1.75 ± 0.07 m and 1.65 ± 0.06 m, respectively. For Indo-Fijians, these were 1.70 ± 0.07 m

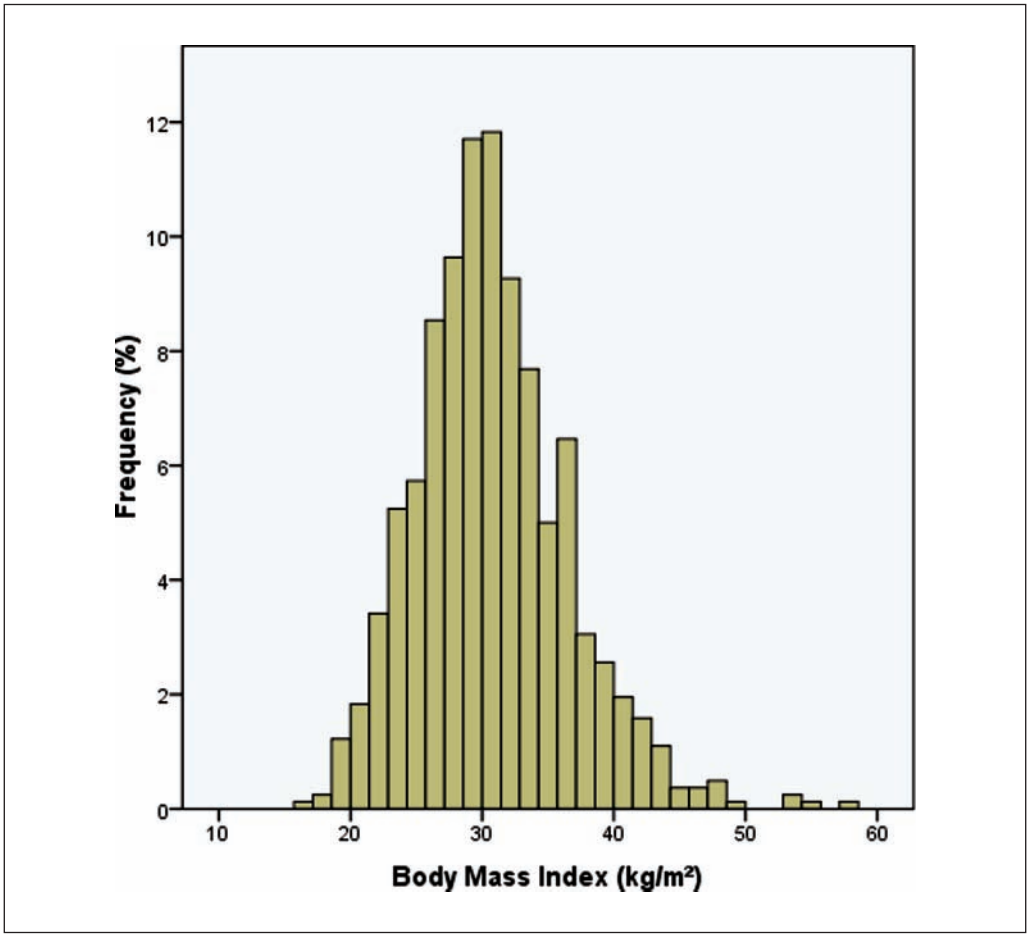

Figure 1. Distribution of body mass index (mean 30.76 ± 5.77 kg/m^2) among 820 Melanesian Fijians aged ≥40 years

(207 men) and 1.56 ± 0.07 m (289 women). Mean weights for all these groups were 90.2 ± 17.5 kg, 86.2 ± 17.4 kg, 70.4 ± 14.2 kg, and 66.9 ± 13.8 kg, respectively.

