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Research Article

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Associations between Colorectal Cancer Risk Perception and Dietary Patterns among University Students in the Caribbean: A Cross- Sectional Analysis

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Abstract

Background: *Early perceptions of risk for chronic non-communicable diseases have been seen to be attributed to unhealthy lifestyles from as early as the stage of late adolescence; this relationship, however, has not been examined in the context of dietary patterns. This study investigated the relationship between risk perception for colorectal cancer (CRC) and dietary patterns among university students.*

Methods: *A cross-sectional study of 1056 university students was conducted collecting data on demographics, lifestyle, and dietary patterns were obtained using a structured paper-based questionnaire. Principle component analysis (PCA) was used to identify dietary patterns and logistic regression models were used to examine the relationship between perceived risk for CRC and dietary patterns adjusting for confounders.*

Results: *PCA analysis identified three main dietary patterns- westernized, prudent and dairy. The majority of participants (90%) perceived their risk for CRC as none/low. No significant differences were observed between dietary (western and prudent) patterns and risk perceptions ($p>0.05$). Higher consumptions of westernized diets were significantly associated with higher risk perceptions (OR= 1.13, $p=0.022$). Greater adherence to prudent (OR= 1.01, $p=0.94$) and dairy (OR=0.97, $p=0.642$) patterns didn't significantly influence risk perceptions for CRC.*

Conclusion: *Diets influenced highly on westernized patterns may increase one's subjective perception of risk for developing CRC in the future. Cancer prevention marketing strategies are needed at the university level in assisting to combat the rise of the incidence of cancer globally.*

Impact: Knowledge and awareness of risk factors for CRC may help aid in the development and design of age-specific public health messages to young adult populations.

Keywords: Colorectal Cancer; Perception; Dietary Patterns; University Students; Caribbean

Introduction

Risk perception of adverse health outcomes have been shown in several studies to promote an increase in health seeking behaviours in different multi ethnic and cultural environments [1-4]. Perceived risk is defined as the subjective belief about the probability or likelihood of harm, i.e. the probability that a health problem will be experienced if no precautions or behaviour changes occur [5-7]. Cognitive representation (causes, treatment and timeline) of various non-communicable diseases is a shared phenomenon among individuals that results in alterations in the health-locus-of-control beliefs and different propensities to seek regular medical check-ups [8].

Research has shown that people who perceive themselves at lower risk to developing preventable diseases are less likely to engage in health promoting behaviours [7, 9]. Many individuals rank themselves at being at no or lower than average risk for developing chronic non communicable diseases such as cancers. This belief may have a substantial influence on the action taken by individuals to engage in behaviours which would lower their risk for developing such a disease. Furthermore, this perception is strongly seen in younger populations as they are unaware or not very knowledgeable of risk of developing cancers; thus this has led to an ignorance to factors which increase one's risk for developing such a disease. This relationship was seen in a study by Weinstein and colleagues who reported that a higher majority of the study population perceived their risk for

developing cancer at lower than average risk [10]. It is therefore imperative to understand the determinants which influence this euphoric immunity to cancers in younger populations.

Cancer risk perception and associated confounding factors have been previously explored in several study settings focusing mainly on breast and colorectal cancer [9, 11-15]. In a population-based cross-sectional study in the United Kingdom, lower perceptions of risk for colorectal cancer were associated with male gender and older age, however higher risks were associated with lower ratings on perceived health status, family history of colorectal cancer, smoking and not exercising [13]. Similar findings were observed in Western and Asian populations which saw higher risk perceptions being associated with poor rating of health status and family history of colorectal cancer [16-18].

Colorectal cancer (CRC) remains a serious public health -problem/ concern, as it remains one of the most incidental and fatal non-gender specific cancers globally [19]. In the Caribbean, it is the third leading common cause of cancer occurrence and mortality and the leading cause of occurrence and mortality among non sex-specific cancers [20-22]. CRC seems to be partially driven by unhealthy lifestyle-related factors such as obesity, smoking, high consumptions of red and processed meat, and reduced intakes of dietary fiber. This has resulted in the development of substantial economic and social burdens on the health care systems in treating the disease. Additionally, the slow nature of the mortality associated with this condition results in individualized patient treatment for several years leading to exceptionally high costs associated with patient care. Regionally, Caribbean governments spend millions of state funds on the development of tertiary education with the primary focus on training prospective candidates to become the cornerstone of future economic development. Realization of this long-term investment in human capital necessitates that recipients remain in good health for approximately 2-3 decades. The novelty of tertiary education is often times associated with negative behaviours that induce poor lifestyle behaviours which places the investment made by Caribbean states in jeopardy.

