

# Knowledge of Cardiovascular Risk Factors in West African Refugee Women Living in Western Australia

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Published online: 6 February 2010  
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**Abstract** As obesity and cardiovascular disease are elevated in refugees who have migrated recently to Western countries, barriers to healthy eating and exercise were investigated in West African women who had entered Australia recently as refugees. Questionnaires on diet and exercise were administered to convenience samples of 51 West African women and 100 Australian women. Eighty percent of the West African women were overweight or obese compared with 49% of Australian women. The West African women were less clear about nutritional guidelines and had more misconceptions about exercise than the Australian women. BMI increased with age in both groups, and increased with fewer years at school and the number of internal barriers to exercise in Australian women. Dietary changes, limited nutritional knowledge of Western foods, a sedentary lifestyle, and barriers to participating in physical activity programmes may increase vulnerability to obesity and cardiovascular disease in West African women who have entered Australia recently as refugees.

**Keywords** Refugees · Women · Obesity · Nutritional knowledge · Barriers to exercise

## Introduction

Morbidity and mortality from cardiovascular disease are significantly greater in African migrants than in the resident population of host nations [1–6]. Two modifiable risk factors for cardiovascular disease, obesity and salt intake, are both over-represented in African people living outside their country of origin [6]. Rises in blood pressure and the incidence of stroke may result from changes towards a more ‘Western’ style of diet [1, 6–9]. This ‘dietary acculturation’ effect [10] has been found even in urban areas of Africa [6, 11], and has been observed in minority groups around in the world [10, 12–15]. Unfortunately, the typical ‘Western’ diet has been linked to an increased risk of type-2 diabetes [16], a health condition that is elevated in African migrants [4]. The adoption of a sedentary lifestyle linked with low energy-demanding jobs may exacerbate the effects of dietary acculturation.

In recent years, the nine fastest growing birthplaces for people in Australia were countries in sub-Saharan Africa [17], and one-third of the 13,000 refugees granted entry to Australia in 2007–2008 under the Humanitarian program were from African nations [18]. The rapid rate at which the sub-Saharan African population is increasing in Australia, and the dietary challenges and cardiovascular health concerns observed in African migrant populations in other developed nations, makes this population a high priority for health research. Thus, the goal of the present study was to explore knowledge about and attitudinal barriers to healthy eating and exercise in a group of West African women who had entered Australia recently as refugees, and to compare the findings with a convenience sample of Australian women. Body mass index (BMI) was investigated in relation to age, education, and knowledge about and attitudes toward diet and exercise within each group, and in relation

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to years of residence in Australia within the West African sample. We hypothesized that knowledge deficits and attitudinal barriers would be greatest in West African women with little schooling, and that this would be associated with an increased BMI.

## Method

### Participants

Questionnaires were administered to a convenience sample of 51 West African women aged between 20 and 67 years (mean age  $\pm$  SD, 35.0  $\pm$  10.6 years) from Liberia or Sierra Leone who had lived in Australia for 6 months to 5 years (mean duration 2.3  $\pm$  1.3 years). They had lived in refugee camps for up to 10 years before arrival in Australia, where they resided in a small, tightly knit community of around 1,000 members in approximately 300 families. They were recruited between May and June 2006 by personal invitation from the social network of eight West African survey administrators. All but eight of those approached agreed to be interviewed (86% participation rate). Reasons given for not participating included family or work commitments, or difficulty arranging a time or place with suitable privacy. Questionnaires were also administered to 100 Australian women of European descent living in Perth or its outer-metropolitan region. Caucasian women across the full age range, from young adult through to old age (range 18–90 years, mean age 43.0  $\pm$  17.8 years), were recruited between May and August 2006 by personal invitation from the social network of eight Australian survey administrators. All but two of those approached agreed to fill out the survey (98% participation rate), and the response rate thereafter was 100%. Where possible, the West African women were matched for educational background (years at school), then by age  $\pm$  5 years and, if more than one match was made, by marital status to Australian women [19]. However, nine West African women who had not attended school at all, and an additional five who had attended school for only a few years, could not be matched on the primary variable of interest (educational background). The less- and more-educated West African women were similar in age, employment and marital status, but a smaller proportion of the less-educated women spoke English at home (50 vs. 92%,  $P < 0.01$ ). The procedures were approved by the institutional Ethics Committee, and each respondent provided written informed consent before participating.

