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Food acquisition habits in a group of African refugees recently settled in Australia

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ABSTRACT

This study investigated how recently arrived refugees acquired food in their local food neighbourhood. Ten African humanitarian migrants belonging to separate households were asked to keep a travel and food diary for one week. Participants' food neighbourhoods were mapped using online satellite pictures and direct observation. On average 78 food outlets were available within a 2 km radius of participants' homes. Vegetable consumption was higher in participants who resided <1 km from a major grocery retailer ($p<0.05$). Foods provided during migrant orientation events were the major opportunities where subjects were introduced to foods more typical of reported usual intake in the general sedentee Australian population. The initial 12 months of resettlement is a critical period for acculturation as participants stabilise food habits. While participants seemed not to live in food deserts, intakes of all food groups remained inferior to recommended levels suggesting physical proximity and implied in-store choice alone do not guarantee a healthy diet. Migrant orientation events may represent an important setting for education about suitable options for adopting new foods into diets.

1. Introduction

At the end of 2008 approximately 10 million refugees worldwide lived in temporary accommodation awaiting resettlement (UNHCR, 2009). Refugees wait an average of 17 years for such placements (UNHCR, 2006, 2008). Of the 13 014 humanitarian visas offered by Australia in 2007–2008, approximately 30% were offered to people from sub-Saharan Africa (Affiars, 2008). Upon arrival in industrialised countries, refugees often have existing health issues due to malnutrition and undernutrition in their homelands (Renzaho, 2004). In the Australian context, major health issues identified in newly arrived refugees include inadequate vaccination, compromised nutrition (iron and vitamin D), infection, dental disease (Tiong et al., 2006) and the dual burden of overweight/obesity and undernutrition in children (Renzaho et al., 2006).

For refugees from sub-Saharan Africa, the social and cultural constructs surrounding food are an important aspect of dietary habits following resettlement (Renzaho, 2004). The importance of these constructs extends to other health related issues including seeking treatment (Nyagua and Harris, 2008) and expectations of health care treatment (Morris et al., 2009). Following resettlement, refugees are exposed to new social and cultural practices of the sedentee (Misra and Ganda, 2007) population and environmental factors that influence dietary patterns (Dixon et al., 2007). This is evidenced by the nutrition transition refugees undergo, characterised by lowered consumption of fruits and vegetables, and various traditional dishes, and an increase in the consumption of foods with high contents of sodium, fats, saturated fats, sugars and energy (Burns et al., 2000; Kruseman et al., 2005; Manandhar et al., 2006; Misra and Ganda, 2007; Raschke and Cheema, 2008; Renzaho and Burns, 2006). In essence, nutrition transition tends to be a process of eliminating many healthful aspects of traditional diets, replacing these with less desirable elements of typical "Western-style dietary patterns." These adopted dietary patterns are likely to intensify the consequences of existing compromised health status. In particular, children who experience undernutrition early in life are at increased risk of metabolic syndrome when they move to an environment of excess food availability (Adair and Cole, 2003; Yajnik, 2004). It is likely that the process of acculturation, defined as a long-term adaptation process where individuals adapt to a new culture by modifying values, norms and behaviours (Ayala et al., 2008) (in the present case refugees adapt to a sedentee culture), leads to diet-related problems including increasing body mass index (Ayala et al., 2008) and gestational diabetes (Flynn et al., 2009). Consequently second-generation immigrants are more likely to become overweight than their parents (Gordeon-Larsen et al., 2003; Kremmyda et al., 2008). Typically measured using birthplace, years in the destination country or age at arrival in

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the destination country (Ayala et al., 2008); dietary acculturation is a well documented process. However the underlying reasons why it occurs, that is, what factors influence dietary changes in refugees and immigrants are less well understood.

