Prospective Analysis of Dietary Risk Factors Involved in the Occurrence of Irritable Bowel Sydrome among Students in Ivory Coast

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Abstract	Original Research Article

This is a prospective cross-sectional study, with a descriptive and analytical aim, with the main objective of analyzing the dietary risk factors involved in the occurrence of irritable bowel syndrome among students in Côte d'Ivoire. This investigation follows the work of Amoikon *et al.,* (2016) who revealed among students an unbalanced, unstructured and poorly hydrated diet with a high prevalence of abdominal irritation syndrome. Thus, a new food and health consumption survey was carried out from October 15, 2016 to February 17, 2017, in a population of 1,228 student volunteers, with an average age of 22.5 years, dominated by males. It revealed a high prevalence of intestinal irritation syndrome (47.7%) and dietary imbalance. After analyzing the relationship between eating habits and pathology, it turned out that high consumption of red meat, soft drinks, non-alcoholic exciting products, spicy products and low water consumption were the factors risk of the occurrence of the pathology among the respondents. To this end, it would be important to carry out nutritional education sessions on university campuses across the country, with a view to improving their eating habits, their food security and their health conditions.
Keywords: Students, eating habits, irritable bowel syndrome.

INTRODUCTION

Irritable bowel syndrome is a very common digestive pathology in Africa, as in the rest of the world. It is a chronic disease related to changes in the motility and sensitivity of the intestine which results in a set of symptoms, the main ones of which are the triad: constipation, abdominal pain and diarrhea (Tzeuton, 2000). In Ivory Coast, the symptomatic tables are richer, with descriptions so graphic that the practitioner can be disoriented. In addition, traditional and ancestral beliefs, sorcerers, healers, fetishists, and self-medication considerably complicate the care of these patients (N'dri *et al.,* 2010). Inconvenient, the syndrome is frequently encountered among young people and eating habits occupy an important place among the risk factors (Talley, 2006) (Sabaté, 2013), (Dupont, 2007). Furthermore, a nutritional epidemiological study carried out in 2016 among students at Felix Houphouët Boigny University in Cocody, revealed a significant prevalence of signs linked to intestinal irritation (Constipation, Diarrhea, colic) (Amoikon *et al.,* 2016) and an unbalanced diet. In view of this situation, it would be important to research the dietary reasons specific to this population, with a view to proposing appropriate and adapted solutions. It is in this context that a new nutritional epidemiological survey was carried out on the same population, in order to describe eating habits, analyze them and determine those which constitute risk factors in the occurrence of intestinal irritation syndromes in the students.

MATERIALS AND METHODS OF THE STUDY

I. MATERIAL

1. Framework of the study

The study was carried out in West Africa, in Ivory Coast precisely at the Félix Houphouët Boigny University of Cocody in Abidjan. It was carried out from October 15, 2016 to February 17, 2017 with student volunteers. It follows the work of Amoikon *et al.*, (2016) and N'guessan *et al.*, (2024) whom found a significant prevalence of the pathology in an Ivorian student population dominated by a poorly structured and poorly balanced diet. This work noted that the students had a

diet including the seven food groups, namely: milk and dairy products (families 1), meat, fish and eggs (families 2), fats (families 3), cereals, starchy foods, sweet products (families 4), fruits and vegetables (families 5 and 6) and drinks (families 7). All these foods have been classified by category. These categories have been established on the basis of food groups and the different ingredients used in the preparation of meals. These are cereals and derived products, tubers and derived products, protein-oil crops and vegetable fats, fruits and vegetables and derived products, dairy products/foods containing eggs/sweet products and derived products, white meat/fish and derived products, red meat /animal fat and derived products, beverages, alcoholic exciting products, non-alcoholic exciting products, spicy foods, flavor enhancing products and water.

2. Study population (inclusion and non-inclusion criteria)

A total of 1228 male and female students volunteered to participate in the study. Any student enrolled in the second year of Chemistry Biology Geology (CBG) at Félix Houphouët-Boigny University who wished to participate in the study was included in this study. They were not included in the study, all other people whom did not respect the conditions raised.

3. Data collection tools

The survey data was collected using a questionnaire designed for this purpose and validated by a pre-survey of 45 students from the Agrhymet Regional Center of NIAMEY (NIGER). It is structured in three parts: (i) the first part traced the socio-demographic characteristics of the study population (ii) the second revealed the medical histories regularly experienced by the patients over a period of one year, while (iii) the third part was reserved for eating habits (Frequency of food consumption).

