SciMedCentral

Journal of Human Nutrition & Food Science

Research Article

Dietary Change of English, French and Chinese Speaking Immigrants in Ottawa and Gatineau, Canada

Ning Tang*

21-76 rue Richard, Gatineau, Quebec J8Y 4Z2, Canada

***Corresponding author**

Ning Tang, 21-76 rue Richard, Gatineau, Quebec J8Y 4Z2, Canada, Tel: 1-819-420-1691; Email: tang0139tang@flinders.edu.au;nt920000@yahoo.com

Submitted: 19 February 2015

Accepted: 16 April 2015

Published: 11 May 2015

ISSN: 2333-6706

Keywords

- Immigration; dietary Change; Acculturation; difference; Correlation; Impacting factors

Abstract

Objectives: The multicultural study aims at examining Dietary Change (Dietary Behaviour Change and Dietary Belief Change) of English, French and Chinese speaking immigrants in Ottawa and Gatineau, Canada, and identifying demographic factors that correlate with the change and impact the change.

Materials and Methods: In total, 810 immigrants of the three language sub-groups were recruited by purposive-sampling. Using self-reports, respondents answered questions regarding Behaviour Change and Belief Change in Nutritional Food Consumption and Junk and Processed Food Consumption, and Demography in Multicultural Lifestyle Change Questionnaire of English, French or Chinese version. Percentage, significance of difference, correlation, regression and factor analysis were performed respectively to analyze the data in Dietary Change.

Results: Immigrants of different gender, language and category sub-groups exhibited different rates in nutritional food and junk and processed food consumption changes, increasing and decreasing rates in consumption of different nutritional foods, increasing and decreasing rates in consumption of different junk and processed foods, and rates in nutritional food and junk and processed food belief changes. However, no statistical difference between the rates, except significant differences between increasing and decreasing rates of different category sub-groups in consumption of different nutritional foods and consumption of different junk and processed foods. Dietary Change (Dietary Behaviour Change + Dietary Belief Change) was correlated positively with Speaking Languages, Age and Religion, and Dietary Behaviour Change was correlated negatively with Religion. Speaking Languages, Age and Religion significantly impacted Dietary Change, and Religion significantly impacted Dietary Behaviour Change. Speaking Languages and Age significantly impacted Dietary Belief Change. One factor (factor one: dietary behaviour change factor) significantly influenced Dietary Change. Other factor (factor two: dietary belief change factor) did not significantly impacted Dietary Change.

Conclusion: Immigrants of different sub-groups in Canada experienced different Dietary Change. Religion was a main factor influencing Dietary Change. Speaking Languages and Age were important factors impacting Dietary Belief Change. Acculturation was a relating factor contributing Dietary Change. Data of immigrant dietary change can provide evidence for dietetic health policy-making and policy-revising in Canada.

INTRODUCTION

Nutrition is considered a key lifestyle contributor in reducing or causing chronic diseases [1,2]. A healthful diet is an essential component maintaining and improving health [3]. Immigrants could have higher rates of mortality and morbidity linked to nutrition-related non communicable diseases in most host countries [4], because immigrants are at risk of poor nutrition due to economic/adaptive factors such as different food preferences and customs, special needs, language barriers, and acquisition of unhealthy lifestyles [5-7].

Usually, immigrants to move to western countries have arisen important modifications in dietary pattern and practices, food preparation habits, dietary and nutritional beliefs after arrival in the host countries according to the availability of food and dietary acculturation [8-11], but they could both adopt some of new dietary practices in the countries and maintain some of traditional dietarypractices [12]. For example, Asian immigrantsthe United Statesboth adopted western-style hamburger and ate traditional evening meals [13]. Similarly, many of Canadian immigrants consumed more Canadian convenience food, but also ate traditional aliment. For instance, Chinese immigrants in Canada consumed both pizzas and Chinese Dumplings (jiaozi) [14]. Especially, immigrants from non-Western countries consumed healthier diets before arrival in Canada, but they could eat more unhealthy food after arrival in the host country [15].

Yet, no study examined dietary change of Canadian English, French and Chinese speaking immigrants simultaneously enabling a direct comparison in differences.

English speaking immigrants represent one of the largest ethnic or cultural immigrant sub-groups in Canada and are the largest immigrant sub-groups in the Ottawa (Ontario)– Gatineau (Québec) region [16,17]; while French speaking immigrants are one of principal ethnic immigrant groups in Québec and the second largest immigrant sub-group in the region [16-18].

Chinese speaking Canadians have constituted the largest ethnic immigrant sub-group entering Canada, one of the fastest-growing sub-groups in Canada since 1987 and the fourth largest sub-group following Arabic speaking immigrants in the Ottawa– Gatineau region [17,19,20].

The main objectives of this study were to explore the differences in Dietary Change (Behaviour Change and Belief Change in consumption of Nutrition Foods and Junk and Processed Foods) among different sub-groups of immigrants as well as to explore the relationships between Dietary Dependent Variables(Dietary Behaviour Change and Dietary Belief Change) and Demographic Independent Variables (Mother Tongue, Speaking Languages, Age, Gender, Category of Immigration, Primary Occupation, Religion and Income). The explorations show far-reaching significance in multicultural health research, nutritional improvement, health policy-making and health promoting program in Canada.

ETHICAL APPROVAL

The immigrant dietary change study was part of a multicultural lifestyle change research project that was approved by Social and Behavioural Research Ethics Committee, Flinders University in Australia in 2010 and by Office of Research Ethics and Integrity, University of Ottawa in Canada in 2014.

MATERIALS AND METHODS

Survey methods

English, French and Chinese speaking immigrants at Adult Educational Centres/Schools, Christian Community Churches and Residential Communities in Gatineau and Ottawa of Canada were identified as the target population of this multicultural study. Random sampling was deemed impracticable for the study and could be biased because immigrant status of three language sub-groups could not be identified effectively according to the sampling criteria. Purposive-sampling method was applied in the study to recruit qualified immigrant participants [21,22].

Immigrants of the first generation in Ottawa and Gatineau were defined as the participants in the multicultural study, who must have been 18 years or older, have resided in Ottawa or Gatineau one year or more, and had been 16 years or older when they arrived in Canada, for controlling confounders of the immigrant dietary change study as far as possible. In total, 810 qualified participants (278, 268 and 264 subjects respectively for English, French and Chinese immigrants) were recruited to the study. All participants answered questions relating to Dietary Change and Demography in a Multicultural Lifestyle Change Questionnaire of English, French or Chinese version developed by the authors, with all responses self-reported. The Multicultural Lifestyle Change Questionnaire was demonstrated by a pilot-test in the three immigrant sub-groups to have high validity (Pearson correlation coefficient r= 0.435 > satisfactory value 0.40) [23,24], and reliability (alpha coefficient α=0.754 > satisfactory value 0.70) before the multicultural study [25,26].

Dietary change included dietary behaviour change and dietary belief change (dependent variables). Dietary behaviour change contained Nutritional Food and Junk and Processed Food Consumption Changes, Increasing and Decreasing Consumption in Different Nutritional Foods, and Increasing and Decreasing Consumption in Different Junk and Processed Foods. Dietary belief change comprised Nutritional Food and Junk and Processed Food Consumption Belief Changes.

Nutritional Food and Junk and Processed Food Consumption Changes: Nutritional Food and Junk and Processed Food Consumption Changes were identified based on the response choices of questions in nutritional food consumption and junk and processed food consumption in the Multicultural Lifestyle Change Questionnaire. Nutritional Food consumption question was "Since arrival in Canada, did your consumption of the nutritional foods (i.e. lean meat, fish, chicken, seafood, egg, fresh fruit and vegetable, etc) change each week?". The options of this question were as follows: "A. Changed, go to questions below", "B. Not changed", and "C. Do not know". The respondent was identified experiencing nutritional food change if choosing option "A". Junk and Processed Food consumption question was: "Since arrival in Canada, did your consumption of the junk and processed foods (i.e. fat meat, fried foods, canned foods, high-sugar fruit juices, etc.) change each week?". The options of this question were as follows: "A. Changed, go to questions below", "B. Not changed", "C. Do not know". The respondent was identified experiencing junk and processed food change if choosing "A".