### Procedures

Questions on cardiovascular health were administered as part of a larger survey initiated by a group of West African

women who were concerned about health issues within their community. Also included in the health survey were questions that addressed knowledge of and attitudes toward sexual and reproductive health [19], hygiene, help-seeking pathways and barriers to accessing healthcare. Findings from these parts of the survey were not included in the present report because they did not directly address risk factors for cardiovascular disease. Eight of the West African women reviewed the survey to ensure that the wording of questions was culture-appropriate, and each administered the survey to 6–8 female acquaintances or family members. The first interview was supervised by the project coordinator to ensure that questions were administered in a standard manner and that answers were recorded correctly.

Eight female undergraduate psychology students each recruited 12–15 Caucasian women (acquaintances or family members) to participate in the survey. The student interviewer explained the nature of survey items to the respondent, obtained informed consent, and administered items concerned with age, height, weight, educational background and other demographic variables. The respondent filled out the remainder of the survey in private, and returned it in a sealed envelope to the student interviewer.

To investigate knowledge of nutrition, respondents were asked whether health experts would recommend that people should be eating more, the same amount or less of a range of foods (Table 2). These items were based on Parmenter and Wardle's general nutrition knowledge questionnaire for adults [20]. Responses were later recoded as correct or incorrect. Respondents were also asked how often they ate each of these foods. From this information, an approximate rate of consumption per week was calculated for each type of food. The West African women were also asked whether their consumption of traditional foods had changed since living in Australia (Table 4). Additional questions concerned with attitudes towards diet and health (Table 5) were drawn from items constructed by Gates and McDonald [21]. Questions that addressed knowledge about exercise (Table 6), personal benefits of exercise (Table 7), and barriers to exercise (Table 8), were based on items reported by Chinn et al. [22].

### Statistical Approach

Demographic characteristics were investigated in analyses of variance with planned contrasts between the less- and more-educated West Africans and between the more-educated West Africans and the matched Australian sample. Nutritional knowledge was investigated in Kruskal–Wallis analyses and with planned contrasts (Fisher's exact test). The dependent variables were each of the food groups listed in the questionnaire. Rate of consumption of the

various foods, attitudes toward diet and health, knowledge of exercise, the personal benefits of exercise, and internal and external barriers to exercise, were investigated in similar analyses. Changes in diet after the West African women arrived in Australia were investigated with Wilcoxon's match-pairs signed-ranks test.

The association between BMI and the number of correct items for nutritional knowledge, exercise knowledge and personal benefits of exercise, the number of barriers to exercise, age and years at school was investigated separately in the West African and Australian samples with Pearson's correlation coefficient. In addition, the association between the number of correct items and years of residence in Australia was investigated in the West African sample. The capacity of these variables to predict BMI was investigated within each group in hierarchical multiple regression analyses. Age, years at school and years of residence in Australia were entered in the first step, and nutritional knowledge, exercise knowledge, benefits of exercise, and internal and external barriers to exercise were entered in the second step. The criterion of statistical significance for all analyses was  $P < 0.05$ .

## Results

Demographic characteristics of the West African and matched Australian samples are shown in Table 1, along with the results of analyses of variance across all three groups and planned contrasts between the more-educated West African women and the other two groups. Mean weight and BMI were greater in West African than Australian women. However, mean height did not differ among the three groups. BMI was less than 25 in 20% of West African women (normal range), between 25 and 32 in 53% (overweight range), and greater than 32 in 27% (obese range). In contrast, BMI was less than 25 in 51% of the Australian sample ( $N = 100$ ), between 25 and 32 in 39% and greater than 32 in another 10%.