A basic tenet of the health belief model suggests that perceptions of the level of risk may lead to the right motivation to actions which may reduce or eliminate their development. Knowledge, awareness and risk perception are crucial to amenable actions that may reduce risk factor development. Studies examining younger populations in the Caribbean and their perceptions of risk for colorectal cancer appear to be non-existent. Upon reviewing the existing body of literature on the link between perceived colorectal cancer, dietary patterns and lifestyle confounders, we found no study investigating these relationships. Furthermore, we found no study focusing on Caribbean populations or university students. The present study therefore investigated the relationship between risk perception of CRC and dietary patterns among students attending a tertiary education institution in the Caribbean.

Materials and Methods

Design and Procedure

The design for this study was cross-sectional in nature. Study participants were registered undergraduate and postgraduate students attending The University of the West Indies, St. Augustine Campus, and Trinidad. Students who were not attending or completed their course of the study at the university were excluded. It was assumed for this study that none of the participants had been screened for CRC in the past, as these screening services are not offered at the university level and are not easily accessible at public health-care facilities. Additionally, prior screening behaviour should not confound risk perceptions of study participants.

Data was collected from students from all faculties of the university (Food and Agriculture, Science and Technology, Social Sciences, Engineering, Humanities and Education, Medical Sciences and Law). Verbal and written consent was given from each participant before any information was gathered. A total of 1300 students were approached for this study. Data collection for this study was conducted between January to March 2013. Ethical approval was granted by the ethics review board of the faculty of Medical Sciences, the University of the West Indies, St. Augustine, and Trinidad.

Materials

A structured interviewer administered questionnaire was used to collect data from study participants. The questionnaire included sections such as demographics, lifestyle characteristics, knowledge of CRC risk factors, food frequency and auxiliary information (e.g. factors influencing purchasing behaviours, perception of current health status and body image perceptions).

Perceived CRC risk

The dependent variable for the analysis was perceived risk of CRC. Due to the fact that there is no gold standard measure for perception of risk for CRC we asked a single question "What do you think is your risk for developing colorectal cancer?" which included responses such as: "No risk", "Low risk" and "High risk". This was dichotomized for the analysis into No/Low Risk and High Risk [23].

Socio-demographic characteristics and family history of cancer

Gender, age, ethnicity and knowledge of someone who has/had colorectal cancer were assessed from the survey. Family history of cancer was assessed with the question "Do any member(s) of your family have/ had any of the following cancers?" Options were breast, prostate, colon, cervical, lung and not applicable.

Lifestyle characteristics

Lifestyle characteristics were assessed using smoking, alcohol consumption and physical activity. Smoking was determined based on responses given for the question "How long have you been smoking?" Options were never, <1 year, 1-5 years, >5 years. Alcohol consumption was determined from the question "How often do you drink alcoholic beverages?", with the following options: never, 1-4 drinks weekly, 1-2 drinks daily and more than 2 drinks daily. This was dichotomized into "consuming two or less drinks of alcohol daily" and "consuming more than two drinks of alcohol daily." Physical activity was assessed for both moderate and vigorous physical activity using metabolic equivalents which were calculated using a modified version of the IPAQ formula [24]. Moderate METS= 4.5 x number of days of self-reported moderate physical activity and Vigorous METS= 6.5 x number of days of self-reported vigorous physical activity.

Knowledge of CRC and its risk factors

Knowledge scores were assessed by the calculation of a score to determine the level of knowledge of CRC from three questions and agreement to impact of risk factors increasing the risk of CRC. The first question asked "How much do you know about colon cancer?"

a response of none was given a score of 0, very little was given a score of 1, fair amount was given a score of 2 and very much was given a score of 3. The second question asked "Which group of individuals do you think is at greatest risk for developing colon cancer?" the correct response which was "Both Male and Female" was given a score of 1; all other incorrect responses were given a score of 0. The third statement said "Vegetarians are at a lesser risk than non-vegetarian individuals of developing colon cancer." the correct response was "Disagree" which was given a score of 1 while all incorrect responses were given a score of 0.

