ORIGINAL ARTICLE

Dietary patterns in Liberian refugees in Buduburam, Ghana

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Abstract

Previous research suggests that acculturation (i.e., exposure and assimilation to local culture) is associated with changes in dietary patterns among immigrants. This study investigates this association in a refugee population using time in refugee settlement as a proxy for acculturation. A cross-sectional survey was conducted among a systematic sample to (a) identify dietary patterns in Liberian refugees and Ghanaians living in or near a refugee settlement, (b) compare adherence to these dietary patterns between groups, and (c) investigate the association between acculturation and dietary patterns in Liberian refugees. Participants were Liberian and Ghanaian women with young children living in the Buduburam refugee settlement or Awutu in Ghana ($n = 480$; 50% Liberian; mean age 28, SD 6.3, range 16–48 years). Time in settlement was assessed by self-report; food consumption was assessed by food frequency questionnaire. Principal component analysis was used to identify dietary patterns; a generalized linear model was used to test the association of interest. Three distinct dietary patterns emerged: Healthy, Sweets, and Fats. Ghanaians were more adherent to the Healthy pattern than Liberians ($p < 0.05$). Liberians were more adherent to the Sweets and Fats patterns than Ghanaians ($p < 0.05$). There were no significant differences in dietary pattern adherence among the Liberians based on time in settlement. Ghanaians living in Awutu were more adherent to the Healthy pattern than Ghanaians who lived in settlement ($p < 0.05$). Differences in dietary patterns were observed between Liberian refugees and Ghanaians. These differences were not associated with acculturation and may be related to the food environment in the settlement.

KEYWORDS

acculturation, dietary patterns, Ghana, Liberia, refugees, West Africa

1 | INTRODUCTION

As defined by the 1951 Refugee Convention, a United Nations treaty, a refugee is an individual who

owing to a well-founded fear of being persecuted for reasons of race, religion, nationality, membership of a particular social group or political opinion, is outside the country of his nationality, and is unable to, or owing to such fear, is unwilling to avail himself of the protection of that country. (United Nations General Assembly, 1951)

In mid-2015, there were an estimated 15.1 million refugees of concern to the United Nations High Commissioner on Refugees (UNHCR), a two-decade high (UNHCR, 2016). As the number of refugees around the world grows due to various complex humanitarian

emergencies, it becomes increasingly important to understand the health-related experiences of refugees.

One important component of the refugee experience is diet, as this has a significant impact on overall health status. While research on the dietary patterns of refugees is lacking, a body of literature exists on the dietary patterns and health outcomes of immigrants. A review of immigrants from various countries, including China and Haiti, living in Canada concluded that dietary changes are inevitable upon immigration and that these changes can have deleterious effects on health including an increase in chronic conditions (Sanou et al., 2014). Similarly, a review of South Asian immigrants in Europe found evidence of dietary changes that seemed to be associated with increased risk of chronic conditions including type 2 diabetes and cardiovascular disease (Holmboe-Ottesen & Wandel, 2012).

Acculturation may explain, in part, the relationship between changes in dietary practices and chronic diseases among immigrants.

Acculturation has been defined as a complex, multidimensional, and dynamic process by which a racial/ethnic group is exposed to and adapts to the practices (e.g., language and beliefs) of the majority group of the host country (Satia-Abouta et al., 2002). It has been shown that upon settling in a new country, immigrants go through the process of acculturation. In particular, existing research shows that the acculturation of immigrants moving from less to more developed countries often involves the adoption of a "Western" diet high in fat and low in fruits and vegetables (Satia-Abouta et al., 2002). This is of public health concern given the association between a poor diet and poor health status. In a study looking at immigrants, defined generically as foreign-born individuals, in the USA, the age- and sex-adjusted prevalence of obesity was 8% for immigrants who had lived in the USA less than 1 year but reached 19% for immigrants who had lived in the USA for at least 15 years (Goel et al., 2004). Greater duration of residence in the USA was indeed associated with greater body mass index among immigrants, reflecting acculturation and suggesting the adoption of suboptimal dietary practices (Goel et al., 2004).

Acculturation has been measured using several different proxies including birth country, language, and time in host country. The latter has been commonly used as a proxy for acculturation (Perez-Escamilla & Putnik, 2007). It is expected that longer duration of residence in a foreign country allows for greater exposure and adaptation to the culture of the host country. The primary objectives of this study were to identify and compare adherence to diverse dietary patterns among Liberian refugees and Ghanaians living in and near the Buduburam refugee settlement in Ghana and to investigate the association between acculturation (assessed as time living in the refugee settlement) and dietary patterns in Liberian refugees. It was hypothesized that, as time living in the settlement increased, the dietary practices of the Liberian refugees would become more similar to the dietary practices of Ghanaians.