## Diet

The percentage of participants in each of the three groups who were aware of nutritional guidelines for various foods is shown in Table 2, and the frequency of consumption of these foods is reported in Table 3. Significant differences among all three groups in the percentage of participants who endorsed each item (Kruskal–Wallis chi-square), and between the more-educated West African women and the other two groups, are also listed. Nearly all of the participants were aware that dietary guidelines recommend increased consumption of fruit and vegetables, and most were aware that these guidelines advocate less consumption of sugary and fatty foods. However, Australian women generally were more knowledgeable about nutritional guidelines for common Western foods than West African women. In addition, the less-educated West African women were less aware of the nutritional benefits of high-fibre foods than the more-educated West African women. Australian women reported that they ate vegetables and white meat such as chicken and pork more frequently than African women (Table 3). The West African women reported that their diet now included more meat, eggs, chicken and potatoes but less fish and local African produce since their arrival in Australia (Table 4).

Beliefs and attitudes toward diet and health are listed in Table 5, along with the significance of differences among groups in the frequency of endorsement of these beliefs. A greater proportion of the more-educated West African women were confused about which dietary recommendations to believe than in the other two groups. Conversely, most of the less-educated West African women believed that there was no reason to change their diet because they thought that what they ate and drank now was healthy. In addition, the majority of West African women believed that “some people are born fat and some thin; there is not much you can do to change this”, whereas only 3% of Australian women subscribed to this view.

**Table 1** Demographic characteristics

	Mean $\pm$ SE			<i>F</i> ratio (2,85 <i>df</i> )
	West Africans		Australians ( $N = 37$ )	
	Less-educated ( $N = 14$ )	More-educated ( $N = 37$ )		
Age (years)	37.9 $\pm$ 2.3	34.0 $\pm$ 1.8	34.1 $\pm$ 2.1	0.67
Years at school	1.7 $\pm$ 0.7*	10.8 $\pm$ 0.3	11.3 $\pm$ 0.1	213.4, $P < 0.001$
Years in Australia	2.1 $\pm$ 0.3	2.4 $\pm$ 0.2	NA	0.34
Height (cm)	160 $\pm$ 2.1	163 $\pm$ 2.1	166 $\pm$ 1.5	1.64
Weight (kg)	77.9 $\pm$ 3.8	75.9 $\pm$ 2.3	67.4 $\pm$ 2.3*	4.49, $P < 0.05$
BMI (kg/m <sup>2</sup> )	30.4 $\pm$ 1.3	28.9 $\pm$ 1.0	24.6 $\pm$ 0.8*	8.53, $P < 0.001$

NA Not applicable

\* Significantly different from the more-educated West African group ( $P < 0.05$ )

**Table 2** Knowledge of nutritional guidelines

	Percent agreement			Kruskal–Wallis Chi-square
	West Africans		Australians (N = 37)	
	Less-educated (N = 14)	More-educated (N = 36)		
<i>We should eat more</i>				
Vegetables	86	94	100	4.8
White meat	14	14	46*	11.1, P < 0.01
High-fibre foods	50*	81	92	11.3, P < 0.01
Fruit	93	100	97	2.4
Oily fish	64*	17	73*	25.4, P < 0.001
<i>We should eat less</i>				
Sugary foods	93	100	100	5.3
Starchy foods	57	78	84	4.1
Fatty foods	86	97	100	6.3, P < 0.05
Red meat	0	8	8	1.2
Fried foods	79	86	100*	7.1, P < 0.05
Dairy products	64	83	81	2.4

\* Significantly different from the more-educated West African group (P < 0.05)