Melanesian Fijians had a mean BMI of 30.76 ± 5.77 (range 16.51 to 57.81; Figure 1): 29.44 ± 5.22 (range 18.61 to 53.45) for men and 31.78 ± 5.96 (range 16.51 to 57.81) for women (Table 1). No males and only 3 (0.7%) females had a BMI <18.5. Of males, 79.7%, 42.9%, and 3.1% had a BMI ≥25, ≥30, and ≥40, respectively. For females, these were 88.7%, 59.7%, and 9.1%, respectively. On multivariate analysis, BMI ≥25 was independently and significantly associated with gender ($P = .001$) and educational attainment ($P = .013$), but not age ($P = .142$), domicile ($P = .836$), or principal source of household income (no income, pension, fisher/farmer, employee, self-employed; $P = .858$). Females were 2.03 times (95% CI = 1.34-3.06; $P = .001$) more likely to be overweight. So too were those with completed primary (odds ratio [OR] = 2.18; 95% CI = 1.18-4.04; $P = .013$), secondary (OR = 3.38; 95% CI = 1.61-7.11; $P = .001$), and university education (OR = 3.37; 95% CI = 1.31-8.66; $P = .012$), compared with those with no formal education. For BMI ≥30, only gender was significantly associated on multivariate analysis ($P < .001$), with women 1.92 times (95% CI = 1.43-2.59; $P < .001$) more likely to be obese.

Table 1. Distribution of Body Mass Index Among 820 Melanesian Fijians Aged ≥40 Years

			Body Mass Index (kg/m^2)										
			n (%)										
Participant Characteristic	n (%)	Mean (SD)	<18.5	≥18.5 to < 23.0	≥18.5 to < 25.0	≥23.0	≥25.0	≥27.5	≥30.0	≥32.5	≥35.0	≥37.5	≥40.0
Gender													
Male	359 (43.8)	29.44 (5.22)	0 (0.0)	35 (9.7)	73 (20.3)	324 (90.3)	286 (79.7)	226 (63.0)	154 (42.9)	94 (26.2)	45 (12.5)	20 (5.6)	11 (3.1)
Female	461 (56.2)	31.78 (5.96)	3 (0.7)	24 (5.2)	49 (10.6)	434 (94.1)	409 (88.7)	359 (77.9)	275 (59.7)	186 (40.3)	124 (26.9)	71 (15.4)	42 (9.1)
Age (years)													
40-49	284 (34.6)	31.10 (5.56)	2 (0.7)	18 (6.3)	37 (13.0)	264 (93.0)	245 (86.3)	218 (76.8)	155 (54.6)	110 (38.7)	65 (22.9)	32 (11.3)	17 (6.0)
50-59	251 (30.6)	31.76 (6.22)	0 (0.0)	16 (6.4)	32 (12.7)	235 (93.6)	219 (87.3)	192 (76.5)	150 (59.8)	104 (41.4)	64 (25.5)	40 (15.9)	23 (9.2)
60-69	180 (22.0)	30.12 (5.14)	0 (0.0)	11 (6.1)	25 (13.9)	169 (93.9)	155 (86.1)	120 (66.7)	81 (45.0)	50 (27.8)	30 (16.7)	13 (7.2)	8 (4.4)
≥70	101 (12.3)	28.38 (5.38)	1 (1.0)	14 (13.9)	27 (26.7)	86 (85.1)	73 (72.3)	53 (52.5)	41 (40.6)	14 (13.9)	8 (7.9)	5 (5.0)	4 (4.0)
Unknown	4 (0.5)	32.07 (9.24)	0 (0.0)	0 (0.0)	1 (25.0)	4 (100.0)	3 (75.0)	2 (50.0)	2 (50.0)	2 (50.0)	2 (50.0)	1 (1.1)	1 (25.0)
Domicile													
Urban	433 (52.8)	31.19 (5.92)	3 (0.7)	29 (6.7)	62 (14.3)	401 (92.6)	368 (85.0)	321 (74.1)	241 (55.7)	164 (37.9)	104 (24.0)	53 (12.2)	31 (7.2)
Rural	387 (47.2)	30.27 (5.56)	0 (0.0)	30 (7.8)	60 (15.5)	357 (92.2)	327 (84.5)	264 (68.2)	188 (48.6)	116 (30.0)	65 (16.8)	38 (9.8)	22 (5.7)
Total	820 (100.0)	30.76 (5.77)	3 (0.4)	59 (7.2)	122 (14.9)	758 (92.4)	695 (84.8)	585 (71.3)	429 (52.3)	280 (34.1)	169 (20.6)	91 (11.1)	53 (6.5)