Access to food has been suggested as an influential factor in diet and health (Larson et al., 2009; Moore et al., 2008; Rose and Richards, 2004; Spence et al., 2009; Timperio et al., 2008). For marginalised and disadvantaged sub-populations in society such as refugees (Grondin, 2004; Sheikh-Mohammed et al., 2006) lack of access to healthy food has been associated with residing in so called "food deserts" (Larsen and Gilliland, 2008). In its simplest guise, a food desert is described as a residential area with poor access to healthy food due to geography, in-store choice or affordability (Beaulac et al., 2009; Bodor et al., 2007). One study suggests refugees are often placed into such environments (Manandhar et al., 2006) that may compound and exacerbate existing health issues due to the unavailability or un-affordability of nutritionally or culturally appropriate foods (Grondin, 2004; Gushulak and MacPherson, 2006; Muecke, 1992; Sheikh-Mohammed et al., 2006). Conversely, people living in neighbourhoods with high proportions of immigrants are more likely to have better access to healthy foods (Osypuk et al., 2009) and a higher intake of fruit and vegetables (Dubowitz et al., 2008), although other health related factors are reported to be less available (Osypuk et al., 2009). Although the food environment into which refugees are placed or enter is an important factor in the acculturation process, there is no clear or consistent environmental profile that these transient populations move through.

While there is evidence that people of lower socioeconomic status are more likely to be exposed to fast food outlets and have poorer geographical access to fresh food (where supermarkets are used as a proxy for fresh food) (Ball et al., 2009; Burns and Inglis, 2007; Kwate, 2007; Larsen and Gilliland, 2008; Larson et al., 2009; Smoyer-Tomic et al., 2008), the influence of this geography on diet and health is inconclusive. Previous studies suggest that socially disadvantaged people may have equal or better access to other community resources related to health (Pearce et al., 2007; Smoyer-Tomic et al., 2008). On one hand, some studies have found a relationship between geographical proximity and food intake (Larson et al., 2009; Moore et al., 2008; Rose and Richards, 2004; Spence et al., 2009; Timperio et al., 2008). However, other studies have found no such relationship (Jeffery et al., 2006; Pearce et al., 2008, 2006; Thornton et al., 2009). Aside from physical proximity, food access also relates to other demographic and socio-cultural determinants such as social and cultural background, private transport availability, nationality of friends, knowledge of food and socioeconomic status (Apparicio et al., 2007; Barry and Udry, 1998; Burns and Inglis, 2007; Coveney and O'Dwyer, 2009; Wandel et al., 2008).

The purpose of this study was to investigate how recently arrived refugees interpret the environment in their local area in terms of food acquisition. A better understanding of how dietary acculturation unfolds, in relation to the physical food environment, after arrival in their destination country will inform the development of appropriate health interventions for refugee populations settling in industrialised countries. The present study centered on tracking how and where a group of humanitarian migrants from sub-Saharan Africa acquired their food during the early stages of their resettlement in Australia.

2. Methods

2.1. Overview

To investigate refugee interactions with the physical food environment and subsequent food intake two data sets were collected. The first involved a description of the physical food environment and travel habits of participants. The second documented the dietary intake of participants. For the purposes of this study food acquisition was classified as either "grocery shopping" (food acquisition for later consumption) or "food consumption" (food purchased for immediate consumption). Food intake was classified as either food prepared and consumed at home, food not prepared at home and consumed away from home or food prepared at home but consumed away from home. Timmerman's (2003) definitions for travel were used where movements between two locations were "trips" and sequences of trips starting and ending at the same location were "journeys". In the present study, journeys were always considered to start and end at the participant's home.

2.2. Sampling

An established non-government organisation (NGO) (ACCES Services Inc.) in the local area, which specialises in the settlement of newly arrived refugees, acted as a gatekeeper for recruitment. Participants were included based on four criteria: nominal head of a family, mainly responsible for grocery shopping in the household, born in the sub-Saharan region of Africa and had arrived in Australia within 12 months on humanitarian visas.

2.3. Dietary intake and travel

Participants were asked to keep a travel and food acquisition diary for one week recording all travel movements away from home, food acquisition and food intake with receipts acting as validation. Three 24-h dietary recall interviews were conducted over the week. Data from 24-h recalls were converted into portion sizes and food groups according to Australian national guidelines (Kellet et al., 1998). To enhance the transparency of the dietary intake data, legumes were classified as a separate food group, rather than being included in the "meat and meat substitutes" group. Travel distances of participants were calculated using an electronic street directory according to transport mode. A member of the refugee community acted as an interpreter when necessary.