**Table 3** Frequency of consumption of various food groups

	Mean ± SE (times/week)			Kruskal–Wallis Chi-square
	West Africans		Australians (N = 37)	
	Less-educated (N = 14)	More-educated (N = 37)		
Vegetables	3.5 ± 0.6	3.9 ± 0.4	5.5 ± 0.4*	9.9, P < 0.01
White meat	2.0 ± 0.5	2.0 ± 0.3	3.1 ± 0.3*	8.3, P < 0.05
High-fibre foods	3.4 ± 0.7	3.1 ± 0.4	2.4 ± 0.4	1.3
Fruit	4.9 ± 0.7	4.5 ± 0.4	4.0 ± 0.4	1.6
Oily fish	1.9 ± 0.5	1.6 ± 0.3	1.2 ± 0.3	1.0
Cakes, biscuits or icecream	1.7 ± 0.6	2.3 ± 0.4	2.6 ± 0.4	3.4
Sugary drinks	1.0 ± 0.6	2.2 ± 0.4	1.4 ± 0.4	1.6
Starchy foods	5.0 ± 0.7	3.6 ± 0.4	4.2 ± 0.4	3.0
Red meat	3.7 ± 0.6	3.1 ± 0.4	2.3 ± 0.4	2.4
Fried foods	1.7 ± 0.5	1.9 ± 0.3	1.2 ± 0.3	0.7
Butter, cheese or full-cream milk	2.9 ± 0.7	3.2 ± 0.4	4.4 ± 0.4*	5.1

\* Significantly different from the more-educated West African group (P < 0.05)

**Exercise**

Knowledge about the pros and cons of exercise is listed for the West African and Australian women in Table 6, and recognition of the personal benefits of exercise is shown in Table 7. In general, knowledge was greater in Australian than West African women, and the less-educated West African women had more misconceptions about exercise than the more-educated women (Table 6). In addition, more Australian than West African women thought that exercise helped them to relax and forget about their worries (Table 7). As shown in Table 8, West African women also identified more barriers to exercise than Australian women,

including not enough time, lack of transport, chronic illness and pain after exercise.

**Predictors of BMI**

Correlations between demographic variables, questionnaire scores and BMI are listed separately for West African and Australian women in Table 9. In the West African group, BMI increased with age but was not related to nutritional or exercise knowledge or the number of internal or external barriers to exercise (Table 9). Moreover, the combined set of variables failed to predict BMI in a hierarchical multiple regression analysis.

**Table 4** Foods consumed by West African women at least once per week before and after their arrival in Australia ( $N = 51$ )

	Percent who consumed foods weekly		Wilcoxon's $Z$
	In Africa	In Australia	
Rice	98	98	0.00
Potatoes	29	81	4.69, $P < 0.001$
Cassava	81	12	5.15, $P < 0.001$
Palm oil	92	20	6.00, $P < 0.001$
Gari	38	5	3.15, $P < 0.01$
Okra	63	38	2.45, $P < 0.05$
Fish	98	47	4.69, $P < 0.001$
Meat	68	96	3.50, $P < 0.001$
Chicken	37	92	5.01, $P < 0.001$
Eggs	49	94	4.69, $P < 0.001$
Beans	55	64	1.07
Egg plants	59	47	1.41
Cabbage	27	48	2.24, $P < 0.05$
Tomatoes	73	92	2.50, $P < 0.05$
Lettuce	24	58	3.00, $P < 0.01$
Bananas	87	60	3.00, $P < 0.01$
Pawpaws	81	40	3.67, $P < 0.001$
Oranges	94	89	1.00
Apples	39	95	4.38, $P < 0.001$
Grapes	26	91	4.69, $P < 0.001$

Within the Australian sample, BMI increased in proportion to age and the number of internal barriers to exercise (Table 9). Even without the items “I’m too fat to exercise” and “I’m too old to exercise”, BMI increased in line with the number of internal barriers to exercise [ $r(97) = 0.28$ ,  $P < 0.01$ ]. BMI was also greater in women who attended school for fewer years. In the first step of the hierarchical multiple regression analysis, age and years at school predicted BMI [ $r^2 = 0.092$ ,  $F(2,96) = 4.88$ ,  $P < 0.01$ ]. The addition of the nutritional and exercise variables into the equation improved the accuracy of BMI prediction [ $r^2$  change = 0.106,  $F$  change (5,91) = 2.41,  $P < 0.05$ ], primarily because of the relationship between BMI and internal barriers to exercise [ $\beta = 0.342$ ;  $P < 0.01$ ]. The multiple regression equation changed only slightly after the items “I’m too fat to exercise” and “I’m too old to exercise” were removed from the list of internal barriers to exercise [ $r^2$  for the full equation = 0.196,  $F(7,91) = 3.17$ ,  $P < 0.01$ ; internal barriers to exercise  $\beta = 0.334$ ;  $P < 0.01$ ].