Increasing and decreasing consumption in different Nutritional Foods: Increasing and decreasing consumption in different Nutritional Foods were identified according to the response choices of two questions- "Since arrival in Canada, which nutritional foods did you *increase* consuming *each week*?" and "Since arrival in Canada, which nutritional foods did you *decrease* consuming *each week*?". The response options of multiple-choice of 21 nutritional foods for both of the two questions were as follows: "a. Lean meat", "b. Beef", "c. Chicken", "d. Fish", "e. Shrimp", "f. Egg", "g. Honey", "h. Low-fat milk", "i. Yogurt", "j. Tofu", "k. Rice", "l. Pastes", "m. Oatmeal", "n. Maize", "o. Potato", "p. Sweet potato", "q. Fresh vegetable", "r. Fresh fruit", "s. Natural fruit juices", "t. Tea" and "u. Other".

Increasing and decreasing consumption in different Junkand Processed Foods: Increasing and decreasing consumption in different Junk and Processed Foods were identified according to the response choices of two questions – "Since arrival in Canada, which junk and processed foods did you *increase* consuming *each week*?" and "Since arrival in Canada, which junk and processed foods did you *decrease* consuming *each week*?". The response options of multiple-choice of 14junkand processed foods for both of the two questions were as follows:"a. Fatty", "b. Fried foods", "c. Pickled vegetable", "d. Salted meat", "e. Sausage and dried meat", "f. Chips, biscuits, instant noodles", "g. Canned foods", "h. High-sugar cakes and desserts", "i. Candy and chocolate bars", "j. Soft drinks and colas", "k. High-sugar fruit juices", "l. Ice cream and popsicle", "m. Coffee with sugar" and "n. Others".

Nutritional Food and Junk and Processed Food Consumption Belief Changes: Nutritional Food and Junk and Processed Food Consumption Belief Changes were identified according to the response choices of questions in nutritional food belief change and junk and processed food belief change in the Questionnaire. The questions of nutritional food belief

change included question one -"Before arrival in Canada, which of these statements best describes your belief with regards to nutritional foods?", and question two -"Since arrival in Canada, which of these statements best describes your belief with regards to nutritional foods?". The response options for both of the two questions were as follows: "A. The above mentioned nutritional foods can *very strongly promote* health", "B. The above mentioned nutritional foods *strongly promote* health", "C. The above mentioned nutritional foods *promote* health", "The above mentioned nutritional foods *somewhat promote* health". "E. The above mentioned nutritional foods *less than somewhat promote* health", "F. The above mentioned nutritional foods *not promote* health", and "G. Do not know". The questions of junk and processed food belief change included question one - "Before arrival in Canada, which of these statements best described your belief with regards to junk and processed foods?", and question two - "Since arrival in Canada, which of these statements best describes your belief with regards to junk and processed foods?". The response options for both of the two questions were as follows:"A. The above mentioned junk and processed foods have *very strongly adverse effects* on health", "B. The above mentioned junk and processed foods *strongly adverse effects* on health", "C. The above mentioned junk and processed foods *adverse effects* on health", "D. The above mentioned junk and processed foods *somewhat adverse effects* on health", "E. The above mentioned junk and processed foods *less than somewhat adverse effects* on health", "F. The above mentioned junk and processed foods *no adverse effect* on health", and "G. Do not know". The respondent was identified experiencing nutritional food belief change and/or junk and processed food belief change if there were different choices in the options of two questions except option "G" (i.e. picking option "A" for question one and choosing option "B" for question two).

Immigrant status: Immigrant status of English or French or Chinese speaking subjects was identified by the response of "Original Country" question in the Questionnaire– "What is your country of origin?".

Demographic characteristics: Demographic characteristics (independent variables) of the study population were identified according to the response choices of demographic questions relating to "Mother Tongue", "Speaking Language", "Age", "Gender", "Marital Status", "Category of Immigration", "Duration of Residence", "Education", "Employed Status", "Employed Status", "Occupation", "Religion" and "Income" in the Questionnaire.

Statistical methods

Percentage: Rates of the Total Sample, the Gender (Man and Woman) Sub-groups, the Language (English, French and Chinese speaking) Sub-groups and the Category (Principal Applicant Immigrant, Spouse and Dependant Immigrant, Family Class Immigrant, Other / Refugee Immigrant)Sub-groups in Dietary Change were respectively calculated and presented in Table 1, 2, 3, 4, which included (1) Rates in Nutritional Food and Junk and Processed Food Consumption Change, (2) Increasing and Decreasing Rates in Consumption of Different Nutritional Foods, (3) Increasing and Decreasing Rates in Consumption of Different Junk and Processed Foods, and (4) Rates in Nutritional Food and Junk and Processed Food Belief Change.

Significant level: Chi-square tests were performed to test if there were significant differences between the rates of different sub-groups in Dietary Change. The results were presented Table 5.

Multivariate analysis: Following the descriptive analysis, correlation analysis was performed to test whether there were a correlation between the independent variables - Mother Tongue, Speaking Languages, Age, Gender, Category of Immigration, Primary Occupation, Religion and Income, and the dependent variables – Dietary Change (Dietary Behaviour Change + Dietary Belief Change) and Dietary Behaviour Change. Then, multiple linear regression analysis was used to determine if the independent variables had significantly impacted the dependent variables. The results were presented Table 6.

Factor analysis: Finally, factor analysis of two independent variables (Mother Tongue and Category of Immigration) and three dependent variables (Nutritional Food Consumption Change, Junk and Processed Food Consumption Change, and Dietary Belief Change)was executed respectively to assess how many factors were significantly impacted Dietary Change and which factor was the most significant factor influencing the change. The results were presented respectively Figure 1, 2, and Table 7.

Table 1: Rates of Total Sample and Different Immigrant Sub-groups in Nutritional Food and Junk and Processed Food Consumption Change.

Item		Dietary Change	
		*Rate in nutritional food consumption change %	Rate in junk and processed food consumption change %
Total sample (810)		92.75	91.85
Gender sub-groups	Immigrant men (411)	91.93	93.19
	Immigrant women(399)	92.98	90.48
Language sub-groups	English immigrants (278)	94.60	95.68
	French immigrants (268)	86.57	84.33
	Chinese immigrants (264)	95.83	95.46
Category sub-groups	Principal Applicant immigrants (193)	91.71	91.71
	Spouse and Dependent immigrants (193)	94.82	90.57
	Family Class immigrants (354)	91.24	90.11
	Other (Refugee) immigrants (70)	84.29	88.57

Notes: *Change rate in nutritional food consumption= change subjects / sampled subjects x 100%.

Table 2: Increasing and Decreasing Rates of Total Sample and Different Immigrant Sub-groups in Consumption of Different Nutritional Foods.