To determine the student's knowledge level of the risk factors of colorectal cancer, a Likert-scale was utilized whereby 14 factors were given which could have been replied to and scored as: "strongly disagree", "disagree", "undecided", "agree" and "strongly agree". The responses for agree and strongly agree were combined and a response of either was given a score of 1. The responses for disagree, strongly disagree and undecided were combined and a response of either was given a score of 0. The overall knowledge score was computed by summing all scores. A percentage of the score was then computed for ease of interpretability.

Dietary intake

Usual dietary intakes were measured using a 23 item modified food frequency questionnaire adapted from the "Block Questionnaire" to include culturally relevant foods of the food environment specific to university students in the Caribbean [25-28]. For each food item each participant was asked to estimate the frequency with which they consumed the item as well as usual portion size as "1 serving", "2-3 servings" and "≥ 4 servings". Portion sizes for each item were described under each food item. Total dietary intake of each food item was calculated by multiplying the frequency of intake by the usual portion size. From the point of view of nutritional epidemiology, food items are rarely consumed in isolation, rather they are mostly consumed in several combinations at every meal representing different dietary patterns therefore to account for this explanatory factor analysis has been extensively used to derive a posteriori of these dietary patterns [29].

Data Analysis

Data were analysed using STATA 13.1 (Stata Corp, College Station, Texas). From the 1300 participants, only 1056 were used for the analysis as these individuals had complete data on dietary intake and perceived risk of CRC. Normality of continuous variables was assessed using the Shapiro-Wilks and Kolmogorov-Smirnov tests.

Dietary patterns were assessed using principal component analysis (PCA) - a data reduction technique commonly used in nutritional epidemiology to derive dietary patterns by aggregating food items into factors which represent the broad dietary patterns for the study population [30]. Rotation was done using orthogonal transformation (varimax rotation) to allow for greater interoperability of components. Retention of components was based on the following criteria: eigenvalues of ≥ 1.25, cattel's scree plot; individual variance explained by each component ≥ 5.0%; Horn's parallel analysis (see Figure 1); factor interpretability [1-4]. Factor loadings of ≥ 0.3 were used to identify food items closely correlated with the respective component (See table 1). Following this, three components were identified. For each pattern each participant received a factor score which was calculated as the sum of the food intakes from each food group by their factor loadings. Higher scores were indicative of a higher adherence to the respective dietary pattern.