2.4. Physical food environment

Details on participants' neighbourhoods were collected via an online database with geographic information system principles using a previously reported process (Macdonald et al., 2007; Reidpath et al., 2002; Timperio et al., 2008) and supplemented thorough satellite pictures and contacting outlets directly (Larsen and Gilliland, 2008). Food outlets were classified according to the Australian and New Zealand Standard Industry Classification (ABS, 2006). Supermarkets and grocery stores were divided into two subgroups: (PriceWaterHouseCoopers, 2007) major grocery retailers (MGR), (Woolworths, Coles, Bi-Lo and Aldi), and independent grocers (IG) and convenience stores (CON). Specialised food retailing categories considered in this study were: fresh meat (FM), poultry and fish retailing (MPFR), fruit and vegetable retailing (FVR), bakery product manufacturing (BA), cafes and restaurants (REST), takeaway food services (TA) and pubs, taverns and bars (PUB). Minimum distance from participant homes to each type of shop (Apparicio et al., 2007; Larsen and Gilliland, 2008), concentration of food outlets within a 2 km radius from participants' homes (Apparicio et al., 2007; Ball et al., 2009; Larsen and Gilliland, 2008), and average distance to three closest different chain name MGRs were calculated (Apparicio et al., 2007; Larsen and Gilliland, 2008).

2.5. Ethics and informed consent

The informed consent protocol in this study was approved by the University Human Research Ethics Committee, and was conducted in accordance with the Ethical Guidelines for Qualitative Research (National Health and Medical Research Council, 1999) and the National Privacy Principles (2001). All participants had the study explained to them verbally in plain terms and were asked to read (aloud) and sign a Plain Language Consent Form (PLCF), a copy of which they retained. The PLCF contained an explicit statement that participation in the research was completely voluntary, and subjects could withdraw at any time. This was also communicated to the project officer working for the NGO facilitating their settlement. The PLCF contained the contact details of appropriate university contacts and participants were advised to contact the research team or University Ethics Officer at any time should they have concerns or wish to withdraw from the study. The researchers had no contact with the participants, other than specifically for the conduct of the research.

2.6. Data analysis

Participants' preferred locations for grocery shopping and food consumption were calculated using number of visits and percentage of budget spent in various store categories. These data were then compared against the distance between the closest stores in that category to participants' homes. The median daily intake of food groups for each participant was calculated to determine the impact of food neighbourhood over diet quality using a statistical analysis program (SPSS 16.0 for windows®). Subjects were subsequently assigned to one of two groups based on proximity to closest MGR ($<$ or ≥ 1 km). Food group intake was compared between these groups using independent sample *t*-test analysis.

3. Results

Ten African humanitarian migrants belonging to separate households in three adjacent suburbs were recruited using snowball sampling. Prior to arrival in Australia, nine of the participants had spent an average of 11 years in a refugee camp. Subjects reported that the food received whilst in refugee camps comprised almost exclusively of grains, with fresh vegetables, fruit, meat and dairy needing to be sourced independently of rations. None were involved in community gardening at the time of interview. General characteristics of participants are summarised in Table 1.

3.1. Participant income and expenditure

All participants resided in suburbs with mean incomes between the second and third quintile of national income statistics (ABS, 2007). Weekly household income of participants indicated that most were classified as low socioeconomic status and 70% had an income lower than the value stipulated by the Henderson Poverty Line (UQSRC, 2006) (Table 2). All participants lived in rented accommodation in a variety of family situations including share housing, single and two-parent households, with or without children. Forty percent of participants had a learner's license for automobiles, 50% owned bicycles and 20% owned cars. Only one of the participants was currently employed, receiving an average weekly wage of AUS $87.00. All participants received government allowances, with an average total weekly household income of AUS $600.15 (average AUD$ 141.30 per capita). Of the total weekly household income an average of 35% was spent on rent (AUD$ 204.00) and 24% (AUD$142.25) on grocery shopping (range 8–48%). Food consumption costs usually represented less than 1% of participants' disposable income, with one exception spending 27% of their income. None of the refugees reported having their own food garden. Details on refugee income and expenditures are provided in Table 2.