Item		Lean Meat		Beef		Chicken		Fish		Shrimp		Egg		Honey	
		*Increasing rate %	Decreasing rate %	Increasing rate %	Decreasing rate %	Increasing rate %	Decreasing rate %	Increasing rate %	Decreasing rate %	Increasing rate %	Decreasing rate %	Increasing rate %	Decreasing rate %	Increasing rate %	Decreasing rate %
Total sample (810)		33.09	19.63	51.11	20.25	38.15	29.75	49.26	13.70	43.33	10.62	29.01	26.67	9.51	16.17
Gender sub-groups	Immigrant men (411)	34.31	18.00	57.66	16.55	41.61	27.01	47.69	16.30	40.39	11.44	27.49	24.57	8.52	15.09
	Immigrant women (399)	31.83	21.30	44.36	24.06	34.59	32.58	50.88	11.03	45.01	9.77	30.58	28.82	10.53	17.29
Language sub-groups	English immigrants (278)	28.06	22.30	52.52	24.46	35.25	12.95	58.99	10.43	54.32	9.35	27.34	21.58	9.35	17.99
	French immigrants (268)	28.36	12.69	47.76	15.67	51.49	45.90	21.64	25.37	15.30	13.81	25.00	22.01	10.07	8.21
	Chinese immigrants (264)	43.18	23.86	56.06	20.45	27.65	42.05	67.05	5.30	60.23	8.71	34.85	36.74	9.09	22.35
Category sub-groups	Principal Applicant immigrants (193)	38.34	14.51	62.69	15.03	40.93	27.98	48.19	14.51	41.45	11.92	26.94	21.76	8.81	13.99
	Spouse and Dependent immigrants (193)	32.64	16.06	50.26	18.13	36.27	30.57	49.74	14.51	44.56	12.44	32.12	29.02	9.84	24.35
	Family Class immigrants (354)	31.07	25.14	48.31	24.29	35.59	33.62	54.52	11.58	49.44	9.60	29.10	30.51	11.02	12.99
	Other (Refugee) immigrants (70)	30.00	15.71	35.71	20.00	48.57	12.86	24.29	20.00	14.29	7.14	25.71	14.29	2.86	15.71
Item		Low-Fat Milk		Yogurt		Tofu		Rice		Pastes		Oatmeal		Maize	
		Increasing rate %	Decreasing rate %	Increasing rate %	Decreasing rate %	Increasing rate %	Decreasing rate %	Increasing rate %	Decreasing rate %	Increasing rate %	Decreasing rate %	Increasing rate %	Decreasing rate %	Increasing rate %	Decreasing rate %
Total sample (810)		40.74	7.53	55.06	6.91	27.28	17.78	39.01	28.64	19.51	23.09	22.47	5.80	14.44	18.40
Gender sub-groups	Immigrant men (411)	39.17	7.54	50.12	8.76	29.20	14.60	47.45	26.03	18.49	22.38	19.71	6.08	13.87	18.73
	Immigrant women (399)	42.36	7.52	60.15	5.01	25.31	21.05	30.33	31.33	20.55	23.81	25.31	5.51	15.04	18.05
Language sub-groups	English Immigrants (278)	50.00	8.99	64.03	6.83	37.41	5.76	47.48	9.71	12.95	15.83	16.19	4.68	15.11	13.31
	French immigrants (268)	18.66	8.96	38.43	8.21	16.79	4.10	53.73	12.31	22.39	17.91	10.07	4.48	10.45	17.91
	Chinese immigrants (264)	53.41	4.55	64.39	5.68	27.27	44.32	15.15	65.15	23.48	35.98	41.67	8.33	17.80	24.24
Category sub-groups	Principal Applicant immigrants (193)	42.49	7.25	49.22	7.77	30.57	20.73	40.93	33.68	16.58	24.35	20.21	8.29	12.44	21.76
	Spouse and Dependent immigrants (193)	44.56	7.77	63.21	4.66	24.87	19.17	37.82	33.68	23.83	21.76	29.02	4.66	17.10	20.73
	Family Class Immigrants (354)	43.22	6.78	57.91	7.34	28.81	18.64	35.31	25.71	17.23	23.16	23.16	5.37	14.69	16.38
	Other (Refugee) immigrants (70)	12.86	11.43	34.29	8.57	17.14	1.43	55.71	15.71	27.14	22.86	7.14	4.29	11.43	12.86
Item		Potato		Sweet Potato		Fresh Vegetable		Fresh Fruit		Natural Fruit Juices				Tea	
		Increasing rate %	Decreasing rate %	Increasing rate %	Decreasing rate %	Increasing rate %	Decreasing rate %	Increasing rate %	Decreasing rate %	Increasing rate %		Decreasing rate %		Increasing rate %	Decreasing rate %
Total sample (810)		20.37	19.38	28.02	11.98	49.63	31.73	49.88	34.32	20.62		18.52		15.80	18.52

Gender sub-groups	Immigrant men (411)	19.71	17.27	22.38	11.92	46.96	15.09	48.42	34.55	23.60	17.03	17.27	20.92
	Immigrant women (399)	21.05	21.55	33.83	12.03	52.38	17.29	51.38	34.09	17.54	20.05	14.29	16.04
Language sub-groups	English immigrants (278)	21.94	14.75	33.45	8.99	41.01	47.84	43.88	46.40	21.22	15.47	16.55	20.86
	French immigrants (268)	19.78	16.04	19.78	13.43	27.61	35.45	27.61	42.91	19.78	12.69	20.9	19.40
	Chinese immigrants (264)	19.32	27.65	30.68	13.64	81.06	10.98	78.79	12.88	20.83	27.65	9.85	15.15
Category sub-groups	Principal Applicant immigrants (193)	19.69	15.54	25.39	11.92	52.85	29.02	52.33	30.57	21.24	22.28	16.58	18.13
	Spouse and Dependent immigrants (193)	21.76	22.28	34.72	10.88	49.22	33.68	50.78	35.23	26.94	16.06	17.62	19.17
	Family Class immigrants (354)	20.62	19.49	28.25	10.73	53.67	30.51	52.82	34.46	17.23	20.34	14.69	17.80
	Other (Refugee) immigrants (70)	17.14	21.43	15.71	21.43	20.00	40.00	25.71	41.43	18.57	5.71	14.29	21.43

Notes: *Lean meat increasing rate = lean meat increasing subjects / sampled subjects x 100%.

Table 3: Increasing and Decreasing Rates of Total Sample and Different Immigrant Sub-groups in Consumption of Different Junk and Processed Foods.

Item		Fatty		Fried Foods		Pickled Foods		Salted Meat		Sausage and Dried Meat		Chips, Biscuits and Instant Noodles	
		*Increasing rate %	Decreasing rate %	Increasing rate %	Decreasing rate %	Increasing rate %	Decreasing rate %	Increasing rate %	Decreasing rate %	Increasing rate %	Decreasing rate %	Increasing rate %	Decreasing rate %
Total sample (810)		32.84	29.51	48.64	23.70	16.54	30.12	8.64	33.33	28.64	20.25	55.19	13.21
Gender sub-groups	Immigrant men (411)	43.36	23.84	48.42	24.33	17.76	30.17	9.25	32.85	28.95	20.19	54.01	13.14
	Immigrant women (399)	23.31	35.34	48.87	23.06	15.29	30.08	8.02	33.83	28.32	20.30	56.39	13.28
Language sub-groups	English immigrants (278)	35.61	18.71	47.48	25.54	25.90	14.81	11.15	28.42	29.50	16.55	56.83	17.27
	French immigrants (268)	46.64	16.04	38.81	19.03	12.31	20.90	10.07	29.10	26.12	17.91	38.81	8.58
	Chinese immigrants (264)	15.91	54.55	59.85	26.52	10.98	50.00	4.55	42.80	30.30	26.52	70.08	13.64
Category sub-groups	Principal Applicant immigrants (193)	33.68	29.53	52.85	21.24	19.17	27.98	7.77	33.16	20.21	25.39	57.51	13.47
	Spouse and Dependent immigrants (193)	33.68	30.05	52.33	22.80	16.58	34.72	12.95	35.23	30.05	20.21	56.48	12.44
	Family Class immigrants (354)	27.40	31.36	46.33	26.84	15.82	30.51	6.50	33.05	32.49	18.64	57.91	14.41
	Other (Refugee) immigrants (70)	55.71	18.57	38.57	17.14	12.86	21.43	10.00	30.00	28.57	14.29	31.43	8.57