Liberia experienced two civil wars (1989–1996; 1999–2003) during which approximately 200,000 Liberians were killed and close to a million Liberians became refugees (Dick, 2003). The Buduburam refugee settlement was established in 1990 to accommodate the influx of Liberian refugees into Ghana. Over the next two decades, instability and dwindling humanitarian aid in Liberia caused many refugees to remain in the Buduburam refugee settlement rather than return to Liberia (Omata, 2012). Within that time, the UNHCR suspended aid to the settlement in 1997 but later resumed it again in 2002 (N'Tow,

2004). Vulnerable Liberian refugees (e.g., the chronically ill) were still receiving food rations until 2009. However, by the summer of that year, virtually all aid had ended. The UNHCR later launched two official repatriation efforts (2004–2007; 2008–2009), but not all Liberians repatriated. On June 30, 2012, the UNHCR invoked the cessation clause, which provides for the termination of refugee status once stability and safety have returned to the refugees' home country. However, research has shown that many Liberians are against returning to Liberia, citing reasons ranging from a feeling of insecurity to lack of resources and support in Liberia (Omata, 2012).

The Buduburam refugee settlement is composed of about 140 acres and lies 32 km west of Accra, the capital city of Ghana. The settlement is divided into 12 zones. Zones 1–10 are within the original boundaries of the settlement. Over time, many Liberian refugees settled in the village of Buduburam, which is adjacent to the settlement, and this area became part of the settlement, forming Zones 11 and 12. Mainly, Liberians live in Zones 1–10, while Liberians and Ghanaians coexist in Zones 11 and 12. The unique composition of the Buduburam refugee settlement, with refugees living both among and separate from the native population, provides an ideal setting to investigate the refugee experience.

2 | PARTICIPANTS AND METHODS

2.1 | Study design and participants

A cross-sectional survey was administered between July and August 2008 among 480 female Liberian refugees and Ghanaians living in the Buduburam refugee settlement and the nearby urban village of Awutu (5 km from Buduburam). Women were included in the study if they were Liberian or Ghanaian, were 16 years of age or older, had a biological child between the ages of six and 59 months, were not currently pregnant, had no health problem or condition that caused a modification to their diet (e.g., diabetes and heart disease), and lived in either the Buduburam refugee settlement or Awutu.

2.2 | Sampling

A systematic sampling approach was used to identify and recruit participants. Within Buduburam, a central location was chosen in each of 12 zones. Four teams of interviewers (one Ghanaian and one Liberian per team) were employed to collect the data. Each team began

Key messages

- Female Liberian refugees in Ghana consume less healthy dietary patterns than their Ghanaian counterparts living inside and outside the refugee settlement.
- Ghanaians living inside the settlement consume less healthy dietary patterns than Ghanaians living in a nearby village.
- Perhaps less access to healthy foods within the settlement explains the less healthy dietary patterns consumed inside versus outside the settlement.
- Time living in the settlement was not associated with dietary patterns among Liberians.
- Studies are needed to further understand the role that complex transit migration patterns and experiences prior to reaching the final destination have on shaping dietary patterns of long-term refugees.

at a central location within their assigned zone. Standing in that central location, the team chose a random direction and visited the first household they encountered. The team then went to every fifth house in the same block and then moved to the next block and continued the sampling procedure until reaching the desired sample size within that zone (120 Liberians in Zones 1–10; 119 Liberians and 121 Ghanaians in Zones 11 and 12; and 120 Ghanaians in Awutu). If the mother was not present in the household at the time of the visit, the household was revisited at a more convenient time. If more than one mother living in the household met the inclusion criteria, one mother was randomly chosen to participate. This same sampling method was also employed in Awutu.

2.3 | Survey administration procedures

Trained Liberian and Ghanaian interviewers from the target communities administered the survey. The interviewers underwent 3 days of training on conducting the interviews, interview techniques, and taking anthropometric measurements. The Liberian interviews were conducted in English (Liberian pigeon English). The Ghanaian interviews were conducted in English or the local Ghanaian dialect based on the interviewee's preference. Each interview lasted 1.5 to 2 hr. Interviews were reviewed daily for quality and standardization. Participants were revisited if data were missing or if responses were inconsistent to resolve any issues.

Verbal informed consent was obtained and formally recorded for all participants prior to survey administration. Participants were assured that all information would remain confidential, would not affect access to programs within the settlement, and would not be used for determining repatriation. Institutional Review Board (IRB) approval to conduct this study was obtained from the University of Connecticut and the University of Ghana IRBs. Yale University IRB granted approval to conduct data analysis. Representatives of the Buduburam refugee settlement gave permission to defer ethical approval for this study to the collaborating universities.

The administered survey was pretested among five Liberian and four Ghanaian women meeting the inclusion criteria, and the survey was modified as a result. The final survey administered at each interview assessed the following: demographic/household characteristics, degree of acculturation, household food security, infant feeding practices, infant and maternal health status, and maternal dietary intake. The following anthropometrics were also assessed in the respondent and the index child: weight, height, mid-upper arm circumference, and head circumference (children only).