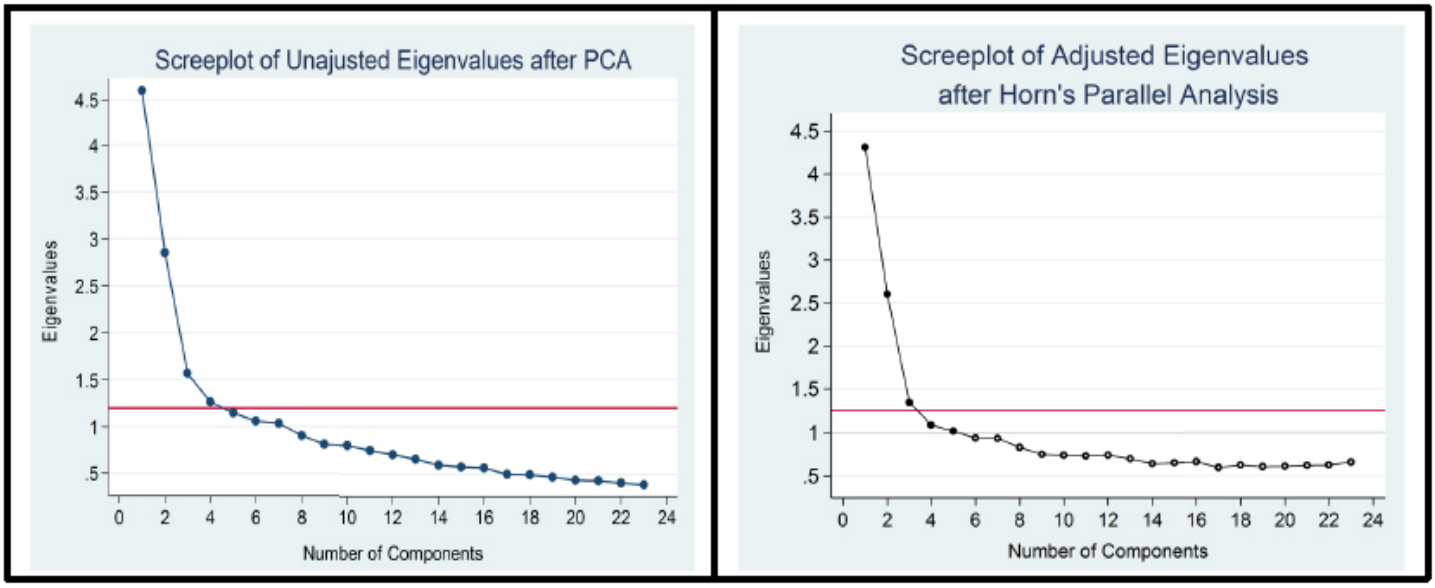

Figure 1: Screeplots of Unadjusted and Adjusted Eigenvalues of 23 components after Principle Component and Horn's Parallel Analysis
Note: y-axis reference line at eigenvalue 1.25

Table 1: Factor-loadings matrix for dietary patterns among university students

Foods	Westernized Pattern	Prudent Pattern	Dairy Pattern
Fruit Juice	0.099	0.279	-0.075
Fruits	0.071	**0.385**	-0.138
Green salad	-0.016	**0.436**	-0.114
Potatoes	0.231	0.152	0.108
Fiber cereals	0.016	0.267	0.021
Whole wheat bread/ crackers	-0.106	0.147	**0.305**
Legumes (peas or beans)	-0.049	**0.325**	0.158
Vegetables (raw/cooked)	-0.051	**0.462**	-0.005
Garlic/ Onions (raw/cooked)	-0.110	0.296	0.235
Fried chicken	**0.418**	-0.024	-0.028
Hamburgers	**0.447**	-0.016	-0.102
Beef/Pork	**0.363**	-0.036	0.028
Processed meat	0.265	-0.032	0.095
Salad dressing	0.138	0.090	0.059
Butter (bread /potatoes)	0.026	-0.085	**0.427**
Mayonnaise	0.062	-0.069	**0.328**
Butter/Oil in cooking	-0.080	-0.037	**0.481**
Eggs	0.147	0.128	0.126
Cheese	0.037	-0.013	**0.403**
Milk	0.155	0.134	0.030
French fries	**0.380**	0.016	0.014
Pastries/cookies/cakes	0.120	-0.013	0.225
Fried hot appetizers	**0.301**	-0.047	0.021

Data were described using means and medians for continuous variables and percentages for categorical variables. Mann Whitney U and chi-square analysis were conducted to determine differences of potential confounders across perceived CRC risk categories. Simple and multivariable logistic regression models were developed to determine associations between perceived CRC risk and dietary patterns adjusting for confounders (gender, age, knowing someone with CRC, family history of CRC, smoking, perceived health, knowledge score and physical activity). Significance was set at a two-sided p-value of <0.05 for all analyses.

Results

Dietary Patterns from Principle Component Analysis

Three distinctive dietary patterns were identified. These patterns described 39.2% of the total variance from the 23 food group items (see Table 1). Higher factor loadings to a given matrix of a given food group/item are representative of that food group to the given dietary pattern. The first component was labelled "Westernized Pattern" because of high consumptions of fried chicken, hamburgers, red meat, french fries and fried hot appetizers. The second was labelled "Prudent" because of high consumptions of fruits, green salad, peas and beans, cooked/raw vegetables and garlic/onions. The third component was labelled "Dairy Pattern" due to high loadings on cheese, margarine/butter on bread, mayonnaise, butter/oil in cooking, and whole wheat bread.

Associations between Socio-demographic Characteristics and Perceived risk

Overall, 9.9% of respondents perceived their risk of developing CRC as high compared to persons who perceived their risk as none/low (see Table 2). No significant differences for gender and knowing someone with CRC between CRC perception groups were observed; however there were significant age differences in persons older than 25 years with 16 % perceiving their risk as high compared with 8.9% in the younger age group. Knowing someone with CRC was not significantly associated with perceived risk.

Associations between Dietary, Lifestyle and Knowledge Characteristics and Perceived risk

Family History of CRC

Higher perceptions of risk were seen in participants who had a family history of CRC compared to their counterparts (see Table 2). Persons with no family history of CRC were seen to have lower risk perceptions with 90.8% compared to 82.4% in those with a family history of the disease.