Item		Canned Foods		High Sugar Cakes		Candy and Chocolate Bars		Soft Drinks and Colas		High-Sugar Fruit Juices		Ice Cream and Popsicle		Coffee with Sugar	
		Increasing rate %	Decreasing rate %	Increasing rate %	Decreasing rate %	Increasing rate %	Decreasing rate %	Increasing rate %	Decreasing rate %	Increasing rate %	Decreasing rate %	Increasing rate %	Decreasing rate %	Increasing rate %	Decreasing rate %
Total sample (810)		15.56	16.3	48.02	15.43	39.14	14.57	13.21	22.72	12.59	27.90	14.81	20.12	49.63	8.40

Gender sub-groups	Immigrant men (411)	18.49	15.82	44.53	16.30	33.09	14.36	13.87	20.44	12.90	28.71	13.14	21.17	57.91	9.00
	Immigrant women (399)	2.53	16.79	51.63	14.54	45.36	14.79	12.53	25.06	12.28	27.07	16.54	19.05	41.10	7.77
Language sub-groups	English immigrants (278)	11.15	17.99	50.72	14.75	42.45	15.11	6.83	66.19	5.40	26.26	17.99	18.71	57.55	10.43
	French immigrants (268)	18.66	8.58	38.81	13.43	27.24	11.57	17.54	19.78	23.51	21.64	15.30	17.91	30.97	6.72
	Chinese immigrants (264)	17.05	22.35	54.55	18.18	47.73	7.05	5.53	21.97	9.09	27.65	10.98	23.86	60.23	7.95
Categorys Sub-groups	Principal Applicant immigrants (193)	19.69	17.62	46.11	14.51	28.50	13.47	13.47	24.35	11.40	27.98	10.88	22.80	64.77	7.77
	Spouse and Dependent immigrants (193)	14.51	17.62	51.30	16.58	47.15	17.62	15.54	24.87	15.54	25.39	17.62	20.21	47.15	5.70
	Family Class immigrants (354)	13.28	16.67	49.15	16.10	41.53	13.84	10.73	20.06	9.04	30.51	13.84	18.93	47.18	9.32
	Other (Refugee) immigrants (70)	18.57	7.14	38.57	11.43	34.29	12.86	18.57	25.71	25.71	21.43	22.86	18.57	27.14	12.86

Notes: *Fatty increasing rate = fatty increasing subjects / sampled subjects x 100%.

Table 4: Rates of Gender and Language Sub-groups in Nutritional Food and Junk and Processed Food Belief Change.

Item		Nutritional Food Consumption Belief			Junk and Processed Food Consumption Belief		
		*Change rate %	Increasing rate % of "Nutritional Food Can Promote Health"	Decreasing rate % of "Nutritional Food Can Promote Health"	Change rate %	Increasing rate % of "Junk and Processed Food Have Adverse Effects on Health"	Decreasing rate % of "Junk and Processed Food Have Adverse Effects on Health"
Gender sub-groups	Immigrant men(411)	51.34	33.82	17.52	69.10	44.28	24.82
	Immigrant women(399)	51.63	37.09	14.54	67.92	52.88	15.04
Language sub-groups	English immigrants (278)	50.92	30.94	19.78	66.19	45.68	20.50
	French immigrants (268)	52.24	31.72	20.52	59.70	31.72	27.99
	Chinese immigrants (264)	51.52	43.94	7.58	79.55	68.18	11.36

Notes: *Change rate = change subjects / sampled subjects x 100%.

RESULTS

Percentages in dietary change

1. Table 1 presents Nutritional Food and Junk and Processed Food Consumption Change.
2. Table 2 presents increasing and decreasing consumption in different nutritional foods.
3. Table 3 presents increasing and decreasing consumption in different junk and processed foods.
4. Table 4 presents Nutritional Food and Junk and Processed Food Belief Change.
5. Table 5 presents significance levels of rates in Dietary Change.
6. Table 6 presents multivariate analysis results in Dietary Change.
7. Table 7 Factor Analysis of Variables in Dietary Change.

Factor analysis

Figure 1 and Figure 2 presents Cree plots of factor analysis. Table 7 presents factor analysis results of variables.

DISCUSSION

The results show that the immigrants in the Ottawa-Gatineau region experienced dietary change. However, different gender, language and category sub-groups showed differences in nutritional food and junk and processed food consumption changes, increasing and decreasing consumption in different nutritional foods, and increasing and decreasing consumption in different junk and processed foods. Meanwhile, different gender and language exhibited differences in nutritional food and junk and processed food belief changes. Some of the demographic factors were correlated with dietary change and significantly impacted dietary change.

Table 5: Significance levels of rates of different immigrant sub-groups in Dietary Change.

Significance levels:				
Item		**Chi-square**	***P-values**	**Significant Difference**
Gender (Man and Woman) sub-groups	Rates in nutritional food and junk and processed food consumption change	4.000	0.261	No
	Increasing and decreasing rates in consumption of different nutritional foods	4.000	0.261	No
	Increasing and decreasing rates in consumption of different junk and processed foods	49.333	0.460	N0
	Rates in nutritional food and junk and processed food belief change	12.000	0.364	No
Language (English, French, and Chinese) sub-groups	Rates in nutritional food and junk and processed food consumption change	12.000	0.364	No
	Increasing and decreasing rates in consumption of different nutrition foods	240.000	0.091	No
	Increasing and decreasing rates in consumption of different junk and processed foods	156.000	0.075	No
	Rates in nutritional food and junk and processed food belief change	36.000	0.287	No
Category (Principal Applicant, Spouse and Dependent, Family Class, and Other/Refugee) sub-groups	Rates in nutritional food and junk and processed food consumption change	24.000	0.155	No
	Increasing and decreasing rates in consumption of different nutrition foods	409.333	0.004	Yes
	Increasing and decreasing rates in consumption of different junk and processed foods	208.026	0.009	Yes
	Rates in nutritional food and junk and processed food belief change	26.000	0.252	No

Notes: Significant difference: $p < 0.05$

Table 6: Multivariate Analysis Results in Dietary Change.

Multivariate analysis:								
Correlation analysis					**Regression analysis**			
Dependent variable	**Independent variable**	**Pearson's r**	**p-value**	**Correlation between independent variable and dependent variable**	**Dependent variable**	**Independent variable**	**p-value**	**Impact of independent variable on dependent variable**
Dietary Change (Dietary Behaviour Change + Dietary Belief Change)	Speaking Languages	0.158	0.000	Positive correlation	Dietary Change (Dietary Behaviour Change + Dietary Belief Change)	Speaking Languages	0.028	Significant impact
	Age	0.167	0.000	Positive correlation		Age	0.001	Significant impact
	Religion	0.215	0.000	Positive correlation		Religion	0.000	Significant impact
Dietary Behavior Change	Religion	-0.125	0.000	Negative correlation	Dietary Behavior Change	Religion	0.004	Significant impact

Notes: Significance Level: $p< 0.05$

Table 7: Factor Analysis of Variables in Dietary Change.

Item		***Factor**	
Independent variable	**Dependent variable**	**1**	**Factor name**
Mother Tongue	Nutritional food consumption change	0.485	Dietary behaviour change factor
	Junk and processed food consumption change	0.504	
	Dietary belief change	-0.360	Dietary belief change factor
Category of Immigration	Nutritional food consumption change	0.686	Dietary behaviour change factor
	Junk and processed food consumption change	0.755	
	Dietary belief change	-0.565	Dietary belief change factor

*Notes: The factor loading matrix was a varimax rotated matrix.

Nutritional food and junk and processed food consumption changes

(1). Total Sample: The overwhelming majority of total sample experienced changes of nutritional food consumption and junk and processed food consumption. However, nutritional food consumption change of the immigrants was close to or higher 0.1% than their junk and processed food consumption change.