## Discussion

Many refugees from African countries who resettle in Western countries such as the United Kingdom, New Zealand and Australia are overweight or obese [3, 4, 8, 23].

**Table 5** Attitudes toward diet and health

	Percent agreement		Kruskal–Wallis Chi-square
	West Africans		
	Less-educated ( $N = 14$ )	More-educated ( $N = 37$ )	
<i>Do you think that</i>			
What you eat can determine whether you get heart disease or cancer	43	57	5.5
There are so many recommendations about what is healthy to eat, it's hard to know what to believe	50*	87	9.2, $P < 0.05$
I know that what I eat and drink now are healthy, so there is no reason for me to make a change	71	41	7.2, $P < 0.05$
Some people are born fat and some thin; there is not much you can do to change this	71	54	30.6, $P < 0.001$
When shopping for food it is important to consider whether the food I choose to buy is healthy or not healthy	93	95	0.6

\* Significantly different from the more-educated West African group ( $P < 0.05$ )

**Table 6** Knowledge about exercise

	Percent correct			Kruskal–Wallis Chi-square
	West Africans		Australians (N = 37)	
	Less-educated (N = 14)	More-educated (N = 37)		
Regular exercise can make bones stronger so that they do not break easily (true)	79	68	78	1.3
You can exercise even when you are old (true)	71*	95	95	7.6, P < 0.05
You need a lot of expensive equipment for exercise (false)	50	65	97*	16.8, P < 0.001
Regular exercise can help reduce your risk of having a blocked or burst blood vessel in your brain (true)	79	68	73	0.7
Regular exercise can help prevent blockage of blood vessels in your heart (true)	57	70	84	4.1
Sport is only for fit young people (false)	57*	89	97	15.0, P < 0.001
Too much exercise can be dangerous if you are not used to it (true)	43	65	89*	12.0, P < 0.01
Exercise must be painful before it does any good (false)	7	24	92*	45.5, P < 0.001
Regular exercise is important if you want to lose weight (true)	93	100	100	5.3
A short walk every day is better than no exercise at all (true)	100	97	100	1.4
People with heart disease should not exercise (false)	21	16	89*	43.6, P < 0.001

\* Significantly different from the more-educated West African group (P < 0.05)

**Table 7** Recognition of the personal benefits of exercise

	Percent agreement			Kruskal–Wallis Chi-square	
	West Africans		Australians (N = 37)		
	Less-educated (N = 14)	More-educated (N = 37)			
<i>Do you think that exercise helps you to</i>					
Feel healthy and fit	100	97	100	1.4	
Feel like you've done something good	100	95	92	1.2	
Keep healthy	100	97	100	1.4	
Look good	93	97	97	0.7	
Relax, forget about your worries	64	60	84*	5.5	
* Significantly different from the more-educated West African group (P < 0.05)	Control your weight	79	95	100	8.6, P < 0.05
	Become slimmer	93	92	97	1.1

In the present study, the mean BMI was significantly greater in West African than Australian women, and 80% of the West African women were in the overweight or obese range. The West African women were less clear about nutritional guidelines for Western foods and had more misconceptions about exercise than the Australian women, which may have increased their vulnerability to obesity.

**Diet**

Consumption of milk products and meat increases with income and urbanization in many parts of Africa whereas high-fibre foods such as vegetables are considered to be a

“poor man’s diet” [24]. This might explain why West African women reported that they ate vegetables less often than Australian women. In minority groups, healthy eating is often equated with giving up traditional foods and conforming to the eating habits of the dominant culture [25, 26]. In addition, many Africans believe that a larger body size is a sign of higher status and wealth [27]. Conversely, thinness may be associated with war, poverty, malnutrition and chronic diseases that tax the body such as HIV and tuberculosis. Challenging such beliefs in community-led health promotion campaigns may help migrants to retain the benefits of their traditional diet and to find appropriate substitutes for foods that are no longer available.