3.2. Food environment

Analysis of food outlet concentration showed an average of 77 food outlets within a 2 km radius of participant's homes (Table 3). The concentration of MGRs and FVRs within 2 km ranged between

Table 1
General characteristics of the study population.

Participant	Age (years)	Gender[a]	Religion[b]	Time since arrival[c]	BMI (kg/m^2)	Employment status[d]	Household size (# people)	Special diets[e]	Drivers license[e]	Transport available at home[f]	Previous location of stay	Time spent there (years)	knowledge of nutrition[e]	Level of education[g]
1	44	M	M	13 d	38.7	Un	6	y	N	B	Camp	12	Y	C
2	45	M	M	22d	22	Un	6	N	N	B	Camp	13	Y	B
3	31	F	M	3 m	28	Un	6	N	N	N	Camp	15	N	PS
4	35	M	C	3 m	27.4	Empl	4	N	Learner's car	B	Camp and City	6	N	IU
5	21	M	C	9 m	24	Un	7	N	Learner's car	B	Camp	14	Y	MS
6	24	M	C	1 m	22.6	Un	2	N	N	B	Camp	1	Y	C
7	20	F	C	9 m	27.7	Un	3	N	N	B	Camp	15	N	MS
8	32	F	C	5 m	26.3	Un	6	N	Learner's car	N	Camp	12	N	MS
9	40	M	C	12 m	24.4	Un	3	N	Learner's car	C	City	10	N	B
10	29	F	M	8 m	27.3	Un	5	N	Learner's car	C	Camp	12	N	N

[a] M: male; F: female.
[b] M: Muslin; C: Christian.
[c] d: days; m: months.
[d] Un: unemployed; Empl: employed.
[e] Y: yes; N: no.
[f] B: bicycle; C: car; N: none.
[g] B: bachelor's; C: certificate degree; PS: primary school degree; IU: incomplete university degree; MS: Middle school degree.

Table 2
Distribution of income and expenditure.

Participant	Household income (AUD$)	Rent (AUD$)	% spent on rent	Total spent on food acquisition (AUD$)	% of household income spent on food acquisition	Total spent on groceries (AUD$)	% of household income spent on groceries	FIC (AUD$)	% of household income spent on FIC
1	582.00	[a]	0	281.92	48	277.72	47.70	6.70	1
2	582.00	[a]	0	236.05	41	236.05	40.55	–	0
3	510.00	300.00	58.80	192.89	38	192.89	37.82	–	0
4	654.50	250.00	38.10	173.69	27	173.69	26.50	0.99	0
5	967.00	300.00	31	113.03	12	103.40	10.70	9.90	1
6	224.00	100.00	40.90	78.42	35	18.32	8.20	60.10	27
7	530.00	230.00	43.30	122.64	23	122.64	23.10	0.90	0
8	860.00	290.00	33.70	179.98	21	175.92	20.50	6.00	1
9	542.00	270.00	49.80	72.76	13	69.76	12.90	3.00	1
10	550.00	300.00	54.50	52.19	9	52.19	9.50	–	0
Average	$600.15	$204.00	0.3501	150.357	27	142.258	0.23747	8.76	3

FIC: Foods for Immediate Consumption.

[a] Refugees in Australia less than one month have their rent paid for them by the Australian Government.

Table 3
Distribution of food outlets within a 2 km radius of each participant's residence.

Outlet	Number shops	Percentage of shops of each category (%)	Distance of nearest shop (km)
Bakeries	2.8	4	0.703
Convenience stores	7.3	9	0.631
Fruit and vegetable retailer	3.3	4	0.668
Independent grocer	16.2	21	0.398
Meat fish and poultry retailer	3.8	5	0.642
Major grocery retailer	3.2	4	0.971
Pubs and bars	1.8	2	0.549
Restaurants and cafés	7.9	10	0.609
Takeaway shops	30.8	39	0.350
Total	77	–	0.610

2 and 4 stores, respectively. Forty percent of participants resided less than 1 km away from the closest MGR with the rest between 1 and 2 km away. The average distance to access three different MGRs was 1.44 km, with three participants having access within a 1 km buffer, three between 1 and 1.99 km buffer and four over the 2 km buffer. In the participants' food neighbourhoods, the nearest IG and TA were closer to participants' homes than the nearest MGR on average by 600 m each. TAs were more concentrated than MGRs with an average of 9.5($\pm$) TAs per MGR within the 2 km buffer.