Smoking and Physical Activity

Having a history of smoking tobacco and engaging in moderate physical activity were not associated with perceived risk. On the other hand, higher engagements of vigorous activity were seen to be significantly associated lower risk perceptions, as seen with a median METS of 6.5 compared to 0 among persons perceiving their risk for CRC as high.

Table 2: Demographic, lifestyle characteristics and dietary patterns on perceived risk of CRC

	Perceived risk		p-value
	No/Low Risk n= 943	**High Risk** n= 104	
Gender[a]			
Female	654 (89.5)	77 (10.5)	0.323
Male	289 (91.5)	27 (8.5)	
Age[a]			
<25 Years	824 (91.1)	81 (8.9)	0.007
≥25 Years	119 (83.8)	23 (16.2)	
Knowing someone with CRC[a]			
No	801 (90.7)	82 (9.3)	0.099
Yes	141 (86.5)	22 (13.5)	
Family History of CRC[a]			
No	882 (90.8)	89 (9.2)	0.019
yes	61 (82.4)	13 (17.6)	
Smoking[a]			
Non-smoker	815 (90.3)	88 (9.8)	
Smoker	127 (88.8)	16 (11.2)	0.592
Perceived Health[a]			
Excellent/ Very Good	220 (96.5)	8 (3.5)	<0.001
Good	402 (93.7)	27 (6.3)	
Fair/Poor/Very Poor	319 (82.2)	69 (17.8)	
METS Moderate PA[b]	9 (13.5)	9 (13.5)	0.114
METS Vigorous PA[b]	6.5 (19.5)	0 (13)	0.029
Percentage Knowledge Score[c]	54 9 ± 19.73	60.3 ± 19.0	0.003
Western Pattern[a]			
Tertile 1	312 (89.4)	37 (10.6)	0.605
Tertile 2	318 (91.4)	30 (8.6)	
Tertile 3	313 (89.4)	37 (10.6)	
Prudent Patterna			
Tertile 1	312 (88.9)	39 (11.1)	0.251
Tertile 2	321 (92.3)	27 (7.8)	
Tertile 3	310 (89.1)	38 (10.9)	
Dairy Patterna			
Tertile 1	324 (93.1)	24 (6.9)	0.015
Tertile 2	316 (90.5)	33 (9.5)	
Tertile 3	303 (86.6)	47 (13.4)	

Perceived health and knowledge: Higher knowledge scores for CRC and perceiving health negatively were significantly associated with higher perceptions of risk. Respondents perceiving their risk as high had an overall percentage knowledge score of 60% compared to 54.9% with respondents perceiving their risk as none/low. Seventeen percent (17%) of individuals rating their health as fair/poor/very poor were not optimistic of risk for CRC compared with 3% of individuals reporting their health as excellent/very good.

Dietary Patterns

Perception of risk was not significantly associated with neither westernized nor prudent dietary pattern tertiles but was associated with the dairy pattern. Thirteen percent (13%) of respondents with higher dietary consumption of dairy and whole wheat products perceived their risk as high compared to seven percent (7%) of persons with lower consumptions.

Logistic Regression

Simple logistic models were conducted to describe the association of each independent predictor on the outcome for comparisons in the multivariable logistic model (see Table 3). Contrary to the results from the $\chi 2$tests the simple logistic regression showed that the dairy pattern was not related to perceived risk. This relationship was also seen with the western and prudent dietary patterns. On

the other hand, being ≥ 25 years, having a family history of CRC, negative perceptions of health and higher knowledge scores were seen to have higher perceptions of CRC risk. Higher vigorous activity levels among respondents showed lower odds of higher risk perceptions. Multiple logistic regression was used to examine the predictive effects of dietary patterns on perception of CRC risk while adjusting for confounders (see Table 3). Adjusting for confounders showed marked differences in the associations for westernized dietary pattern, family history of CRC and METS for vigorous physical activity. Higher consumptions of the westernized dietary pattern were seen to significantly increase the odds of higher risk perceptions for CRC. Neither having a family history of CRC nor higher vigorous physical activity levels were significantly associated with CRC risk perceptions.