**Table 8** Barriers to exercise

	Percent agreement			Kruskal–Wallis Chi-square
	West Africans		Australians ( <i>N</i> = 37)	
	Less-educated ( <i>N</i> = 14)	More-educated ( <i>N</i> = 37)		
<i>Internal barriers</i>				
I do not enjoy exercise	36	20	20	1.9
Parts of my body are always in pain after exercise	64	62	22*	14.5, <i>P</i> < 0.001
I'm too fat to exercise	29	16	5	4.9
I have a chronic illness which prevents me from exercising	21	16	3*	5.0
I'm too old to exercise	14	5	0	4.8
I don't like sporting activities	21	19	24	.3
I don't have enough time to exercise	50	73	46*	5.9
I don't have enough energy to exercise	21	19	38	3.6
<i>External barriers</i>				
There's no one to exercise with	29	24	24	0.1
I don't have suitable clothes/equipment for exercise	43	22	8	8.0, <i>P</i> < 0.05
Lack of transport prevents me from exercising	21	22	3*	6.4, <i>P</i> < 0.05
Lack of child care facilities prevents me from exercising	14	8	8	0.5
Lack of money prevents me from exercising	29	30	19	1.3

\* Significantly different from the more-educated West African group (*P* < 0.05)

**Table 9** Predictors of BMI in West African and Australian women

	Pearson's correlation coefficient	
	West African women ( <i>N</i> = 51)	Australian women ( <i>N</i> = 100)
Years in Australia	−0.06	–
Nutrition knowledge <sup>a</sup>	0.09	0.12
Exercise knowledge <sup>a</sup>	0.01	−0.04
Exercise benefits <sup>a</sup>	0.10	−0.05
Internal barriers to exercise <sup>a</sup>	0.09	0.29, <i>P</i> < 0.01
External barriers to exercise <sup>a</sup>	0.24	0.01
Age	0.34, <i>P</i> < 0.05	0.27, <i>P</i> < 0.01
Years at school	−0.11	−0.21, <i>P</i> < 0.05

<sup>a</sup> Total number of correct items (nutrition knowledge and exercise knowledge), and the number of endorsed benefits of exercise, internal barriers to exercise, and external barriers to exercise

Adjusting traditional diets to the abundant and affordable foods of a new country, while trying to understand dietary guidelines, may be overwhelming during the early stages of acculturation [27, 28]. Overall nutritional knowledge was greater in the more- than less-educated West African women, but their awareness of the recommendations might

have had the unintended consequence of exacerbating confusion about which recommendations should be followed. For example, only a minority of the more-educated West African women recognised that dietary guidelines recommend increased consumption of oily fish, perhaps because of conflicting advice to reduce intake of fats and oils but to eat more fish.

In general, the Australian women were more knowledgeable about dietary guidelines than their West African counterparts. However, this knowledge did not always match behaviour. In particular, rate of consumption of fried foods was similarly high in the West African and Australian women, and the Australian women reported that they ate dairy foods more frequently than the West African women. The dissociation between dietary knowledge and practice represents a major challenge for governments of Western nations faced with the repercussions of an obesity epidemic [29].

The West African women reported that they had made significant dietary changes after their arrival in Australia. As in previous studies, women reported that their consumption of cassava, palm oil, and fish had decreased whereas consumption of meat, chicken, apples, potatoes and lettuce/salad had increased [8, 28], presumably due to an increased availability and affordability of these foods

[8, 10]. Consumption of animal products increases with income in Africa, and the same is likely to occur in African migrants in Australia [24]. Although not investigated in this study, consumption of high-energy take-away foods, soft drinks, cordials, frozen foods, and other ‘junk’ foods was reported to increase in African migrants after resettlement in Australia [8, 28]. In combination with reduced physical activity, a high-fat calorie-dense diet could contribute to weight gain in resettled refugees [30].

### Exercise

Most of the women recognised personal benefits of exercise such as feeling healthy and fit and looking good. However, compared to the Australian women, West African women were less likely to agree that exercise helped them relax and forget about their worries or could help control their weight. Apart from these attitudes, several misconceptions about exercise may have discouraged some West African women from participating in physical activity. For example, some thought that elderly people and those with heart disease should not exercise, that sport is only for fit young people and that a lot of expensive equipment is needed to exercise; moreover, most thought that exercise must be painful before it did any good.