II. METHODS
1. Type of study

This is a prospective cross-sectional study with a descriptive and analytical aim based on a food consumption survey associated with a nutritional and health assessment.

2. Diagnostic of irritable bowel syndrome

The diagnosis of irritable bowel syndrome is based on clinical analysis and it is a diagnosis of elimination. Indeed, we based our investigation on a diagnosis of elimination with a clinical examination consisting of questioning and abdominal palpation. Our diagnosis was based on at least two of these following criteria for at least 3 months (not necessarily consecutive) over a year. They are:
- Abdominal pain relieved by defecation,
- Change in usual consistency of stools at the start of painful periods,
- Change in the usual frequency of stools at the start of painful periods.

Objective bloating, a feeling of incomplete evacuation or pushing efforts strengthened the diagnostic criteria.

3. Statistical Analysis
- **Quantification of the frequency of food consumption:**

Food consumption is categorized based on the methods used by Amoikon *et al.,* (2016) and Kouakou Ossei (2010). Indeed, food consumption was evaluated by the food consumption frequency method and by the retrospective study of eating behavior, readjusted over one week.
- ✓ When the consumption of a food is less than once to once a week, it is considered low.
- ✓ When consumption is 2 times a week, it is considered medium.
- ✓ When consumption is 3 to 4 times per week, it is considered high.
- ✓ When consumption is 5 to 7 times per week, it is considered very high.

- **Quantification of the frequency of water consumption:**

When water consumption is less than one liter outside of meals per day, it is considered low.

When water consumption is 1 to less than 1.5 liters outside of meals per day, the consumption is considered average.

4. Processing of qualitative and quantitative data.

Quantitative and qualitative data were collected. The analysis was done with SPSS 20.0 software. For quantitative variables, the mean, standard deviation, and extreme values were highlighted. At the level of qualitative variables, the distribution and comparison of proportions was retained. The relationship between food habit and the pathology has been searched by the Chi square test.

5. Ethical aspects

With regard to ethical considerations, the volunteers were informed of all stages before the start of the investigation and were interviewed or examined after free and informed consent. Confidentiality was assured by assigning an anonymity number to each survey sheet. This study was approved by the Felix Houphouët Boigny University of Côte d'Ivoire and the ethical principles of the Declaration of Helsinki were respected.

RESULTS AND DISCUSSION
I. RESULTS
1. SOCIO-DEMOGRAPHIC CHARACTERISTICS

In terms of sociodemographic criteria, three parameters were analyzed, namely ethnic group, age and gender. Regarding the ethnic group, the Akans are the most represented with a number of 621 people, the Krous, the Northern Mandé and the Gour are respectively 161, 109 and 182 and the foreigners are the

least represented with a workforce of 31 people (Figure 1). Regarding the age of the respondents, the age of the population was subdivided into 3 groups. Thus, respondents aged 17 to 19 years old are 20% and those aged 20 to 24 years old and 25 and over are respectively 77% and 3% (Figure 2). And in this population, 74% are men compared to 26% women (Figure 3).
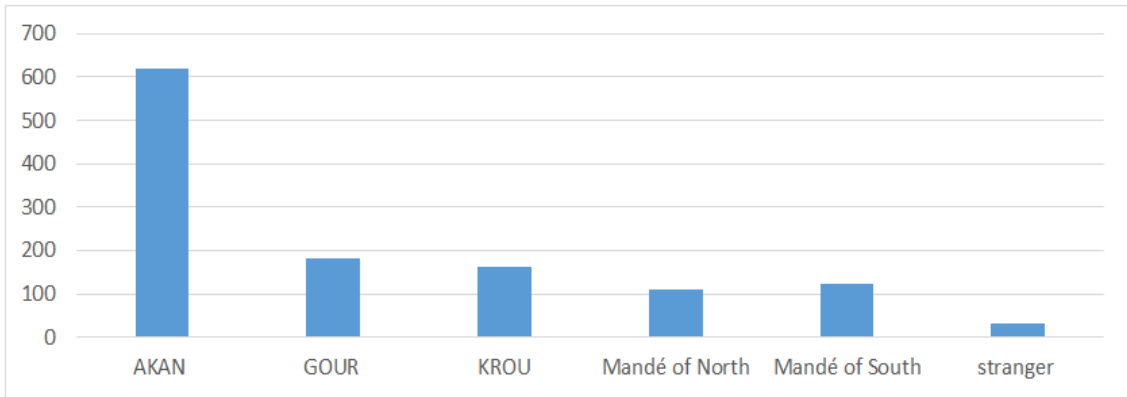
a. Ethnic group