2.3.1 | Food frequency questionnaire

Dietary intake was assessed using a culturally appropriate detailed food frequency questionnaire (FFQ). The FFQ was adapted from the Block FFQ (Block et al., 1986) to include traditional Liberian and Ghanaian foods. Traditional Liberian and Ghanaian foods were included in the FFQ after conducting key informant interviews with Liberian refugees and Ghanaians living or working within the Buduburam refugee settlement or Awutu, visiting local markets, and consulting with Liberian refugees employed by the Buduburam nutrition program.

Participating women were asked about their consumption (yes/no) of 132 food/beverage items over the past 6 months within the following 12 food/beverage categories: fruits; vegetables; beans and nuts; meats; fish and seafood; cereal and grains; milk and dairy products; snacks, sweets, and desserts; drinks; tubers; other foods; and traditional mixed dishes. Participants were shown pictures of various food/beverage items to ensure they clearly understood the food/beverage items in the list. They were then asked to report how many times they had consumed each food/beverage item, reported as either daily, weekly, monthly, or only occasionally. Participants were also able to provide the name and consumption frequency of any other foods/beverages they had consumed within the 12 food/beverage categories.

2.3.2 | Acculturation

Time in the Buduburam refugee settlement served as a proxy for acculturation. Time in the settlement was assessed in years and/or months during the interview through self-report.

2.4 | Statistical methods

Of the 132 specific food/beverage FFQ items collected, 34 were excluded in the final FFQ analyses, specifically 26 Liberian and Ghanaian traditional mixed dishes and eight food/beverage items that were added to the survey after survey administration began. The traditional mixed dishes were excluded to ensure food/beverage items were not double counted and consumption levels were not inflated because these mixed dishes consisted of mixed food groups (i.e., complex composition) and it was uncertain whether the constituents of these mixed dishes were included by participants in the reporting of individual food/beverage items. Those food/beverage items that were added to the survey after survey administration began were excluded because not all participants were asked about these foods/beverage items. Finally, any foods/beverages that participants specified in response to the prompt "other" (e.g., "other fruits, specify") were not included in the analysis because these items were not systematically collected for every participant. This resulted in a final total of 98 food/beverage items included in the analysis.

2.4.1 | Principal component analysis

Research suggests that it is preferable to study dietary patterns and quality (i.e., whole diet) rather than individual food components (Newby & Tucker, 2004). Therefore, the FFQ data were recoded into 32 food groups using the groupings classified in the Nutrient Data System for Research software from the University of Minnesota (University of Minnesota, Nutrition Coordinating Center, Minneapolis, MN; Table 1). Average weekly frequency of consumption over a 6-month period was calculated for each individual for each food group. For example, a response of one time per day was represented by $1 \times 7 = 7$ times per week.

Principal component analysis was used to identify distinct dietary patterns among all respondents. Principal component analysis assigned coefficients to each food group, which were used

TABLE 1 Food/beverage groups used in final analysis and descriptions

Category	Description
Alcohol	Beer (bottled), hausa beer (ginger beer), palm wine, pito
Beans/legumes	Beans/peas, canned beans (e.g., baked beans)
Bread	Local bread (sugar, butter, tea, wheat, or brown)
Butter/margarine	Nkuto (shea butter/doughnut grease), butter/margarine
Candy	Toffees/candies
Cereal	Bulgur wheat, sorghum, Atuku (millet/millet porridge), oats
Cheese	Cheese (e.g. Laughing Cow, Wagashi)
Dark-green vegetables	Examples: lettuce, nunum (fever leaves), ayoyo (plato leaves), santun leaves (potato greens), aleefu (careless greens)
Deep yellow vegetables	Carrots, pumpkin, sweet potatoes
Eggs	Eggs (chicken)
Fish (dried, fresh, canned)	Fish, canned fish (tuna, sardines), momoni (momoi/stinking fish), kobi (salted tilapia/bukor)
Fried/salty snacks	Wele (cow skin), kelewele (ripe plantain chips fried with hot pepper and ground nuts), flour/plantain chips, exotic chips
Fruit	Examples: oranges, pineapple, banana, mango (plum), papaya (pawpaw), watermelon, sweet apple (soursop/guanabana), sugar apple
Fruit juice	Fresh fruit juice/punch (e.g., pineapple juice)
Meat	Goat, cow meat (beef), pig meat
Milk	Powdered milk, tin/canned milk
Nuts and seeds	Groundnuts/groundnut paste, sesame seeds (beneseed), agushi/ground melon seeds
Oil	Palm oil, cooking/vegetable oil (argo oil), other oils (e.g. coconut)
Other non-starchy vegetables	Alsusua (kittiley/small garden eggs), konsusua, cucumbers, okra, onion, green pepper, cabbage, roroyie (garden egg/bitterball), ntropo (eggplant)
Other starchy vegetables	Roasted/boiled corn, gari/farinas, cocoyams (eddoes)/koko (taro, batanga buds), Irish potatoes, cassava, yam
Pasta	Spaghetti/macaroni
Poultry	Chicken, turkey
Processed meat	Sausages
Ready-to-eat cereal	Semolina (cream of wheat), corn flakes
Rice	Rice
Salad dressing	Mayonnaise
Shellfish	Apofee (kissmeat)/snails, crabs/shrimps (craw fish)
Soft drinks	Soft/mineral drinks (e.g. Coke, Sprite, Fanta)
Sweet baked goods	Bofrot (kala), short/corn/banana/rice/cassava bread, biscuits/cookies, doughnuts
Sweetened fruit drinks	Canned/packed juice, jolly juice/kool aid, sobolo (bissa)
Sugar	Sugarcane
Tomato/tomato-based products	Fresh tomato, tin tomato