3.3. Dietary intake

On average, dietary intake was below suggested levels (Australian Government, 2007) in all food groups except "extras", which exceeded recommended levels. Participants who lived within 1 km of a MGR consumed higher amounts of cereals, vegetables, extras and legumes and lower amounts of dairy products (significant ($p < 0.05$) only for vegetables). No significant difference in the consumption of fruits and meat products was noted (Table 4). Food that was prepared at home but consumed elsewhere was similar in composition to food eaten at home and comprised rice, meat, tomato sauce, maize meal, eggs, cassava, bread, peanut butter sandwiches, soft drinks and juices. Food eaten at friend's houses was similar with the inclusion of items such as biscuits, potatoes and cabbage. All friends visited were of African origin. Foods provided and consumed at orientation events such as English classes and morning teas included more mainstream Australian foods such as juices, breads, cakes, stews and salads.

Table 4
Comparison of mean intake of food groups (servings) according to distance to nearest major supermarket (MGR).

Food group	<1 km from MGR (portions)	>1 km from MGR (portions)
Cereals	**3.0**	**2.5**
Meat and substitutes	**1.5**	**1.5**
Dairy products	**0.5**	**1**
Vegetables	**2.5**	**1**
Fruits	**3.0**	**3**
Legumes	**1.5**	**0.5**
Extras	**4**	**3.5**

3.4. Shopping patterns

On average participants spent one quarter of their weekly household income on food (AUD$ 152.63) 97.8% (AUD$ 157.82) of which was spent acquiring food for preparation and consumption at home. An average of AUD$ 4.50 (2.2% of money spent on food) was spent on food for immediate consumption. One single male participant's shopping patterns were significantly different. He reported spending 35% of his income on food, 76.5% of which was dedicated to food for immediate consumption. He also reported living in a share house with one other male and having very limited cooking skills. Fruits were the most commonly purchased grocery followed by meat and meat substitutes. Of the budget allocated to items acquired for immediate consumption, 82% was directed to the purchase of foods in the "extras" food group and the remaining 17% was spent mainly on the acquisition of sandwiches. Eight of the ten participants used the closest MGR for their grocery shopping. Of the other two, one did not shop at a MGR during the study period and the other used a MGR 1.0 km further away than their closest MGR. Two subjects shopped at two different MGRs, one being the closest one to their house and the second being 300 m and 800 m further than the closer, respectively. When considering participant food intake away from home, about half was not purchased but either eaten at friend's houses or provided to them at the location they had travelled to. The remaining foods consumed away from home were sourced

from a variety of food stores. Six participants sourced specialised African foods; three sourced them from independent grocers and four from fresh food markets. The average distance travelled to purchase traditional African foods was similar to the mean distance travelled for the acquisition of groceries not containing traditional African foods; 1.7 and 1.75 km, respectively.

3.5. Travel patterns

In the general course of their daily lives, subjects travelled an average of 5.8 km per journey, 1.56 journeys per day, with an average 2.96 trips per journeys. Grocery shopping was the primary reason for travel in 26% of journeys, and had lower number of trips per journey (2.6) than average. Food consumption was incidental to travel for other reasons in about one third of the cases. Walking was the main mode of transport used by participants. When analyzing the average distance travelled per journey considering different journey purposes, journeys where participants consumed food while travelling for other reasons were the longest. Participants tended to do shorter journeys when grocery shopping was the main reason for travel and even shorter when food consumption was the main reason for travel. Journeys that included cars as a mode of transport were the longest, followed by public transport, walking and bicycle.