Table 3: Simple and Multiple Logistic Regression of independent predictors of perceived risk of CRC

	Single odds (95% CI)	p-value	Multiple odds (95% CI)	p-value
Western Pattern	1.08 (0.99, 1.18)	0.071	1.13 (1.02, 1.25)	0.022*
Prudent Pattern	0.97 (0.85, 1.10)	0.600	1.01 (0.86, 1.17)	0.940
Dairy Pattern	1.08 (0.99, 1.18)	0.097	0.97 (0.86, 1.10)	0.642
Gender				
Female	1.00 (Reference)	0.324	1.00 (Reference)	0.752
Male	0.79 (0.50, 1.26)		1.08 (0.67, 1.74)	
AGE				
<25 years	1.00 (Reference)	0.008**	1.00 (Reference)	0.003**
≥ 25 years	1.97 (1.19, 3.25)		2.25 (1.32, 3.84)	
Knowing someone with CRC				
No	1.00 (Reference)	0.101	1.00 (Reference)	0.395
Yes	1.52 (0.92, 2.52)		1.38 (0.65, 2.92)	
Family History of CRC				
No	1.00 (Reference)	0.022*	1.00 (Reference)	0.480
Yes	2.11 (1.11, 4.00)		1.43 (0.53, 3.81)	
Smoking				
Non-smoker	1.00 (Reference)	0.592	1.00 (Reference)	0.630
Smoker	1.16 (0.66, 2.05)		1.16 (0.64, 2.10)	
Perceived Health				
Excellent/ Very Good	1.00 (Reference)		1.00 (Reference)	
Good	1.84 (0.82, 4.14)	0.136	1.85 (0.83, 4.08)	0.131
Fair/Poor/Very Poor	5.95 (2.80, 12.62)	<0.001***	5.60 (2.67, 11.75)	<0.001***
Percentage Knowledge Score	1.02 (1.01, 1.03)	0.005**	1.02 (1.00, 1.03)	0.012*
METS Moderate PA	0.98 (0.95, 1.00)	0.061	0.99 (0.97, 1.03)	0.872
METS Vigorous PA	0.97 (0.95, 0.99)	0.008**	0.98 (0.96, 1.00)	0.118

CRC- Colorectal Cancer; CI- Confidence Intervals; METS- Metabolic Equivalents; PA- Physical Activity *p<0.05; **p<0.01; ***p<0.001

Discussion

The aim of this study was to investigate the relationship of dietary patterns on CRC risk perception among students attending a university in the Caribbean. Very few studies have examined the association between lifestyle characteristics and perception of risk for CRC and we are unaware of any study which has attempted to relate dietary patterns to risk perceptions. We identified three dietary patterns termed "westernized pattern", "prudent pattern" and "dairy pattern" in this Caribbean student population. Bivariable analyses suggested that students who had a family history of CRC had greater knowledge of CRC and its risk factors, poor subjective health perceptions, and viewed their risk of developing CRC as high compared to their counterparts. We found no associations between gender, smoking and knowing someone with CRC in relation to higher perceptions of risk.

In our multiple regression analysis we found that higher consumptions of westernized dietary patterns were related to higher risk perceptions among students, indicative of a dose-response relationship. Results for age, negative perceptions of subjective health, and knowledge of CRC and its risk factors were similar to those found in the bivariable analyses, giving some indication of independent contributions to perceived risk Previous studies in selected multi-ethnic populations have shown that higher consumptions of westernized dietary patterns increase the risk of colorectal cancer [27,31-33]. In our study we also found that the westernized dietary pattern was associated with increased risk perceptions of CRC. Similar results have been reported for other types of cancers such as prostate and breast [34-36]. The westernized dietary pattern has long been associated with an increased risk of developing both colon and rectal cancers. This may be due to the

high proportion of fat, heme iron, N-nitroso compounds, polycyclic aromatic hydrocarbons and heterocyclic amines found within foods characteristic of this dietary pattern [37, 38]. In a longitudinal study conducted by Nimptsch and colleagues focusing on the dietary patterns of women from high school to adulthood, it was found that higher consumptions of westernized dietary pattern during adolescence was associated with a higher risk of rectal cancer and not colon cancer later in adulthood [39]. Furthermore, in a population based study conducted in USA examining the relationship between eating patterns and risk of developing colon cancer, it was found that the westernized diet was linked with an increased risk of colon cancer between both males and females [40].