to generate dietary pattern scores (Newby & Tucker, 2004; Sofianou et al., 2011). Dietary patterns with eigenvalues greater than 1.5 were identified and were orthogonally rotated (varimax rotation; Newby & Tucker, 2004; Sofianou et al., 2011). Four dietary patterns were identified, explaining 33.3% of the variance. The food items were retained in the interpretation of their principal component if their loadings were ≥ 0.4 , a cut-off chosen to aid interpretation of results. Only three of the four dietary patterns were retained because it was not possible to interpret the meaning of the fourth dietary pattern (Table 2). Using all coefficients, an individual dietary pattern score was calculated for each individual for each dietary pattern. Individual dietary pattern scores were generated by multiplying the factor loading for each food group by the weekly frequency of consumption of each food group and then summing all products for each

dietary pattern. The scores for each pattern were approximately normally distributed. A high positive score indicated high adherence to a dietary pattern, and a low score indicated little or no adherence to a dietary pattern (Newby & Tucker, 2004; Sofianou et al., 2011).

2.4.2 | Multivariate analyses

The generalized linear model was used to assess the association between time living in the Buduburam refugee settlement and dietary pattern scores. Three models were run with each dietary pattern score as an outcome. The dietary pattern score for each dietary pattern was included in the model as a continuous variable. Time living in the Buduburam refugee settlement was included in the model as the exposure proxy variable for acculturation. Five population subgroups were

TABLE 2 Highest factor loadings of food/beverage groups by dietary pattern^a

Food group	Dietary pattern			
	Healthy	Sweets	Fats	Other ^b
Other non-starchy vegetables	0.777	-0.02	0.067	-0.002
Tomato/tomato-based products	0.774	-0.258	0.045	0.063
Fish (dried, fresh, canned)	0.723	0.087	0.111	0.087
Nuts and seeds	0.480	0.276	0.025	-0.258
Sugar	0.470	0.189	-0.143	0.089
Fried/salty snacks	0.463	0.177	-0.176	0.435
Beans/legumes	0.357	0.109	0.136	0.152
Candy	-0.083	0.653	0.128	0.089
Sweet baked goods	0.066	0.645	0.304	-0.006
Sweetened fruit drinks (homemade/imported)	0.025	0.609	0.094	0.307
Shellfish	0.264	0.499	-0.069	0.002
Fruit	0.375	0.458	0.036	0.204
Meat	-0.055	0.422	-0.029	0.204
Other starchy vegetables	0.395	0.418	0.029	-0.297
Dark-green vegetables	0.138	0.275	0.186	-0.060
Alcohol (homemade/imported)	0.200	0.262	-0.144	0.069
Salad dressing	-0.284	0.147	0.698	0.097
Milk	0.018	-0.041	0.607	0.385
Oil	0.198	0.185	0.584	-0.037
Butter/margarine	-0.099	-0.010	0.514	0.055
Cereal	0.154	0.029	0.495	0.056
Poultry	-0.230	0.436	0.440	0.055
Soft drinks	0.075	0.077	0.174	0.560
Ready-to-eat cereal	-0.274	0.183	0.227	0.5
Eggs	0.131	0.065	0.463	0.470
Cheese	-0.071	0.007	-0.068	0.434
Deep yellow vegetables	0.304	0.124	0.008	0.412
Pasta	0.296	0.068	0.114	0.404
Bread	0.138	0.120	0.359	0.402
Processed meat	-0.142	0.244	0.006	0.362
Rice	-0.395	0.264	0.192	0.318
Fruit juice	0.058	-0.053	0.197	0.277

^aCoefficients greater than 0.4, the cut-off for a strong positive value, are in bold.

^bThis fourth dietary pattern was not retained for further analysis.

created based on this proxy variable: Liberian refugees who had lived in the settlement less than 8 years (the median for this group), Liberians who had lived in the settlement for 8 or more years, Ghanaians who had lived in the settlement less than 5 years (the median for this group), Ghanaians who had lived in the settlement 5 or more years, and Ghanaians who lived in Awutu (i.e., lived 0 years in the settlement). Each model was adjusted for the following covariates: age, marital status, level of education, employment status, income, household size, presence of electricity in the home, and whether or not money had been borrowed from or loaned to others in the past year. Marital status, level of education, employment status, income, presence of electricity in the home, and whether or not money had been borrowed from or loaned to others were included in the model as categorical variables. Age and household size were included in the model as continuous variables. All analyses were performed using SPSS (version 22.0).