4. Discussion

Contrary to the findings of previous studies (Larsen and Gilliland, 2008; Manandhar et al., 2006), this study found that while participants were of low socioeconomic status they were not subject to living in a food desert with participants able to access an average of 78 food outlets within a 2 km buffer of their home. All participants had access to at least one grocery retailer supplying healthy food within a 2 km buffer (if major grocery retailers are used as a proxy for healthy food) (Burns and Inglis, 2007). On average, trips to acquire traditional African foods were similar in distance (± 1.7 km) to those of non-traditional African food (± 1.75 km), suggesting participants had access to both culturally appropriate and nutritious foods within walking distance of their homes. Proximity to a variety of food outlets suggests participants were able to compare price and quality, which further suggests good access to food (Sharkey et al., 2009). These findings support previous studies that people living in areas with high proportions of immigrants are more likely to have good access to appropriate foods (Osypuk et al., 2009). Further, the role of NGOs in locating newly arrived refugees in areas with good food access has been highlighted. While this study found that participants were able to access nutritious and culturally appropriate foods within their physical environment, intakes of all food groups remained inferior to recommended levels (Government, 2007).

In the present study, geographical proximity to food outlets in domiciliary neighbourhoods was used as a proxy for access to food. Although this has been a common approach to the description of food neighbourhoods in many studies, a definitive relationship between measures such as fast food outlet density and proximity to supermarkets has not yet been established. Indeed, the simple dichotomy of living within $<$ or >1 km of a MGR yielded inconsistent results. Statistically significant differences in vegetable intake according to distance from nearest MGR add weight to the argument that geographical proximity to fresh food may in part influence diet. Although Rose and Richards (2004) reported a positive relationship between accessibility to MGR and fruit intake, a statistical difference for fruit intake was not seen in the present study. This difference may be due to the acquisition of fruit and meat at fresh food markets and at MPFRs rather than MGR (although it would be assumed vegetables would also be purchased at fresh food markets in this case). Data from a larger sample size and information on the types of goods purchased at different locations may clarify these observations. The results from the present study suggest that physical access alone does not guarantee a healthy diet and, as indicated by previous studies (Apparicio et al., 2007; Barry and Udry, 1998; Burns and Inglis, 2007; Coveney and O'Dwyer, 2009; Wandel et al., 2008), other socio-demographic factors should be considered.

This research suggests that within the first year of settlement, the diet of African refugees is likely to retain an emphasis on what might generally be described as "African" style foods and eating patterns, comprising a lower surplus energy intake relative to expenditure, lower intake of meat, takeaway food, and fat, and a high consumption of vegetables, whole grains, legumes and fruit. This food is largely prepared at home with the use of a specific range of condiments and spices, and substantial use of cassava, plantains and beans—which are not commonly consumed in Australia. This persistence of traditional diet is despite the likelihood that some traditional foods are more difficult to access. Previous studies suggest this pattern persists for at least five years following resettlement (Burns, 2004). Contrary to the general Australian population whose dietary intake outside of the home consists of minimal amounts of home-prepared meals when away from home participants were much more likely to consume traditional foods prepared at home rather than purchasing foods for immediate consumption. Similar to the other low socio-economic groups in Australia (Miura et al., 2009), when food was purchased for immediate consumption, the majority was obtained from takeaway (fast food) outlets and included soft drinks and chips, tuna sandwiches, lollipops, hamburgers and ice creams. Although the percentage of budget spent on acquisition of takeaway foods was small, acquiring food for immediate consumption may present a point when refugees begin to adopt some less healthy food habits of the sendentee culture.

Subjects reported that the food received whilst in refugee camps comprised almost exclusively of grains, with fresh vegetables, fruit, meat and dairy needing to be sourced independently of rations. Food rations in many of these camps have previously been identified as less than that required to maintain health, and these rations have to be supplemented through gardening, hunting/gathering and trading (Robertson and James, 1999). Nutritional intakes prior to immigration to Australia are likely to have been marginal in terms of micronutrients, with a relatively small energy deficit between intake and expenditure compared to their current dietary situations.