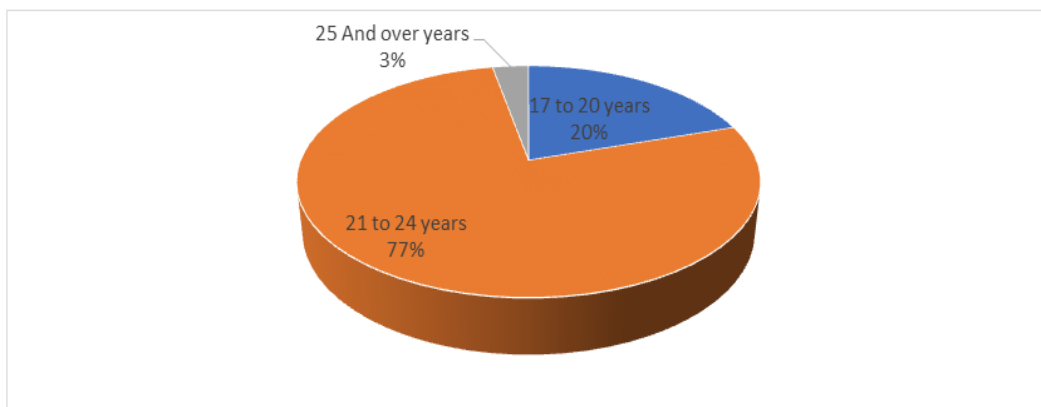**Figure 1: Distribution of respondents according to ethnic group**

b. Age of respondents

Figure 2: Distribution of respondents by age
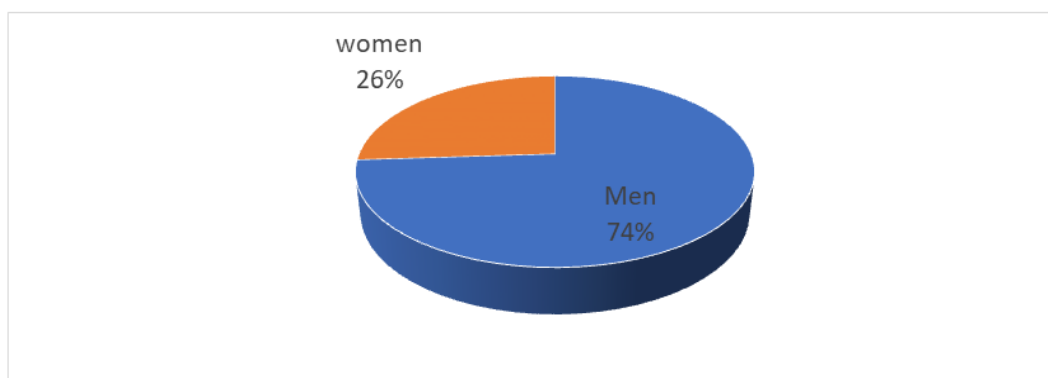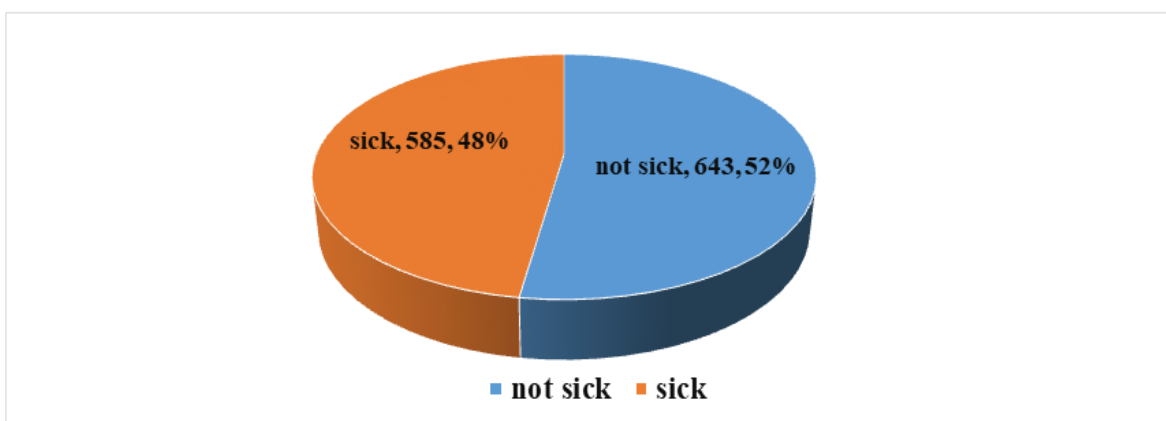
c. Sex of Respondents

Figure 3: Distribution of respondents by gender

2. PREVALENCE OF BOWEL IRRITATION SYNDROME IN THE POPULATION

The health assessment in the study population revealed a prevalence of 47.70% of intestinal irritation syndrome in the study population.