3 | RESULTS

3.1 | Characteristics of the sample

Table 3 presents the characteristics of the sample ($n = 480$). Liberians overall were more likely to be single, be at least a high school graduate, be unemployed, be lower or middle income, have electricity at home, and have borrowed money in the past year compared with Ghanaians overall ($p < 0.001$). Liberians overall were less likely to have gardened or farmed in the past year, bought/eaten from cookshops or chop bars, or lent money compared with Ghanaians overall ($p < 0.01$). Looking at the five population subgroups, the subgroups were significantly different for marital status, level of education, employment status, income, presence of electricity in the home, whether or not money had been borrowed from or loaned to others, gardening or farming, and patronage of cookshops or chop bars (all $p < 0.001$). Among Liberians, those

TABLE 3 Characteristics of the sample by population subgroup^a

Characteristic	Overall (n = 480)	Liberians (n = 239)	Ghanaians (n = 241)	p- value ^b	Liberians <8 years(n = 117)	Liberians ≥8 years(n = 122)	Ghanaians <5 years(n = 58)	Ghanaians ≥5 years(n = 62)	Ghanaians in Awutu(n = 120)	p- value ^b
Age (years), mean (SD)	28.0 (6.3)	27.6 (6.2)	28.5 (6.3)	0.102	26.9 (5.7)	28.3 (6.6)	28.1 (5.7)	28.8 (7.3)	28.6 (6.1)	0.190
Household size, mean (SD)	5.8 (3.0)	5.7 (3.1)	5.9 (2.9)	0.369	5.6 (3.4)	5.8 (2.8)	5.6 (2.4)	6.4 (3.0)	5.8 (3.0)	0.408
Marital status, n (%)				<0.001						<0.001
No partner	136 (28.3)	111 (46.4)	25 (10.4)		53 (45.3)	58 (47.5)	8 (13.8)	6 (9.7)	11 (9.2)	
Married	239 (49.8)	68 (28.5)	171 (71.0)		35 (29.9)	33 (27.0)	41 (70.7)	49 (79.0)	81 (67.5)	
Living w/ or w/o partner	105 (21.9)	60 (25.1)	45 (18.7)		29 (24.8)	31 (25.4)	9 (15.5)	7 (11.3)	28 (23.3)	
Education, n (%)				<0.001						<0.001
No education	62 (13.0)	18 (7.6)	44 (18.3)		10 (8.6)	8 (6.7)	10 (17.2)	15 (24.2)	19 (15.8)	
1–6 years	74 (15.5)	22 (9.3)	52 (21.6)		12 (10.3)	10 (8.3)	10 (17.2)	15 (24.2)	27 (22.5)	
7–11 years	214 (44.9)	93 (39.4)	121 (50.2)		50 (43.1)	43 (35.8)	27 (46.6)	29 (46.8)	64 (53.3)	
H.S. graduate/higher education	127 (26.6)	103 (43.6)	24 (10.0)		44 (37.9)	59 (49.2)	11 (19.0)	3 (4.8)	10 (8.3)	
Employment status, n (%)				<0.001						<0.001
Employed	301 (62.8)	115 (48.1)	186 (77.5)		49 (41.9)	66 (54.1)	37 (64.9)	51 (82.3)	98 (81.7)	
Not employed	178 (37.2)	124 (51.9)	54 (22.5)		68 (58.1)	56 (45.9)	20 (35.1)	11 (17.7)	22 (18.3)	
Income, n (%)				<0.001						<0.001
Lower	86 (18.3)	65 (27.5)	21 (8.9)		29 (25.4)	36 (29.5)	6 (10.7)	8 (13.6)	7 (5.9)	
Middle	195 (41.4)	105 (44.5)	90 (38.3)		49 (43.0)	56 (45.9)	19 (33.9)	20 (33.9)	50 (42.0)	
Higher	190 (40.3)	66 (28.0)	124 (52.8)		36 (31.6)	30 (24.6)	31 (55.4)	31 (52.5)	62 (52.1)	
Electricity at home, n (%)				<0.001						<0.001
Yes	371 (77.3)	205 (85.8)	166 (68.9)		101 (86.3)	104 (85.2)	34 (58.6)	41 (66.1)	90 (75.0)	
No	109 (22.7)	34 (14.2)	75 (31.1)		16 (13.7)	18 (14.8)	24 (41.4)	21 (33.9)	30 (25.0)	
Borrowed money ^c , n (%)				<0.001						<0.001
Yes	195 (40.6)	130 (54.4)	65 (27.0)		68 (58.1)	62 (50.8)	14 (24.1)	20 (32.3)	31 (25.8)	
No	285 (59.4)	109 (45.6)	176 (73.0)		49 (41.9)	60 (49.2)	44 (75.9)	42 (67.7)	89 (74.2)	
Lent money ^c , n (%)				<0.01						<0.01
Yes	155 (32.3)	94 (39.3)	61 (25.3)		54 (46.2)	40 (32.8)	16 (27.6)	17 (27.4)	27 (22.5)	
No	325 (67.7)	145 (60.7)	180 (74.7)		63 (53.8)	82 (67.2)	42 (72.4)	45 (72.6)	93 (77.5)	
Gardened or farmed, n (%)				<0.001						<0.001
Yes	119 (24.8)	13 (5.4)	106 (44.0)		7 (6.0)	6 (4.9)	23 (39.7)	27 (43.5)	56 (46.7)	
No	361 (75.2)	226 (94.6)	135 (56.0)		110 (94.0)	116 (95.1)	35 (60.3)	35 (56.5)	64 (53.3)	
Cookshops or chop bars, n (%)				<0.01						<0.01
Yes	161 (33.5)	97 (40.6)	64 (26.6)		51 (43.6)	46 (37.7)	14 (24.1)	24 (38.7)	26 (21.7)	
No	319 (66.5)	142 (59.4)	177 (73.4)		66 (56.4)	76 (62.3)	44 (75.9)	38 (61.3)	94 (78.3)	