For participants in this study, exposure to foods more typical of the reported usual intake of the general Australian population (McLennan and Podger, 1998) occurred when outside of the domestic environment. The majority of such foods were consumed "on location" at orientation events such as classes, workshops and training programs. Foods provided at these events included: juices, fruits, soft drinks, breads, rice, cakes and salads, some of which were not usually consumed by participants while at home. Thus, foods provided at these events present a major opportunity where subjects are introduced to local sedentee foods and food customs. The choice and quality of these foods may thus be an important consideration for nutrition promotion for this subject group as they could represent an important setting for education about suitable options for adopting new foods into diets.

One factor that is consistently implicated as a determinant of food choice is the constraint of time. None of the subjects in the present study were in full-time employment, and although it was not investigated as part of this study, it is possible that as subjects

become employed and otherwise more engaged with broader cultural and social networks, they will have less time to allocate to food acquisition and preparation. As a result, increased trip chaining may occur to better manage time constraints (Arentze and Timmermans, 2005; Dellaert BGC et al., 1998) and the practice of preparing food at home to eat out may decline, exposing participants to the convenience of fast foods. Although not investigated as part of this study, the influence of time on travel as opposed to distance may also have implications for choices made during the process of dietary acculturation (Brög and Erl, 2001; Burns and Inglis, 2007; Pearce et al., 2006).

Along with the issue of reduced opportunity of statistical analysis due to the small sample size, a number of limitations of the present study are worth noting. During the week of data collection, an average of 42% of the food and grocery budget was spent on fruits and vegetables. Because of the relatively short sampling duration, and the tendency for households to purchase staples such as meat and rice in bulk, these values may have been skewed towards an over-representation. However, a longer collection period would have increased the subject burden and may have compromised the already small sample size of the present study. This issue is compounded further by the need for an interpreter, varied literature skills amongst participants and traditional African recipes requiring detailed descriptions. Notwithstanding this methodological issue, the purchase of vegetables and fruits was substantial in this population. Given the typical nutrition transition refugees go through following resettlement, future interventions designed to maintain high levels of vegetable and fruit consumption characteristic of traditional diets of this population might benefit from the incorporation of economical procurement of vegetables and fruits, through activities such as community gardening (Alaimo et al., 2008).

The choice of neighbourhood definition may also impact on the study conclusions. The majority of studies which analyse food neighbourhoods have focused on a 1 km radius from a central point (Apparicio et al., 2007; Larsen and Gilliland, 2008; Smoyer-Tomic et al., 2008), with other studies using various distances such as 500, 800 and 1500 m (Smoyer-Tomic et al., 2008), 0.5 and 1 mile (Block et al., 2004) and 2 km (Ball et al., 2009). The 2 km radius was selected because it was anticipated that this would be an outer limit of travel on foot, which was predicted to be a major form of transport in the study population.

Pernice (1994) identified several methodological issues affecting research with refugees and immigrants, including high levels of suspicion (which may interfere with snowball sampling) and the process of informed consent. Limiting participants to newly arrived sub-Saharan refugees (33% of resettlement places in Australia are offered to African refugees) further restricted the sample size. A longitudinal follow-up with this sample may be more readily achievable, and more informative, than expanding the sample size in exploring trends associated with the length of stay.

In a recent review of approaches to the measurement of the food environment, Lytle (2009) acknowledged a causal model linking food availability to dietary intake, and therefore disease risk. This causal flow is mediated by food acquisition, or as Lytle describes: food ''purchase'', although this does not account for other ways that food can be acquired (e.g., gardening, friends and donations). Despite being a key conduit between community members and food access (Burns and Inglis, 2007), transport has not been extensively related to health outcomes, except in specific constructs such as the impact of pollution from private motor vehicle use or opportunities for physical activity (Mead et al., 2006). In relation to travel, there are three main methods used to track physical movement (Krizek et al., 2009; Troiano, 2005): self-reported travel behaviour, instruments such as mobile phones or GPS (Asakura and Hato, 2009) or observational data collected in a travel diary, with varying degrees of accuracy reported among the methods (Pitta et al., 2006).