3. Eating habits and occurrence of irritable bowel syndrome

The analysis of the relationship between eating habits and the occurrence of irritable bowel in the study population revealed the implication of the high consumption of certain food categories such as red meat/animal fat, carbonated drinks, non-alcoholic exciting products, spicy products and low water consumption. No relationship between the level of consumption of the following foods: sweet foods, foods containing eggs or milk, fish, white meat, consumption of vegetable fat, starchy foods, cereals, flavor enhancing products, and alcoholic products.

Table I: The relationship between the level of consumption of red meat/animal fat and the occurrence of irritable bowel syndrome

Irritable bowel syndrome	Consumption frequency N (%)				Total	P value
	Low	Medium	High	Very high		
No sick	167ₐ 47 ,4%	103 60,2%	197_b 54,6%	176_c 51,2%	643 52,4%	P = 0,036
Sick	185ₐ 52 ,6%	68 39,8%	164_b 45,4%	168 48,8 %	585 47,6%	
TOTAL	352 100,0%	171 100,0%	361 100,0%	344 100,0%	1228 100,0%	

N = 1228

Table II: The relationship between the level of soft drink consumption and the occurrence of irritable bowel syndrome

Irritable bowel syndrome	Consumption frequency N (%)				Total	P value
	Low	Medium	High	Very high		
No sick	316ₐ 49,7%	91 57,6%	206_b 55,7%	30_c 46,9%	643 52,4%	P = 0,019
Sick	320ₐ 50,3%	67 42,4%	164_b 44,3%	34 53,1 %	585 47,6%	
TOTAL	636 100%	158 100,0%	370 100,0%	64 100,0%	1228 100,0%	

N=1228

Table III: The relationship between the level of spice consumption and the occurrence of irritable bowel syndrome

Irritable bowel syndrome	Consumption frequency N (%)				Total	P value
	Low	Medium	High	Very high		
No sick	78ₐ 55,7%	46 60,5%	165_b 51,6%	354_c 51,2%	643 52,4%	P= 0,021
Sick	62ₐ 44,3%	30 39,5%	155_b 48,4%	338 48,8 %	585 47,6%	
TOTAL	140 100,0%	76 100,0%	320 100,0%	692 100,0%	1228 100,0%	

N=1228

Table IV: The relationship between the level of consumption of non-alcoholic exciting products and the occurrence of irritable bowel syndrome

Irritable bowel syndrome	Consumption frequency N (%)				Total	P value
	Low	Medium	High	Very high		
No sick	287$_a$ 49,2%	83 48,3%	130 57,5%	143$_c$ 57,9%	643 52,4%	P= 0,007
Sick	296$_a$ 50,8%	89 51,7%	96$_b$ 42,5%	104 42,1 %	585 47,6%	
TOTAL	583 100,0%	172 100,0%	226 100,0%	247 100,0%	1228 100,0%	

N=1228

Table V: The relationship between the level of water consumption and the occurrence of irritable bowel syndrome

Irritable bowel syndrome	Consumption frequency N (%)				Total	P value
	Low	Medium	High	Very high		
No sick	158$_a$ 47,0%	430 54,2%	50 53,8%	5$_c$ 83,3%	643 52,4%	P= 0,015
Sick	178$_a$ 53,0%	363 45,8%	43$_b$ 46,2%	1 16,7 %	585 47,6%	
TOTAL	336 100,0%	793 100,0%	93 100,0%	6 100,0%	1228 100,0%	

N=1228

III. DISCUSSION

During this study the predominant ethnic group was that of the Koua Akan with 51% of respondents. This could be explained by the geographical location of the Félix Houphouët Boigny University in Abidjan, which is more accessible to this ethnic group, especially because the bioscience's specialty is found in other universities in the country located precisely in the North and the West-center. These results are comparable to those of Amoikon *et al.,* in 2016 (Amoikon, 2016).

The study population was young with an average age of 22.5 years and dominated by men with a sex ratio of 2.84 in favor of men. This could be explained by the fact that in Ivory Coast the level of education of young boys is higher than that of young girls (INS, 2015).