(2). Gender sub-groups: Nutritional Food Consumption Change Rate (92.98 %) of the female immigrants was higher somewhat than that (91.93%) of the male immigrants, but their

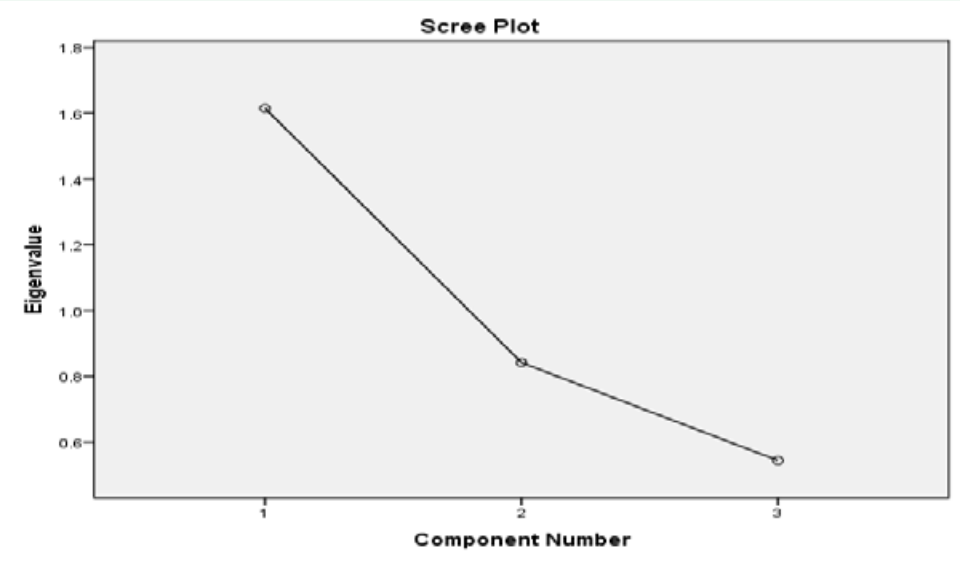

Figure 1 Factor Analysis for Mother Tongue and Dietary Change.

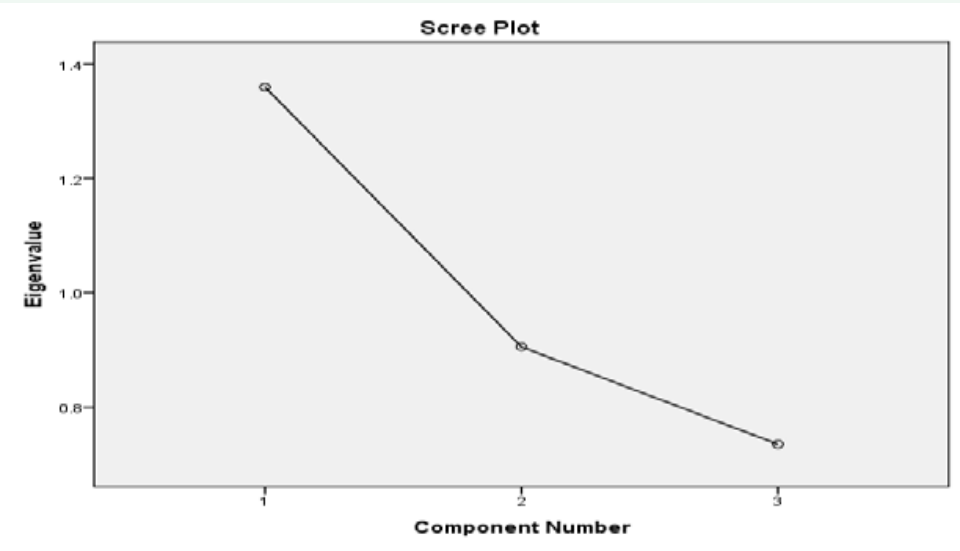

Figure 2 Factor Analysis for Category of Immigration and Dietary Change.

Junk and Processed Food Consumption Change Rate (90.48%) was lower slightly than that (93.19%) of the male immigrants.

(3). Language sub-groups: Chinese and English immigrants had respectively the highest Nutritional Food Consumption Change Rate and Junk and Processed Food Consumption Rate; while French immigrants had the lowermost Nutritional Food and Junk and Processed Food Consumption Change Rates.

(4). Category sub-groups: Principal Applicant immigrants had the highest Junk and Processed Food Consumption Change Rate; while Spouse and Dependent immigrants had the highest Nutrition Food Consumption Change Rate and the lowermost Junk and Processed Food Consumption Change Rate. However, Other (Refugee) immigrants had the lowermost Nutrition Food Consumption Change Rate.

It is observed that different immigrant sub-groups had similarity, difference and preference of consumption of different nutritional foods and different junk and Processed Food, which mainly focused on increasing and decreasing consumption in the foods.

Increasing and decreasing consumption in different nutritional foods

(1). Total Sample: The immigrants increased mainly consumption of Yogurt, Beef, Fresh Fruit, Fresh Vegetable, Fish and Shrimp, and decreased consumption of Pastes, Tea, Maize and Honey. In particular, they increased consumption of Fresh Fruit and Fresh Vegetable, because increasing rates of Fresh Fruit (49.88%) and Fresh Vegetable (49.63%) intake were higher than their decreasing rates (34.32% and 31.73%). However, some of

the studies indicate that immigrants reduced fruit and vegetable intake [7,27,28]. Similarly, a recent study reveals that immigrants in Montréal, Canada declined consumption of Fruit and Vegetable [29].

(2). Gender sub-groups: The male immigrants consumed more Lean Meat, Beef, Chicken, Tofu, Rice, Natural Fruit Juices and Low-Fat Milk, but the female immigrants consumed more Fish, Shrimp, Yogurt, Oatmeal, Maize, Sweet Potato and Fresh Fruit. It is noticed that the male immigrants increased consumption of Rice, but the female immigrants decreased consumption of Rice, and the male and female immigrants had approximate consumption of Egg, Honey, Pastes, Potato, Fresh Vegetable and Tea.

(3). Language sub-groups: English immigrants mainly increased consumption of Yogurt, Fish and Shrimp, and decreased consumption of Fresh Vegetable, Fresh Fruit and Beef; while French immigrants mainly increased consumption of Rice, Chicken and Beef, and decreased consumption Chicken, Fresh Fruit and Fresh Vegetable. Most of the French immigrants came from African countries. A dietary study in the US reveals that African immigrants reported decreasing consumption of fruit and vegetable [30]. However, Chinese immigrants mainly increased consumption of Fresh Vegetable, Fresh Fruit and Fish, and decreased consumption of Rice, Tofu and Chicken. A study in America and Canada discloses that Chinese immigrants increased fruit and vegetable intake [31]. Similarly, a dietary survey in Vancouver, Canada exhibits that over 50% of Chinese immigrants reported increasing consumption of fruits and vegetables after immigration [32]. Nevertheless, the results of this dietary change study exposed that English and French immigrants decreased consumption of Fresh Vegetable and Fresh Fruit, and French immigrants decreased more greatly than English immigrants.

It is worth noting that immigrants of the three sub-groups increased greatly consumption of Yogurt, but English and Chinese immigrants increased more Yogurt consumption than French immigrants. It is interesting to note that Chinese immigrants decreased greatly consumption of traditional foods – Tofu and Rice, with increasing consumption of English and French immigrants in Tofu and Rice, which appears that many of the Chinese immigrants changed dietary behaviours with acceptance of west dietary habits, and some of English and French immigrants changed dietary behaviours with affection of Chinese dietary habits. In the meantime, Chinese immigrants increased consumption of Oatmeal more greatly than English and French immigrants, with more consumption of English immigrants than French immigrants in Oatmeal. It appears that Chinese immigrants had the greatest Nutrition Food Consumption Change, followed by English immigrants, and French immigrants had the least change.