^aNumbers may not sum to totals due to missing data, and column percentages may not sum to 100% due to rounding.^bp-value for t-test or analysis of variance F-test (continuous variable) or χ^2 test (categorical variable).^cFrom/to any neighbors, family members, and/or friends.

who lived in the settlement less than 8 years were more likely to have lent money in the past year compared with Liberians who had lived in the settlement 8 or more years ($p < 0.05$; results not shown). Among Ghanaians, those who had lived in the settlement less than 5 years were more likely to be unemployed compared with Ghanaians who had lived in the settlement 5 or more years ($p < 0.05$; results not shown). Ghanaians who lived in the settlement were less likely to have electricity at home compared with Ghanaians who lived in Awutu ($p < 0.05$; results not shown).

3.2 | Dietary patterns

Based on the food groups that had high loading (coefficients >0.4) within each dietary pattern as well as their strong similarity to dietary patterns identified in the literature (Newby & Tucker, 2004), the three dietary patterns retained were labeled as “Healthy,” “Sweets,” and “Fats” (Table 2). The Healthy pattern had the highest factor loadings for other non-starchy vegetables (including cucumbers, okra, and eggplant); tomato/tomato-based products; fish (dried, fresh, and canned); and nuts and seeds. It should be noted that this pattern also had high factor loadings for sugar and fried/salty snacks, but it was labeled as “Healthy” based on the foods with the highest factor loadings (i.e., a variety of vegetables, fish, nuts, and seeds). The Sweets pattern had the highest factor loadings for candy, sweet baked goods, and sweetened fruit drinks (homemade/imported). Shellfish, fruit, meat, other starchy vegetables, and poultry also loaded with this pattern, although not as strong as candy, sweet baked goods, and sweetened fruit drinks. The Fats pattern had high factor loadings for salad dressing, milk, oil, butter/margarine, cereal, poultry, and eggs.

3.3 | Factors associated with dietary patterns

There were significant differences in mean dietary pattern adherence z-scores between Liberian refugees and Ghanaians (Table 4). Ghanaians who lived in the settlement as well as those living outside of the settlement in Awutu had significantly greater mean dietary pattern scores than Liberian refugees for the Healthy dietary pattern,

independent of the amount of time lived in the settlement ($p < 0.05$). Consistent with this finding, Ghanaians who lived in the settlement and outside of the settlement in Awutu had significantly lower mean Sweet and Fats pattern scores than Liberian refugees, independent of the amount of time lived in the settlement (both $p < 0.05$).

Mean dietary pattern adherence scores for the three patterns were not significantly different for Liberian refugees who had lived in the settlement less than 8 years compared with Liberian refugees who had lived in the settlement for 8 or more years ($p > 0.05$). Similarly, mean dietary pattern scores were not significantly different for Ghanaians who had lived in the settlement less than 5 years compared with Ghanaians who had lived in the settlement for 5 or more years ($p > 0.05$).

The mean dietary pattern score for the Healthy pattern was significantly greater for Ghanaians who lived outside of the settlement in Awutu compared with Ghanaians who lived within the settlement ($p < 0.05$). The mean dietary scores for the Sweets pattern and the Fats pattern were not significantly different for Ghanaians who lived outside of the settlement compared with Ghanaians who lived within the settlement ($p > 0.05$).