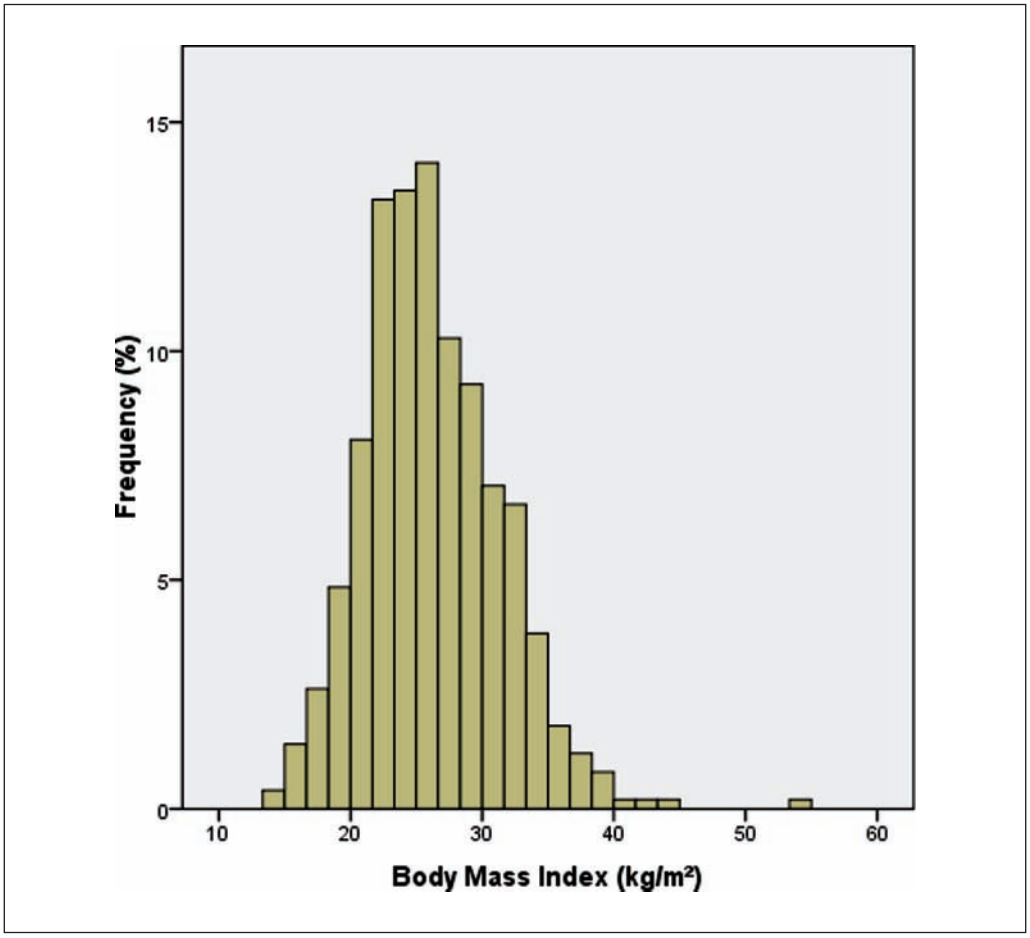

Figure 2. Distribution of body mass index (mean 26.20 ± 5.11 kg/m^2) among 496 Indo-Fijians aged ≥40 years

Indo-Fijians had a mean BMI of 26.20 ± 5.11 (range 13.97 to 54.72; Figure 2): 24.28 ± 4.42 (range 13.97 to 39.63) for men, and 27.57 ± 5.14 (range 15.78 to 54.72) for women (Table 2). Almost 10% of males had a BMI <18.5. For females, this was 1.0%. Of males, 60.0%, 43.5%, and 10.6% had a BMI ≥23, ≥25, and ≥30, respectively. For females, these were 81.7%, 64.7%, and 30.4%, respectively. No males but 1.4% of females had a BMI ≥40. On multivariate analysis, BMI ≥25 was independently and significantly associated with gender ($P < .001$) and age ($P = .005$), but not educational attainment ($P = .836$), domicile ($P = .836$), or primary source of household income ($P = .112$). Females were 2.51 times (95% CI = 1.69-3.73; $P < .001$) more likely to be overweight. So too were those aged 50 to 59 years (OR = 4.37; 95% CI = 1.86-10.24; $P = .001$), 60 to 69 years (OR = 3.42; 95% CI = 1.52-7.68; $P = .003$), and ≥70 years (OR = 3.56; 95% CI = 1.51-8.39; $P = .004$), compared with those aged 40 to 49 years. For BMI ≥30, only gender was significantly associated on multivariate analysis ($P < .001$), with females 3.71 times (95% CI = 2.19-6.29; $P < .001$) more likely to be obese.