(4). Category sub-groups: Principal Applicant immigrants mainly and greatly increased consumption of Beef, Fresh Vegetable and Fresh Fruit, and less decreased consumption of Rice, Fresh Fruit and Fresh Vegetable; while Spouse and Dependent immigrants principally and greatly increased consumption of Yogurt, Fresh Fruit and Beef, and less decreased consumption of Fresh Fruit, Rice and Fresh Vegetable. However, Family Class immigrants mainly and greatly increased consumption of Yogurt, Fish and Fresh Vegetable, and less decreased consumption of Fresh Fruit, Chicken and Egg. Other (Refugee) immigrants principally and greatly increased consumption of Rice, Chicken and Beef, and greatly decreased consumption of Fresh Fruit, Fresh Vegetable and Pastes.

Increasing and decreasing consumption in different junk and processed foods

(1). Total Sample: The immigrants increased mainly consumption of Biscuits and Instant Noodles, Coffee with Sugar, Fried Foods, High Sugar Cakes, Candy and Chocolate Bars, and Fatty, and decreased Salted Meat, Pickled Foods, High-Sugar Fruit Juices. In particular, they increased Fatty intake because increasing rate (32.84%) of Fatty intake was higher than decrease rate (29.51%).Some of research findings indicate that main dietary trend after immigration was a substantial increase in foods that were energy dense and contain high levels of fat, sugar and salt [27,28].

(2). Gender sub-groups: The male immigrants consumed Fattier, Salted Meat, Sausage and Dried Meat, Canned Foods, Soft Drinks and Colas, Pickled Foods and Coffee with Sugar than the female immigrants, but the female immigrants consumed more Chips, Biscuits and Instant Noodles, High Sugar Cakes, Candy and Chocolate Bars, Ice Cream and Popsicle than the male immigrants. It is noted that the male immigrants respectively increased and decreased consumption of Fatty and Canned Foods, but the female immigrants exhibited opposite results, and the male and female immigrants had approximate consumption of Fried Foods and High-Sugar Fruit Juices.

(3). Language sub-groups: English immigrants mainly increased consumption of Coffee with Sugar, Chips, Biscuits and Instant Noodles, and High Sugar Cakes, and decreased consumption of Salted Meat, High-Sugar Fruit Juices and Fried Foods; while French immigrants mainly increased consumption of Fatty, Fried Foods, and Chips, Biscuits and Instant Noodles, and decreased consumption of Salted Meat, High-Sugar Fruit Juices and Pickled Foods. A study in Madrid, Spain reveals that younger and more recent West-African French immigrants consumed more animal fat, and sweetened foods and drinks after immigration [33]. However, Chinese immigrants mainly increased consumption of Chips, Biscuits and Instant Noodles, Coffee with Sugar and Fried Foods, and decreased Fatty, Pickled Foods and Salted Meat. A dietary study in Ontario, Canada discloses that 42% Chinese immigrants reported increasing consumption of Snacks [34].

It has been known that French immigrants consumed more fatty than English immigrants, while English immigrants consumed more Fatty than Chinese immigrants. A study shows that current diet of Asian immigrants in America was relatively low fat and high cholesterol intake [12]. However, Asian students, most of them came from China, Hong and Taiwan, significantly increased consumption of fats after immigration to the US [35].

Meanwhile, Chinese immigrants increased consumption of Fried Foods and Chips, Biscuits and Instant Noodles more greatly than English and French immigrants, while English immigrants increased Fried Foods and Chips, Biscuits and Instant Noodles more greatly than French immigrants. However, decreasing rates of Pickled Foods and Salted Meat consumption of Chinese

immigrants was higher greatly than those of English and French immigrants. A dietary survey exhibits that over 50% of Chinese immigrants in Vancouver, Canada reported decreasing use of deep-frying after immigration, but increasing consumption of convenience foods [32]. Similarly, South Asian immigrants in Canada reported a decrease in deep-frying [36]. However, 50% of South Asian immigrants in the US increased frying and baking/grilling food [37].

Furthermore, Chinese immigrants increased more High Sugar Cakes, Candy and Chocolate Bars and Coffee with Sugar intakes than English immigrants, with the least increasing consumption of French immigrants in the foods.

(4). Category sub-groups: Principal Applicant immigrants mainly increased consumption of Coffee with Sugar, Chips, Biscuits and Instant Noodles, and Fried Foods, and decreased consumption of Salted Meat, Fatty, and Pickled Foods; while Spouse and Dependent immigrants principally increased consumption of Chips, Biscuits and Instant Noodles, Fried Foods, and High Sugar Cakes, and decreased consumption of Salted Meat, Pickled Foods, and Fatty. Nevertheless, Family Class immigrants mainly increased consumption of Chips, Biscuits and Instant Noodles, High Sugar Cakes, and Coffee with Sugar, and decreased consumption of Salted Meat, Fatty, and Pickled Foods. Other (Refugee)immigrants principally increased consumption of Fatty, Fried Foods, and High Sugar Cakes, and decreased consumption of Salted Meat, Soft Drinks and Colas, and Pickled Foods.

Nutritional food and junk and processed food belief changes

(1). Gender sub-groups: The male and female immigrants exhibited approximate belief changes in Nutritional Food and Junk and Processed Food Consumption. However, the female immigrants had stronger beliefs of "Nutrition Food Can Promote Health" and "Junk and Processed Food Have Adverse Effects on Health" than the male immigrants.

(2). Language sub-groups: Chinese immigrants had stronger beliefs of "Nutritional Food Can Promote Health" and "Junk and Processed Food Have Adverse Effects on Health" than English and French immigrants; while English immigrants had stronger belief of "Junk and Processed Food Have Adverse Effects on Health" than French immigrants. The Chinese immigrants in Vancouver, Canada reported a higher awareness of healthy food choices and increased knowledge of nutritional information on food tables and food products after immigration [32]. Chinese cultural beliefs played an important role in the dietary practices of the Chinese immigrants living in North America, but host culture also influenced their nutritional belief and dietary changes [38]. However, more recent educated Chinese immigrants who were employed outside the home did not think Chinese diet was healthier than a typical Western diet, and western acculturated immigrants were more likely to believe in a relationship between diet and cancer/heart disease [38].

7.5. Significance level: Though significance analysis shows that there was no statistical difference between most rates of the sub-groups in Dietary Change, percentage comparisons exhibit that there were substantial percentage differences between some of the rates. Moreover, there were significant differences between increasing and decreasing rates of the four category sub-groups in consumption of different nutritional foods and consumption of different junk and processed foods.

7.6. Multivariate analysis: The result of correlation analysis show that Dietary Change (Dietary Behaviour Change + Dietary Belief Change) was correlated positively with Speaking Languages, Age and Religion, and Dietary Behaviour Change was correlated negatively with Religion. Religion was correlated with Dietary Behaviour Change and Dietary Belief Change. Speaking Languages and Age were correlated mainly with Dietary Belief Change, because they were correlated with Dietary Change, but not with Dietary Behaviour Change. It appears that dietary acculturation could be correlated with Dietary Change as Speaking Languages was correlated with Dietary Belief Change.

Furthermore, the results of regression analysis disclose that Speaking Languages, Age and Religion significantly impacted Dietary Change, and Religion significantly impacted Dietary Behaviour Change. Therefore, Religion significantly impacted both Dietary Behaviour Change and Dietary Belief Change, and was a main determinant of Dietary Change of the immigrants. Speaking Languages and Age principally and significantly impacted Dietary Belief Change instead of Dietary Behaviour Change, and were main determinants of Dietary Belief Change.

Factor analysis

The results of factor analysis indicate that Dietary Change contained two factors: factor one (dietary behaviour change factor) and factor two (dietary belief change). Factor one accounted for majority of the total variance and the line of factor two was almost flaton scree plot, which shows that factor one impacted significant Dietary Change, factor two did not influenced significantly Dietary Change. Dietary Behaviour Change was main or direct influencing factor on Dietary Change. Dietary Belief Change was minor or indirect impacting factor on Dietary Change.