We hypothesized that the prudent pattern would be associated with lower risk perceptions, but there was no evidence of this from our analysis. This may be as a result of the low consumption of fruits and vegetables in this predominantly young student population which is a risk factor for the development of future chronic non-communicable diseases, a feature consistent with the growing global body of literature [41-43]. Studies conducted in larger populations showed that dietary patterns comprising of vegetables and other healthful food items were associated with a reduced risk of CRC colorectal cancer. Unfortunately, the low consumption of healthful food options may be attributed to limited financial resources of university students and their inability to purchase these items due to their cost.

Our study further supported previously published evidence that subjective health was associated with perceived risk thereby suggesting an apparent link with these health correlates and risk judgements [13,44,45]. Additionally, the lack of an association in the present study between risk taking lifestyle characteristics such as moderate physical activity, smoking and excessive alcohol intake was similar to previous studies [1,16,46]. Conversely, a study conducted by Al-Dubai and colleagues in a Malaysian population found an association between excessive alcohol intake and perceived susceptibility of CRC [16]. The lack of an association with smoking also differed from studies conducted previously in different ethnic populations [47,48]. In the current study, the lack of an association between risk taking behaviours and perceived risk may be attributed to the lack of an established temporal relationship which a cross-sectional design is unable to determine.

This study found a relationship between perceived risk and a family history of CRC which was consistent with previous studies [9,49,50], however after adjusting for confounders this relationship dissipated. This may have been as a result of a low proportion of persons reporting family histories of colorectal cancer Knowledge of CRC and its risk factors remains low as has been seen in multi-ethnic populations in many countries worldwide [51-54]. Our findings on the higher knowledge scores being associated with higher risk perceptions for colorectal cancer has remained consistent with the existing body of literature [55]. Conversely, in a study by Wong and colleagues examining the hypothesis that self-perceived risk of CRC was associated with better knowledge of risk factors for CRC found that higher knowledge scores of CRC were associated with lower self-perceived risk perceptions for CRC [56].

To our knowledge this is the first study which has explored the domain of the relationship between diet and perception of risk in the Caribbean and Latin-American region. Furthermore, only a limited amount of studies have explored the perceptions of risk among younger populations such as university students. The present body of empirical published research on cancer risk communication and perception in the Caribbean region remains small or non-existent.

There are limitations which should be considered in interpreting the results presented in this study. Dietary intake, lifestyle characteristics and family history of cancer were self-reported and are subject to substantial recall bias. The dietary intake only included 23 food items with several food items being grouped thereby the true intakes of participants may have been underrepresented. However, we were reluctant to burden participants with a larger food frequency due to inconveniences with respondent burden and recall bias. Additionally, diets vary from island to island in the Caribbean, therefore the relationship seen between the westernized pattern and perceived risk may differ in islands with higher reliance on vegetables and ground staples that may be indicative of that country's traditional diet. Perception of risk was only determined by one question which was not expansive enough to tease out the actual perception of risk among participants. The cross-sectional design of this study was unable to establish a causal relationship between the perceived risk and dietary behaviours. The size of the sample may not be representative enough to make conclusions for the Caribbean region. The study population of university students is not entirely representative of young adults; therefore perception of risk for colorectal cancer may differ among different sub-groups in the general population.

Conclusion

Although there were limitations to the present study, it still remains one of few studies which have examined the relationship between dietary patterns and perceived risk for CRC using rigorous methods such as principal component analysis. Our findings suggest that higher consumptions of foods within a westernized dietary pattern may increase one's subjective perception of their own risk for developing CRC. However this relationship was not seen for other patterns such as prudent or dairy dietary patterns. Further studies are needed in different Caribbean states targeting young adult populations using rigorous causal research designs to explore these relationships in further detail. Our findings support the need for greater marketing strategies and public health programs targeting colorectal cancer and its risk factors to younger populations at the university level and beyond. There is a substantial need for aggressive cancer prevention marketing in the Caribbean region where health messages are based on both published prospective data and cross-sectional data to improve these negative perceptions of susceptibility and lifestyle behaviours.

Disclosure of Potential Conflicts of Interest.

No potential conflicts of interests were disclosed.

Authors' Contributions

Conception and design: KD Rocke, SD Nichols
Development of Methodology: KD Rocke, SD Nichols
Acquisition of data (Collected data from questionnaires): KD Rocke
Analysis and interpretation of data (e.g. statistical analysis): KD Rocke
Writing review, and/or revision of the manuscript: KD Rocke, SD Nichols, NO Dalrymple, AN Ramcharitar-Bourne
Study Supervision: SD Nichols

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