The health status assessment was carried out and a prevalence of 47.6% of irritable bowel syndrome was found. This trend is superimposable to the result of Amoikon *et al.,* (2016) who found 48.21% in the same population.

According to N'guessan *et al.,* (2024) and the work of Amoikon *et al.,* (2016), the eating habits of students are dominated by cereals, tubers, sweet foods, soft drinks, flavor enhancing products, dairy, products containing eggs and sweetened with a low consumption of fruit and vegetables and water. This diet is unbalanced, unstructured (snacking), little varied and poorly hydrated with a predominance of foods low in fiber, slow digestion and a high consumption of foods that can lead to food allergies (Dukan, 2011). This eating behavior is not without consequences for health. Indeed, the analysis of the relationship between eating habits and the occurrence of irritable bowel in the study population revealed the involvement of high consumption of red meat/animal fat, soft drinks, exciting non-alcoholic products, spicy products and low water consumption in the occurrence of irritable bowel syndrome.

Regarding red meat and animal fat, this is justified by their difficulty in being digested by certain people (Dukan, 2011). Indeed, frequent consumption of red meat and animal fat are factors most associated with constipation worldwide. This could be justified by the fact that these foods are difficult to digest (foods low in fiber and high in lipids) (Dukan, 2011). This slow digestibility then leads to a slow progression of the food bolus and a long stay of food in the digestive tract, capable of leading to bouts of constipation in the event of heavy consumption (more than three times according to this study). Furthermore, this slow digestibility of the food bolus and its long digestive stay could lead to a proliferation of pathogenic intestinal germs and inflammation of the loops associated with colic (Talley, 2006) (Martinet, 2009).

Concerning soft drinks, they generally contain acidic substances such as citric acid, malic acid, sodium citrate, phosphoric acid, atric acid, ascorbic acid a significant quantity of carbon dioxide (Dukan, 2011) (Hannifin, 2011). These substances are used as preservatives or flavor enhancers in soft drinks. Unfortunately, at high consumption they could lead to inflammation reactions of the digestive tract and chronic flatulence recognized for their implications in the occurrence of abdominal pain and irritation of the colon (Orr, 2010). Also carbonated drinks are involved in the occurrence of gastritis and constipation which are strongly associated with irritation of the loops (Nilsson, 2006) (Shaheen, 2006) (Traoré, 2008).

In terms of spicy products, and non-alcoholic exciting products, they are foods with great inflammatory and allergenic power on the digestive tract according to Nancey, (2005), Talley (2006), Dukan (2011) and (Hordé, 2014). Food allergies, in fact, are immune reactions of intolerance of the body to the ingestion of a food that is usually well tolerated by the majority. In the event of prolonged exposure to causal dietary factors in sensitive subjects, these chronic inflammatory immune reactions promote either a reduction in the intensity of intestinal peristalsis which can lead to constipation or an acceleration of transit leading to the occurrence of diarrhea; two signs whose alternation is strongly associated with colon irritation syndrome (Nancey, 2005) (Sabaté, 2013) (hordé, 2014).

In terms of water, fruits and vegetables, it has been observed that more we have lower level of consumption, we observe an increasing of the frequency of the pathology in population. It can be explained by the fact that fruits and vegetables are very rich in water and fibers. They have been recognized for several centuries as food-medicines for constipation (Dukan, 2011). Furthermore, consuming more than one and a half liters of water per day is the best way to fight against colopathy (Dukan, 2011). In fact, these foods reduce digestive inflammation, soften stools, increase volume of stools and facilitate the elimination of the faecal bolus.

No relationship between the level of consumption of the following foods and the occurrence of irritable bowel syndrome has been reported. They are sweet foods, foods containing eggs or milk, fish, white meat, vegetable fat, starchy foods, cereals, flavor enhancers, and alcoholic products. This could be justified by their low aggressiveness for the bowel or because of their low level of consumption in the population.

CONCLUSION

Eating habits, when not rationalized, weaken the body and expose it to often chronic and serious illnesses. This study revealed a relationship between high consumption of red meat, soft drinks non-alcoholic exciting products, spicy products and low water consumption and the occurrence of irritable bowel syndrome. In view of these results, it would be wise to raise awareness about the rationalization of the consumption of different causal foods according to personal sensitivity and seasonal availability, so as to obtain a balance and food security, capable of ensuring lasting digestive homeostasis in the student's population.

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