DIETARY CHANGE AND ACCULTURATION

It has been noted that diet may be a salient marker of acculturation among immigrants [39].The immigrants in Ottawa and Gatineau changed their dietary behaviour and belief as time since immigration increased supports strongly theory of dietary acculturation. That is, as immigrants lived longer in a country, that immigrants adopted the eating patterns or food choices of the host country or occurred nutrition transition, and their dietary behaviour and belief was more closely approximate to dietary behaviour and belief of the host culture [31, 40]. Acculturation has been broadly described as "the process by which immigrants adopt the attitudes, values, customs, beliefs, and behaviours of a new culture" [41,42]. Immigrant dietary changes were associated with "dietary acculturation" or "nutrition transition" occurring popularly in different groups or sub-groups [42,43].

Obviously, higher fat, higher meat and sweetened drink, and lower fruit and vegetables intakes were associated with greater acculturation among immigrants [42,44]. Generally, acculturation is associated with adoption of healthy diet. Less acculturated groups or sub-groups exhibited healthier dietary practices [45]. For example, less acculturated immigrants

reported a significantly higher frequency of fruit and vegetable consumption [46]. However, acculturation may also be associated with adoption of unhealthy diet or consumption of junk and processed food [47,48]. Higher acculturated immigrants adopted more "Western diet" [3, 49,50]. For instance, Chinese immigrants in North American countries increased consumption frequency of western foods (i.e. convenient foods), sweets and soft drinks, and reduced consumption frequency of traditional Chinese foods (i.e. rice, tofu and tea) as a result of acculturation [37,51,52]. The result of this dietary change study discloses that Chinese immigrants greatly increased consumption of "Western" foods-High Sugar Cakes, Chocolate Bars and Coffee with Sugar, which exhibited their specific dietary acculturation [40].

Meanwhile, acculturation is equated with language proficiency and preference, [53,54]. Greater English language use was associated with decline in fruit and vegetable intake and growth in fat and sweets intake [55]. For example, Latino immigrants who spoke English and had lived in the United States for more years consumed more sugar than Latino immigrants who spoke Spanish in the country [3]. However, American Chinese immigrants with better English proficiency had a greater increase in their consumption frequency of grains, fruits, vegetables, meat/meat alternatives, and fats/sweets [51]. Moreover, language acculturation may exhibit different dietary impacting effects on some linguistic or ethnic sub-group. For instance, French-speaking immigrants from West Africa in Montréal, Canada were identified a feeble acculturation and a loyalty to African dietary and health values [56], and retained eating habits of native countries after ten years. Nevertheless, many of the French-speaking Haitian immigrants in Montréal increased consumption of fatty and decreased consumption of dietary fibre [57].

POLICY IMPLICATION

The results of this dietary change study provide evidence for making and/or revising policies relating to immigrant dietary health and nutrition in Canada, which may regulate or adjust production and sale of food, dietary health care and service for immigrants, and make more effectively dietary health promotion program to lessen immigrant risk of diseases relating to diet and nutrition, and to reduce dietary health inequality and inequity for immigrants. The data may help policy makers of Health Canada to source and consider evidence of dietary change for the vulnerableand marginalized population in decision-making and policy-modifying process, and to adapt appropriately evidence, prior to and during formulating new dietetic health policy or revising previous dietetic health policy [58]. Therefore, Canadian immigrants can improve their diet, nutrition and health status to contribute Canadian economic and social development.

CONCLUSION

The immigrants of sub-groups with different linguistic or cultural or social background in Canada experienced different Dietary Change. Religion was a main factor impacting Dietary Change. Speaking Languages and Age were important factors impacting Dietary Belief Change. Acculturation was a relating impacting factor on Dietary Behaviour Change and Dietary Belief Change. Data of immigrant dietary change may provide evidence for dietetic health policy-making and policy-revising in Canada.

REFERENCES

1. Yusuf S, Reddy S, Ounpuu S, Anad S: Global burden of cardiovascular diseases: Part II: variations in cardiovascular disease by specific ethnic groups and geographic regions and prevention strategies. Circulation 2001; 104: 2855-2864.
2. Satia JA. Diet-related disparities: understanding the problem and accelerating solutions. J Am Diet Assoc. 2009; 109: 610-615.
3. Ayala GX, Baquero B and Klinger S. A Systematic Review of the Relationship between Acculturation and Diet among Latinos in the United States: Implications for Future Research. Journal of the American Dietetic Association. 2008; 108: 1330-1344.
4. Méjean C. Influence des facteurs socio-économiques, de l'alimentation et des modes de vie sur les maladies non transmissibles liées à l'alimentation chez les immigrés tunisiens vivant en Languedoc-Roussillon. Thèse de Doctorat de l'Université Pierre et Marie Curi. Spécialité: Epidémiologie. Soutenue le 12, Février. 2008.
5. Garcia AC, Johnson CS. Development of educational modules for the promotion of healthy eating and physical activity among immigrant older adults. J Nutr Elder. 2003; 22: 79-96.
6. Johnson CS, Garcia AC. Dietary and activity profiles of selected immigrant older adults in Canada. J Nutr Elder. 2003; 23: 23-39.
7. McDonald JT. The Health Behaviors of Immigrants and Native-born People in Canada. Social and Economic Dimensions of Aging Population Research Papers 144, McMaster University. 2005.
8. Dubowitz T, Subramanian SV, Acevedo-Garcia D, Osypuk TL and Peterson KE. Individual and neighborhood differences in diet among low-income foreign and US-born women. Womens Health Issues. 2008; 18: 181–190.
9. Duffey KJ, Gordon-Larsen P, Ayala GX and Popkin BM. Birthplace is associated with more adverse dietary profiles for US-born than for foreign-born Latino adults. Journal of Nutrition. 2008; 138: 2428–2435.
10. Garcia AC, Da WW. Nutrition and physical activity of older Chinese immigrants. Asian Journal of Gerontology & Geriatrics. 2011; 6: 72-81.
11. Andreeva VA and Unger JB. Host society acculturation and health practices and outcomes in the United States: Public health policy and research implications worldwide. Journal of Public Health Policy. 2014; 35: 278–291.
12. Yang W, Read M. Dietary pattern changes of Asian immigrants. Nutrition Research. 1996; 16: 1277-1293.
13. Lockyear PLB. Cultural Differences in Diet and Heart Health Among Women: Culture and Diet. Medscape Ob/Gyn& Women's Health. 2004; 9.
14. Lv N, Cason KL, Nazimul H, Rohit K, Anjli H. Dietary pattern change and acculturation of Chinese Americans in Trend of Retinal Diseases in Developing Countries. Expert Rev Ophthalmol. 2008; 3: 43-50.
15. Hyman I, Guruge S, Makarchuk MJ, Cameron J, Micevski V. Promotion of healthy eating among new immigrant women in Ontario. Can J Diet Pract Res. 2002; 63: 125-129.
16. Statistics Canada. (2009a). Immigration in Canada: A Portrait of the Foreign-born Population, Census: Portraits of major metropolitan centres: Ottawa - Gatineau: Fifth-largest proportion of foreign-born. 2006.
17. Statistics Canada (SC-census). 2011. Population by mother tongue, by census metropolitan area, excluding institutional residents, 2006 census metropolitan area.
18. Roy J-O, Belkhodja C, Gallant N. Nos diverses cites: Immigration

francophone en milieu minoritaire : le défi de la ruralité. 2007; Université Concordia, Canada.

19. Man G. Gender, work and migration: Deskilling Chinese immigrant women in Canada. Women's Studies International Forum. 2004; 27: 135-148.

20. Lu C, Sylvestre J, MelnychuckN, Li J. East meets West: Chinese-Canadians perspectives on health and fitness. Canadian Journal of Public Health. 2008; 99: 22-25.