Additional barriers to exercise for the West African women, such as not having enough time, chronic illness, pain after exercise, and a lack of transport, suitable equipment or clothes, are similar to those reported by other minority and immigrant populations [9, 25, 30, 31]. For example, Somali women who had recently migrated to Australia or New Zealand reported that incidental activity had decreased markedly due to increased use of public transport, the change from daily to weekly food shopping, and increased use of labour-saving devices [9, 31]. Barriers to increasing physical activity after resettlement included a greater need for formal child care, insecurities about walking alone, and a lack of experience with more formalised exercise. Prohibitions in the Islamic religion against exercising in public spaces and mixed gender settings were also cited by some Somali women as major barriers [9]. As well, cultural and religious beliefs (e.g., time required for prayer, fatalistic notions of illness, cultural expectations for women), poverty, language difficulties, and social isolation create additional barriers to participation in physical activity programmes in migrant groups [30].

Within the West African sample, BMI increased with age but was unrelated to nutritional or exercise knowledge, or the number of barriers to exercise. However, it is noteworthy that external barriers to exercise, such as a lack of suitable clothes or exercise equipment, lack of

transport, lack of a partner to exercise with, lack of child care facilities and lack of money, increased in proportion to years of residence in Australia ( $r = 0.54$ ,  $P < 0.001$ ), presumably because these issues became more salient with acculturation. Within the Australian sample, BMI increased with age but was also associated with fewer years at school and with the number of internal barriers to exercise. The direction of this association is uncertain; nevertheless, it is tempting to speculate that inactivity and excess body weight interact to reinforce internal barriers to exercise in a vicious circle.

### Limitations and Conclusions

Several limitations apply to the findings of this study. First, the study was initiated by a small group of West African women who recruited members of their community to participate in a self-report survey. Thus, the findings may suffer from inaccuracies of self-report and might not generalize to other refugee populations or to community members who were not invited to take part. For example, the survey administrators may have recruited women with health problems or with risk-factors such as obesity because they thought that they should take part in the survey. Likewise, findings from the convenience sample of Australian women may not represent the full spectrum of attitudes within the Australian community toward diet and exercise because most of the respondents were highly educated and all lived in or close to a major capital city. Second, statistical power may not have been great enough to detect significant effects in the small sample of less-educated West African women. Third, it was not possible to distinguish between effects of the migration process and those of acculturation due to the cross-sectional nature of the survey. Thus, further studies are required to confirm and extend the present observations.

Nonetheless, the findings are consistent with previous reports that the prevalence of obesity, a major risk factor for lifestyle diseases, is increased in resettled refugees from sub-Saharan Africa [8, 23, 30]. This may be due, in part, to major changes in diet after migration, limited knowledge of nutritional guidelines for Western foods, a more sedentary lifestyle, and barriers to participating in physical activity programmes after resettlement [9, 31]. Public health initiatives that highlight the best aspects of traditional and host nation diets, and that challenge cultural beliefs that obesity signifies health and high status, are required for immigrant groups at heightened risk of cardiovascular disease. In addition, local food policies should be developed to ensure that migrant populations have access to traditional foods [8]. Furthermore, culturally- and religiously-sensitive strategies that overcome barriers to participation in physical activity are required to address the



health concerns associated with physical inactivity in minority migrant communities [31].

**Acknowledgments** We wish to thank the West African Women's Group (Western Australia) for their participation, in particular Ruth Sims (co-ordinator and interviewer), Annie Gondor, Mercy Kennedy, Evelyn Saah, Fatmata Koromah, Josephine Doe, Mary Mansaray, and Kadi Ngele (interviewers). We also wish to thank Lynette Verrall, Fiona Renton, Katie Wake, Beth Cornish, Jennifer Bradbury, Manda Martinovich, Kate Evans and Diana Roach for their contributions. This project was supported by the Sexual Health and Blood-borne Virus Program, Department of Health, Western Australia. None of the authors have any conflict of interest with the contents of this study.

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