4 | DISCUSSION

Differences in adherence to the dietary patterns identified in our analyses were observed between Liberian refugees and Ghanaians living in and near the Buduburam refugee settlement. After adjusting for confounders, in general, Ghanaians adhered more strongly to the Healthy pattern and less strongly to the Sweets and Fats patterns compared with the Liberians. The strong adherence to the Sweets and Fats dietary patterns coupled with lower scores for the Healthy pattern suggests a propensity towards a poor diet among the Liberian refugees, which may or may not have existed prior to their settlement in Buduburam. If it was the later situation, this would be consistent with previous research on dietary changes experienced by immigrants living in various high-income country settings. Research on Asian immigrants living within the USA and Europe shows that adherence to traditional healthier dietary behaviors fades over time. Yang and Read (1996) found an increase in the consumption of fat and cholesterol and a decrease in the consumption of vegetables among Asian immigrants who had been in the USA for at least 6 months. Similarly, Pan et al. (1999) found that Asian students who had immigrated and had lived in the USA for at least 3 months reported increased consumption of salty and sweet snacks and fats and sweets, as well as decreased consumption of vegetables, compared with pre-immigration levels. Kruseman et al. (2005) found an increase in the consumption of sweetened beverages and a decrease in the consumption of vegetables among African refugees in Geneva. Holmboe-Ottensen and Wandel (2012) reported an increase in fat consumption and a decrease in vegetable consumption among South Asian immigrants in Europe. Among African immigrants living in Australia, Renzaho and Burns (2006) found an increased consumption of unhealthy foods, such as pizza, breakfast foods, and other fast foods. In a systematic review of the literature, Gilbert and Khokhar (2008) looked at ethnic groups in Europe,

TABLE 4 Mean dietary pattern adherence z-scores by population subgroup^{a,b,c,d}

Subgroup	Dietary pattern		
	Healthy	Sweets	Fats
Liberians <8 years ($n = 117$)	−0.6 ^x	0.6 ^x	0.4 ^x
Liberians ≥8 years ($n = 122$)	−0.7 ^x	0.4 ^x	0.1 ^x
Ghanaians <5 years ($n = 58$)	0.6 ^y	−0.3 ^y	−0.3 ^y
Ghanaians ≥5 years ($n = 62$)	0.4 ^y	−0.3 ^y	−0.4 ^y
Ghanaians in Awutu ($n = 120$)	0.9 ^z	−0.5 ^y	−0.5 ^y

^aUnits = SD

^bMean diet pattern z-scores represent average adherence within each subgroup to each dietary pattern.

^cAll estimates adjusted for marital status, level of education, employment status, income, whether or not electricity was in the home, and whether or not money had been borrowed from or loaned to others.

^dMeans with different subscripts (x,y,z) in the same column differ significantly at $p < 0.05$.

including African Caribbeans and West Indians, Turks, South Asians, Latin Americans, Moroccans, Surinamese, and Chinese, and overall found an increase in the consumption of fat, sugar, and salt compared with the pre-immigration diet. However, our study would be among the first studies to document this shift towards unhealthy dietary patterns among immigrants coming from a low-income country and moving to another low-income country, especially within West Africa.

In previous studies, the shift to an unhealthy dietary pattern among immigrant populations has been generally attributed to the effect of acculturation. Essentially, when immigrants move from lower income countries to more economically developed countries, this leads to the adoption of a more "Western" diet. More specifically, dietary changes among immigrants are often found to be associated with duration of stay in the new country, a typical proxy for acculturation (Pan et al., 1999; Lv & Cason, 2004; Yang et al., 2007; Desilets et al., 2007; Franzen & Smith, 2009). Within the Liberian refugee population in this study, dietary pattern adherence was not associated with time in the settlement. In fact, the Liberian diet did not become similar to the Ghanaian diet over time, suggesting that acculturation, represented by time in the settlement in this study, was not the driving force behind dietary practices in this population.

One possible explanation may be the nature of the migration pattern in our study. Most of the Liberian refugees surveyed went through other West African countries to get to Ghana. Forty-four percent of the Liberians surveyed reported that they had lived in at least one other country before arriving in Ghana. Exposure to other countries may have influenced their dietary intake. It is also possible that dietary patterns among the Liberian refugees were influenced by other experiences related to their migration. For example, among Hmong immigrants who had resettled in the USA, parents and grandparents tended to overfeed their children once they were in the USA in response to the threat of food deprivation that they had faced during their time in refugee camps (Franzen & Smith, 2009; Kasemsup & Reicks, 2006). Another study found that Cambodian households reported liberal consumption of high-fat meat because it was a "highly deprived item in pre-migration" (Peterman et al., 2010). Other research has further suggested that the "episodic abundance of food supplies" is associated with disordered eating (Polivy et al., 1994). The pre-arrival experiences of the Liberians living in the Buduburam refugee settlement were highly complex and included varying degrees of exposure to marginalization, food insecurity, conflict, and violence. It is possible that these experiences contributed significantly to the dietary patterns among the Liberian refugees in a way that was not measured in this study. Data on pre-immigration and migration diet were not collected, which would be important to do in future studies.

Other possible explanations might also account for the observed dietary patterns among the Liberian refugees. There may have been a greater availability of foods high in fat and added sugars within the settlement compared with Awutu. Additionally, this study did not differentiate between those foods that were homemade and those that were not, which may have influenced outcomes. For example, Liberians make sweet baked goods, candies, and juice drinks at home, so these types of unhealthy foods might be consumed more by the refugees because they are traditional foods. Lastly, a lack of economic

opportunities for Liberians outside the settlement given their refugee status could have limited their access to healthier foods.