21. Research Methods Knowledge Base (RMKB). Nonprobability Sampling. 2006.

22. Statistics Canada (SC). Survey Methods and Practices. 2010. Catalogue no. 12-587-X.

23. Eshaghi S-E, Ramezani MA, Shahsanaee A and Pooya A. Validity and Reliability of the Short Form- 36 Items Questionnaire as a Measure of Quality of Life in Elderly Iranian Population. American Journal of Applied Sciences. 2006; 3: 1763-1766.

24. Ekeberg OM, Bautz-Holter E, Tveitå EK, Keller A, Juel NG, Brox JI. Agreement, reliability and validity in 3 shoulder questionnaires in patients with rotator cuff disease. BMC Musculoskelet Disord. 2008; 9: 68.

25. Hopkins C, Fairley J, Yung M, Hore I, Galasubramaniam S, Haggard M. The 14-item Paediatric Throat Disorders Outcome Test: a valid, sensitive, reliable, parent-reported outcome measure for paediatric throat disorders. The Journal of Laryngology & Otology. 2010; 124: 306–314.

26. Kwok C, Fethney J & White K. Chinese Breast Cancer Screening Beliefs Questionnaire: development and psychometric testing with Chinese-Australian women. Journal of Advanced Nursing. 2010; 66: 191-200.

27. Gilbert PA, Khokhar S. Changing dietary habits of ethnic groups in Europe and implications for health. Nutrition Reviews. 2008; 66: 203-215.

28. Holmboe-Ottesen G, Wandel M. Changes in dietary habits after migration and consequences for health: a focus on South Asians in Europe. Food Nutr Res. 2012; 56.

29. Girard A and Sercia P. Immigration and food insecurity: social and nutritional issues for recent immigrants in Montreal, Canada. International Journal of Migration, Health and Social Care. 2013; 9: 32-45.

30. Okafor M-TC, Carter-Pokras OD, Zhan M. Greater Dietary Acculturation (Dietary Change) Is Associated With Poorer Current Self-Rated Health Among African Immigrant Adults. Journal of Nutrition Education and Behavior. 2014; 46: 226-235.

31. Saria JA, Patterson RE, Kristal AR, Hislop TG, Yasui Y, Taylor VW. Development of scales to measure dietary acculturation among Chinese-Americans and Chinese-Canadians. Journal of America Diet Association. 2001; 101: 548-53.

32. Rosenmöller DL, Gasevic D, Seidell JandLear SA. Determinants of changes in dietary patterns among Chinese immigrants: a cross-sectional analysis. International Journal of Behavioral Nutrition and Physical Activity. 2011; 8: 42.

33. Delisle HF, Vioque J, Gil A. Dietary patterns and quality in West-African immigrants in Madrid. Nutr J. 2009; 8: 3.

34. Garcia AC, Da WW. Nutrition and physical activity of older Chinese immigrants. Asian Journal of Gerontology & Geriatrics. 2011; 6: 72-81.

35. Pan YL, Dixon Z, Himbury S, Huffam F. Asian Students Change their Eating Patterns After Living in the United States. Journal of the American Dietetic Association. 1999; 99: 54-57.

36. Lesser IA, Gasevic D, Lear SA. The Association between Acculturation and Dietary Patterns of South Asian Immigrants. PLOS One. 2014; 9: 1- 6.

37. Deng F, Zhang A, Chan CB. Acculturation, Dietary Acceptability, and Diabetes Management among Chinese in North America. Front Endocrinol (Lausanne). 2013; 4: 108.

38. Satia-Abouta J, Patterson RE, Kristal AR, Teh C &Tu S-P. Psychosocial Predictors of Diet and Acculturation in Chinese American and Chinese Canadian Women. Ethnicity & Health. 2002; 7: 27-39. http://www.khea.or.kr/InternationalJournal/2003/4-1/7.PDF

39. Akresh IR. Dietary assimilation and health among Hispanic immigrants to the United States. J Health SocBehav. 2007; 48: 404-417.

40. Saria JA. Dietary acculturation and the nutrition transition: an overview. Applied Physiology, Nutrition, and Metabolism. 2010; 35: 219-223.

41. LaFromboise T, Coleman HL, Gerton J. Psychological impact of biculturalism: evidence and theory. Psychol Bull. 1993; 114: 395-412.

42. Pérez-Escamilla R, Putnik P. The role of acculturation in nutrition, lifestyle, and incidence of type 2 diabetes among Latinos. J Nutr. 2007; 137: 860-870.

43. Oster A, Yung J. Dietary acculturation, obesity, and diabetes among Chinese immigrants in New York City. Diabetes Care. 2010; 33: 109.

44. Novotary R, Chen C, Williams AE, Albright CL, Nigg CR, Oshiro CE, et al. US acculturation is associated with health behaviors and obesity, but not their change, with a hotel-based intervention among Asian-Pacific Islanders. Journal of the Academy of Nutrition and Dietetics. 2012; 112: 649-656.

45. Allen JD, Caspi C, Yang M, Leyva B, Stoddard AM, Tamers S, et al. Pathways between acculturation and health behaviors among residents of low-income housing: The mediating role of social and contextual factors. Social Science & Medicine. 2014; 123: 26–36.

46. Ghaddar S, Brown CJ, Pagán JA, Díaz V. Acculturation and healthy lifestyle habits among Hispanics in United States-Mexico border communities. Rev PanamSaludPublica. 2010; 28: 190-7.

47. Unger JB, Reynolds K, Shakib S, Spruit-Metz D, Sun Ping, Johnson CA. Acculturation, Physical Activity, and Fast-Food Consumption Among Asian-American and Hispanic Adolescents. Journal of Community Health. 2004; 29: 467-481.

48. Lynn A. Many New Immigrants to US Change Diet – and not for the better. Archives, University of Illinois, USA, 2/9/2006.

49. Désilets M-C, Rivard M, Shatenstein B and Delisle H. Dietary transition stages based on eating patterns and diet quality among Haitians of Montreal, Canada. Public Health Nutrition. 2007; 10: 454-463.

50. Patil CL, Hadley C, Nahayo PD. Unpacking dietary acculturation among new Americans: results from formative research with African refugees. J Immigr Minor Health. 2009; 11: 342-358.

51. Lv N, Cason KL. Dietary pattern change and acculturation of Chinese Americans in Pennsylvania. Journal of the American Dietetic Association. 2004; 104: 5 771-778.

52. Lv N, Brown JL. Chinese American family food systems: impact of Western influences. Journal of Nutrition Education and Behavior. 2010; 42: 106-114.

53. Abraido-Lanza AF, Chao MT, Florez KR. Do healthy behaviors decline with greater acculturation? Implications for the Latino mortality paradox. SocSci Med. 2005; 61: 1243-1255.

54. Lopez-Class M, Castro FG, Ramirez AG . Conceptions of acculturation: a review and statement of critical issues. Soc Sci Med. 2011; 72: 1555-1562.

55. Montez JK, Eschbach K. Country of birth and language are uniquely associated with intakes of fat, fiber, and fruits and vegetables among Mexican-American women in the United States. Journal of the American Dietetic Association. 2008; 108: 473-480.

56. Pillarella S, Renaud L, Lagacé MC. Acculturation alimentaire des immigrants récents de l'Afrique de l'Ouest francophone établis à Montréal: une analyse écologique. Le groupe de recherche médias et santé - www.grms.uqam.ca. Université du Québec à Montréal (UQAM). 2006; 235-254.

57. Désilets M-C. Immigration, transition nutritionnelle et facteurs de risque de maladies cardiovasculaires: Etude chez des Haitiens de la region de Montreal. Université de Montréal, Canada. 2006. Dissertations &Theses (PQDT) database.

58. Public Health Agency of Canada (PHAC). Stakeholder Convergence on Nutrition labeling: Building Consensus on a Complex Issue. CARMEN Pilot Canadian Case Study Final Report.

Cite this article

Tang N (2015) Dietary Change of English, French and Chinese Speaking Immigrants in Ottawa and Gatineau, Canada. J Hum Nutr Food Sci 3(3): 1064.