Travel diaries have been used to understand behaviour in a range of settings. Traditionally, diaries are used in modelling transport behaviour to understand travel itself, for example to supplement national travel surveys, to understand travel demand in tourism or gauge active travel participation (Bassett et al., 2008; Dickinson and Robbins, 2008; Krizek et al., 2009). More recently they have been used in relation to health impact by understanding how physical activity influences health issues such as obesity risk (Krizek et al., 2009). Although travel diaries typically involve participants recording trips and journeys only, superimposing activities such as food intake and physical activity over actual travel can provide more informative data on daily behaviours (Hoehner et al., 2003). For example, so-called activity diaries are commonly used to assess physical activity. A key limitation in the use of travel diaries is the need to record travel or activity over a timeframe long enough to establish typical behaviour (Brown et al., 2008; Frank et al., 2009).

Frank et al. (2009) recently used a 2-day diary format to collect data on travel destinations, travel mode, and related activity to ascertain relationships between food acquisition, physical activity and body weight. This study showed relationships between BMI and visitation of types of food outlet, and that these relationships were influenced by race (ethnicity). However, the brief observation period rendered this study useful only as a snapshot of fast food outlet usage, rather than food acquisition generally. The travel diary methodology used in the present study has the potential to superimpose and compare a range of determinant behaviours, and therefore provide further means to understanding potential interactions between such behaviours.

The quality of data collection in the present study was enhanced by a variety of means. Firstly, face to face meetings were organized with participants at intervals no greater than two days over the course of the week-long data collection period. This provided opportunities to clarify ambiguities and motivate participants to maintain reliable records. Shopping docket collection was used to cross-validate travel diaries and information from diet diaries was used to prompt questions about various details of the travel diaries. As both the cost and size of GPS tracking devices decrease, their use as a tool for cross-validation of travel diaries will become more feasible in such studies.

The sampling protocol in the present study was purposive, rather than representative, which presents clear limitations in the generalisability of the data. The internal validity of this study centered on sub-Saharan African refugees having been in Australia for 12 months or less and generally having spent years in refugee camps. In this regard, the objective of the present study was to identify general trends across this broad demographic. A larger sample size would be required to detect nuances between the myriad of cultures, religions and nationalities that comprised sub-Saharan Africa.

Other important food access issues remain unanswered due to limitations presented by the restricted inclusion criteria and small sample size. Subjects were selected on the basis of being responsible for food acquisition in the household, so that variations in access for other members of the family unit were not investigated. Also, the focus on physical proximity as the primary element of food access limited insight into other potential barriers to food access such as culture, social status, beliefs and personal preferences.

5. Conclusion

The initial 12 months of resettlement is a critical period for acculturation. During this time, participants stabilise food habits

while adapting to a new food environment, thus finding a balance between their traditional foods and the food influences of the sendentee culture. There is strong evidence that many of the traditional food habits that Africans bring promote health and should be continued in conjunction with the adoption of healthy (as opposed to unhealthy) new foods. Upon arrival, the participants in this study generally retained an emphasis on traditional African foods, possessed limited English skills and relied on government allowances for income. Contrary to other findings, this study reports that while participants were of low socio-economic status they were not subject to living in a food desert. However, despite having physical access to nutritious and culturally appropriate foods within their food neighbourhood, intakes of all food groups remained inferior to recommended levels. This suggests that physical access alone does not guarantee a healthy diet and other socio-demographic factors should be considered.

This study population is particularly vulnerable to the consequences of adopting negative attributes of sedentee Australian dietary patterns, because of their previous nutritional experiences and because of the likelihood of cohabitation with low SES groups and consequent unfavourable dietary habits. The results of this study have identified a possible critical point for exposure to sedentee foods, and therefore an important setting for intervention. Further, these findings underline the importance of interdisciplinary approaches to facilitating optimal settlement of refugees in their new environments. The external training programs and meetings that participants attended centered on basic societal functions such as organizing official paperwork, obtaining a driver's license, accessing social security and improving job seeking skills. Although not health promotion activities per se, these occasions present opportunities for health promotion intervention. In the case of nutrition, a simple set of guidelines for the provision of food during refugee orientation and training programs would be a positive step towards introducing this group to the more healthful options of local food, either in the absence of, or as an adjunct to, formal nutrition education interventions.

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