A major strength of this study is that we were able to examine and compare dietary patterns of a group of long-term refugees and their local counterparts with whom they had been intermingling for several years under a protracted refugee situation. The collection of culturally appropriate detailed food consumption data for both groups is another strength of this study as it allowed for documenting and comparing of dietary patterns as opposed to individual food/beverage items, providing a much better understanding of overall diet quality aspects.

There were some limitations to this study. First, time in the settlement was used as the proxy for acculturation. While length of time in the settlement was not associated with dietary patterns among the Liberian refugees, it is possible that other components of acculturation were at play in this population. Indeed, dietary research among immigrant populations has used other proxies for acculturation, including education and language preference (Lunes et al., 1997), proportion of lifetime spent in the new country (Desilets et al., 2007), and age at arrival (Roshania et al., 2008; Franzen & Smith, 2009), which could reflect adaptive capability. An additional analysis of our data revealed that time in settlement was not significantly associated with level of education or language spoken. Time in settlement was associated with proportion of lifetime spent in the settlement and age at arrival. Liberians who had spent fewer years in the settlement were more likely to have arrived at an older age and spent a smaller proportion of their life in the settlement, whereas Liberians who had spent 8 or more years in the settlement were more likely to have arrived at a younger age and spent a greater proportion of their life in the settlement.

Another limitation to this study is that it did not measure the psychological aspects of migration as well as acculturation. Research has shown that a desire to fit in can actually alter food preferences and food choices (Guendelman et al., 2011). Additionally, stress experienced by immigrants has been linked to high consumption of foods rich in fats (Tseng & Fang, 2011). Future research into the dietary patterns among refugees should include these measures.

A third limitation of this study was describing a multifaceted dietary pattern with a single label (i.e., "Healthy," "Sweets," and "Fats"). While this is convenient to allow analysis and interpretation of dietary patterns, it is imperfect. For example the Healthy pattern had the highest factor loadings for "healthy" foods, including other non-starchy vegetables, tomato/tomato-based products, fish, and nuts and seeds. However, based on a cut-off of 0.4, this pattern also had relatively high factor loadings for foods consistent with the Sweets and Fats dietary patterns. This pattern was still interpreted as "Healthy" based on the healthy trend among foods with the highest factor loadings.

Finally, another limitation of this study was that it was cross-sectional. Therefore, causal inferences cannot be made. Additionally, dietary changes cannot truly be assessed, as information on the pre-immigration diet was not collected.

While the adapted FFQ used in this study was culturally appropriate for both Liberians and Ghanaians, it did not collect data on portion sizes to quantitatively assess dietary intakes nor did it collect details on food preparation, such as cooking method, which may have explained

the dietary pattern differences better. Studies have shown that changes in dietary patterns can be linked to changes in food preparation. In one immigrant study, the increase in the consumption of fat among Asian immigrants was linked to adding butter, margarine, and cheese to food (Yang & Read, 1996), while in another study, poor dietary quality was related to the addition of butter, salt, sugar, and oil to foods (Renzaho & Burns, 2006).

This study assessed dietary patterns among female refugees. Research on the dietary patterns of immigrants has shown greater dietary changes among men compared with women (Yang & Read, 1996; Gupta, 1975). It is possible that the dietary patterns among male Liberian refugees in the settlement are different than among female Liberian refugees.

This study represents a new contribution to knowledge about dietary pattern differences between refugees within a protracted situation and their host country, especially among refugees moving to a country within the same world region. Study findings strongly suggest that dietary pattern differences between refugees and their host country may be complex and influenced by multiple factors. Acculturation may not be able to fully explain what occurs when refugees move to countries within their own world region, especially if those migration patterns involve multiple host countries over time.

5 | CONCLUSIONS

The results of this study suggest that Liberian refugees living in the Buduburam refugee settlement in Ghana adhere to less healthy dietary patterns than the local population living in the same setting. Our findings indicate that research is needed to better understand the factors that determine the dietary patterns of both long-term refugees and local communities in the context of protracted crises. This knowledge is essential for designing food security programs that address the dietary needs of all. Offering culturally appropriate nutrition education could provide assistance with making better dietary choices. Additionally, providing sustainable economic or farming and gardening opportunities could improve access to healthier foods. Future research should assess the impact of these interventions on improving dietary patterns among refugees and local communities, especially those living within a protracted refugee situation.

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CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

CONTRIBUTIONS

AH-F, RP-E, DFG-P, and AL were responsible for the conception and design of the study. AHF, DGP, and AS implemented the study, which included training interviewers and supervising data collection and entry. WLR was responsible for analysis and interpretation of the findings and drafted initial version of manuscript. AH-F, RP-E, DFG-P, AL, and AS assisted with interpretation of the findings. All co-authors have read and approved the final version to be published.

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