Adjusted for gender, age, and education, Melanesians in the sample were significantly more likely than Indians to have BMI ≥25 (OR = 4.73; 95% CI = 3.57-6.28; $P < .001$) and BMI ≥30 (OR = 3.84; 95% CI = 2.94-5.03; $P < .001$).

Table 2. Distribution of Body Mass Index Among 496 Indo-Fijians Aged ≥40 Years

		Body Mass Index (kg/m^2)										
			n (%)									
Participant Characteristic	n (%)	Mean (SD)	<18.5	≥18.5 to < 23.0	≥18.5 to < 25.0	≥23.0	≥25.0	≥27.5	≥30.0	≥32.5	≥35.0	≥37.5	≥40.0
Gender													
Male	207 (41.7)	24.28 (4.42)	20 (9.7)	62 (30.0)	97 (46.9)	125 (60.4)	90 (43.5)	50 (24.2)	22 (10.6)	8 (3.9)	2 (1.0)	2 (1.0)	0 (0.0)
Female	289 (58.3)	27.57 (5.14)	3 (1.0)	50 (17.3)	99 (34.3)	236 (81.7)	187 (64.7)	137 (47.4)	88 (30.4)	51 (17.6)	21 (7.3)	9 (3.1)	4 (1.4)
Age (years)													
40-49	179 (36.1)	26.70 (5.67)	8 (4.5)	39 (21.8)	66 (36.9)	132 (73.7)	105 (58.7)	73 (40.8)	44 (24.6)	28 (15.6)	11 (6.1)	8 (4.5)	3 (1.7)
50-59	176 (35.5)	26.38 (4.72)	5 (2.8)	39 (22.2)	71 (40.3)	132 (75.0)	100 (56.8)	68 (38.6)	41 (23.3)	18 (10.2)	8 (4.5)	3 (1.7)	1 (0.6)
60-69	96 (19.4)	26.04 (4.58)	6 (6.3)	16 (16.7)	32 (33.3)	74 (77.1)	58 (60.4)	33 (34.4)	21 (21.9)	10 (10.4)	3 (3.1)	0 (0.0)	0 (0.0)
≥70	45 (9.1)	23.88 (4.87)	4 (8.9)	18 (40.0)	27 (60.0)	23 (51.1)	14 (31.1)	13 (28.9)	4 (8.9)	3 (6.7)	1 (2.2)	0 (0.0)	0 (0.0)
Domicile													
Urban	126 (25.4)	26.65 (5.25)	5 (4.0)	27 (21.4)	44 (34.9)	94 (74.6)	77 (61.1)	51 (40.5)	30 (23.8)	19 (15.1)	8 (6.3)	4 (3.2)	2 (1.6)
Rural	370 (74.6)	26.05 (5.06)	18 (4.9)	85 (23.0)	152 (41.1)	267 (72.2)	200 (54.1)	136 (36.8)	80 (21.6)	40 (10.8)	15 (4.1)	7 (1.9)	2 (0.5)
Total	496 (100.0)	26.20 (5.11)	23 (4.6)	112 (22.6)	196 (39.5)	361 (72.8)	277 (55.8)	187 (37.7)	110 (22.2)	59 (11.9)	23 (4.6)	11 (2.2)	4 (0.8)

Table 3. Estimated Percentage and Numbers of Melanesian and Indian Fijians Aged ≥40 Years Living in Fiji, Against Body Mass Index Cut-Points Recommended by World Health Organization Expert Consultation[2]

	Body Mass Index (kg/m^2)										
Ethnicity	<18.5	≥18.5 to < 23.0	≥18.5 to < 25.0	≥23.0	≥25.0	≥27.5	≥30.0	≥32.5	≥35.0	≥37.5	≥40.0
Melanesian	300	9400	18 600	114 000	104 800	88 500	64 100	41 800	24 100	13 000	7400
	(0.3)	(7.6)	(15.0)	(91.9)	(84.5)	(71.3)	(51.7)	(33.7)	(19.4)	(10.5)	(5.9)
Indian	6000	24 500	41 000	72 100	55 600	37 400	21 800	12 700	4 300	2400	1000
	(5.8)	(23.9)	(40.0)	(70.3)	(54.2)	(36.4)	(21.2)	(12.4)	(4.2)	(2.3)	(1.0)

Using national census data, adjusting for gender, age, and domicile, and extrapolating to those aged ≥40 years across Fiji (Table 3), 0.3%, 84.5%, and 51.7% of indigenous Melanesians had a BMI <18.5, ≥25, and ≥30, respectively. For the Indian population, these were 5.8%, 54.2%, and 21.2%, respectively. Using current WHO definitions, 104 800 (95% CI = 101 800-107 900) and 64 100 (95% CI = 59 800-68 300) Melanesian Fijians were overweight (BMI ≥25) and obese (BMI ≥30), respectively. Using the same cut-offs for the Indo-Fijian population, 55 600 (95% CI = 51 100-60 100) people were overweight and 21 800 (95% CI = 18 100-25 500) were obese.

Discussion

The conduct of the lives of participants residing away from the larger population centres on the island of Viti Levu is reportedly similar to those of people on the other 100 or so permanently inhabited islands of Fiji (20.9% population). Therefore, limiting this study to Viti Levu was unlikely to bias the results, particularly because domicile was not a predictor of being overweight or obese. Also, although the participation rate may have been improved by including evening visits to villages, the reasons for nonparticipation and for the sporadic omission of height and weight measurements that occurred for some participants were unlikely to be associated with the determinants of BMI. Therefore, the resultant account of BMI from this study and its extrapolation to the whole of Fiji for those aged ≥40 years among the 2 major ethnic populations are likely valid and appropriately descriptive.

Direct comparisons of the data from this survey with those from most of the pre-1993[9] and more recent[8,10] population-based surveys in Fiji were not possible because of age sampling and reporting differences. However, overall, mean BMI has increased and, consistently, Melanesians and women of both ethnicities have greater risk of being overweight or obese. The 2002 STEPS study documented increasing BMI with age increasing from 15 years, although it may have plateaued at the 45- to 54- and 55- to 64-year cohorts.[8] The current study found an age–overweight association only for Indo-Fijians.

Increasing urbanization, with its contingent changes in activity and nutrition, is generally regarded as contributing to the rise of obesity in developing countries, including those of the Pacific.[9] However, this study found urban domicile was not a predictor of being overweight or obese for either ethnic group or gender. Nor was primary source of household income, a likely proxy for food choices and occupational physical activity. Educational attainment, which may also be a proxy for a sedentary lifestyle, was associated with being overweight only for Melanesian Fijians. Perhaps the availability and pricing of processed foods of high calorie and fat content are such that consumption of these is now ubiquitous for both urban and rural dwellers. Overall, intake of energy, protein, and fat has increased over the past 50 or so years, and both urban and

rural physical activity have decreased.[9] This may have resulted in loss of, as observed in this study, the previously reported relationship between domicile and high BMI.

The risks for lifestyle diseases associated with ethnicity-specific BMI cut-points, reflecting the impact of ethnicity-specific body fat composition and distribution, are appreciated for Asian populations such as Chinese in Singapore[5], Indians in India, and Thais.[11,12] There has not been the same quantification of risks associated with WHO or ethnicity-specific BMI cut-points for Indians in Fiji; nor for Melanesians in the same environment. The high and increasing proportion of adults in Fiji defined as overweight and obese mirrors a high and increasing demand for the medical management of chronic degenerative diseases and their complications.[8] This is in a poor country that in 1999 already spent an estimated 6% of its annual health budget on diabetes.[8] If health promotion and education, and disease screening, early intervention, and monitoring are to be targeted and cost-effective in Fiji, then the health risk profiles associated with BMI and other indicators need to be further elucidated for Melanesian and Indian Fijians, separately by gender.

Conclusions/Recommendations

Melanesian Fijians were more likely than Indo-Fijians to be overweight (84.5% vs 54.2%) or obese (51.7% vs 21.2%). Women of both ethnicities were more likely than men to be overweight or obese. Accordingly, the health risk profiles associated with increasing BMI should be elucidated for both Melanesian and Indian Fijians, separately by gender. Furthermore, efforts to prevent overweight and obesity in Fiji need to be redoubled, with further investigation of behavioral determinants in the Fiji context, and, drawing on successful interventions elsewhere, development and implementation of targeted strategies. The Fiji School of Medicine's Centre for the Prevention of Obesity and Noncommunicable Diseases, in collaboration with the Ministry of Health, would appear to be an appropriate driver of this activity.

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Declaration of Conflicting Interests

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