

Review Article

Colorectal Carcinoma: Why Is There a Lower Incidence in Nigerians When Compared to Caucasians?

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Carcinoma of the colon and rectum is the 2nd commonest cancer in the United States; the leading cancer being lung cancer. It has been estimated that 130,200 new cases of colorectal cancer will be diagnosed annually while 56,300 sufferers will die from the disease (Murphy et al., 2000). In developing countries especially West Africa, the rate has not yet reached such magnitude. This suggests that there may be factors either anthropomorphic or environmental which may be responsible for this. The paper acknowledges the reduced incidence of colorectal cancer in native West Africans living in Africa and endeavours to highlight the various factors that produce this observation in medical literature. A diligent search through available literature on the aetiology, epidemiology and comparative anthropology of colorectal cancer was done. Internet search using Pubmed, British library online and Google scholar was also utilized. The rarity of adenomatous polyposis syndromes in the native West African contributes to the reduced incidence of colorectal cancer. Cancer prevention and cancer-protective factors are deemed to lie in the starchy, high-fiber, spicy, peppery foodstuff low in animal protein which many West African nations consume.

1. Introduction

For over 40 years, colorectal cancer incidence has reportedly been lower in West Africans than in Caucasians [2–6]. The prevalence of colorectal cancer in Caucasian countries has been linked to hereditary/genetic predispositions and environmental influences like life-style patterns and diet.

The adenoma-carcinoma sequence has been suggested to be the final pathway of these links mentioned above. In West Africa, the rarity of these colonic adenomata has led to the consideration of a different mechanism by which colorectal carcinoma develops [6–8]. This paper intends to review literature that may have relevance to the possible reason for the low incidence of colorectal carcinoma in the native West African.

2. Discussion

Colorectal carcinoma in Nigeria, the most populous nation in West Africa with 155 million inhabitants [9], seems to be increasing in incidence. The time trends in common cancers

in men from the Ibadan cancer registry in Nigeria show that, four decades ago (1960–1969), the top five cancers in men did not include colorectal cancer. But, by the last decade, carcinoma of the colon and rectum moved from the tenth to the fourth position [10].

However, studies that have been published from various centres in the country show that the number of patients seen per year with colorectal cancer in each centre ranges from about 6 to 25 [11–18]. Each of these centres is a teaching hospital or tertiary health facility that serves populations of about one million to 1.5 million people. In a westernized country like Australia, up to 317 new cases of either colon or rectal cancers are reportedly seen yearly [19]. Incidence rates in Nigeria are put at 3.4 cases per 100,000 compared with 35.8 cases per 100,000 each year in the state of Connecticut, USA [20]. A recent study from Ibadan, Nigeria showed the average annual incidence of colorectal cancer was 27 patients per year [21]. This shows that even if it seems that incidence rates are increasing in Nigeria, such rates are still about one-tenth of what is seen in the truly developed countries. This situation seems to prevail in developing countries, especially

in Africa, and it has been shown in South Africa that, in spite of the long-established Caucasian-like dietary habits in urbanized South African blacks living in the Witwatersrand, they still have a much lower incidence of colorectal cancer than South African whites [22]. The mean age of the South African blacks studied was 54.3 years. The crude incidence of bowel cancer in the South African blacks living in the Witwatersrand was assessed as less than one-tenth of the whites living in the same location (3.5/100,000/year in blacks to 41/100,000/year for whites) despite 3 to 4 generations of “westernization” of the blacks. The authors were unable to find a reportable reason for this difference [22]. These Caucasian-like diets include grilled meats like steaks, deep-fried chicken, and burger meats which are served in ever-growing and popular western fast-food establishments. In a bid to find reasons and explanations for this observed rarity of colon and rectal cancer in West Africans generally and Nigerians specifically, this review will concentrate on the following areas.

2.1. Colonic Adenomatous Polyps. Only four cases of adenomatous polyposis have been reported in Nigeria in the last 35 years [7, 23–25], and two cases of hereditary nonpolyposis colon cancer have been reported within the last 15 years [26]. This relative absence of premalignant conditions like adenomatous polyps in the West African has been reported by several authors [8, 12, 21, 27, 28]. This lack of a detectable adenoma-carcinoma sequence in Africans may indicate a different aetiopathogenesis of colorectal cancer. In addition, the relatively younger age at which Africans develop this disease has also been said to be against the adenoma-carcinoma link [13, 21, 29, 30]. The mean age of patients with colorectal cancer in Ibadan was 41 years in a study by Irabor et al. [21], and studies have shown that the age when colonic polyps start to develop is in the late 1940s to subsequently undergo malignant change 15–20 years after [8, 20]. The incidence of colorectal cancer in Nigeria has been estimated to be 3.4/100,000/year [20]. In the United Kingdom, comparing the incidence rates for the age of 50 and below, it was found that for those between 40–44 years it was 12/100,000/year and 24/100,000/year for ages 45–49 [31]. This shows that, even though Nigerians have an average life span of 49 years, the incidence of CRC is still less than their Caucasian counterparts when comparable age groups are scrutinized. Nevertheless, one can only speculate whether Nigerians would eventually develop adenomatous polyps or have comparable incidence rates of CRC if the life expectancy increases to seventy or eighty years.

2.2. Diet. This is one area that has been extensively researched in the epidemiology of colorectal carcinoma. Appreciation of the environmental dependence of bowel cancer was noticed from migration studies as one can see the contrast between American blacks, who now have an incidence comparable to Caucasians, and that of native Africans. This is because these migrants have adopted the dietary customs of their new country [8]. Indeed, the idea that colon cancer is linked to diet is usually credited to Dennis

Burkitt who reported that colorectal cancer was rare among rural Africans. This, he suggested, was because Africans had little meat in their diet and instead ate a lot of fibre from fruits, grains, and vegetables [8]. Colonic adenocarcinoma is the 3rd commonest malignant neoplasm in societies with western type lifestyle as diet rich in red meat and fat, lacking in vegetables, fruit, and fibre is implicated in colonic carcinogenesis [3, 4, 8]. It is without doubt that countries that consume a lot of meat and animal fat have the highest rates of colon cancer, and this inversely correlates with the consumption of dietary fiber [32–34]. The protection that fibre offers has been shown to be dependent on the type of fibre consumed as many studies have found no protective effect of cereals type fibre and have consistently found a protective effect of vegetable and fruit fiber [34–38]. The typical West African diet consists of a carbohydrate-based bolus type of meal which cannot be consumed alone but with soup that is usually vegetable based. In very rural and poor communities, meat is hardly eaten and fleshy fruits may be the lunch or dinner of many. Another problem concerning meat intake is the mode of preparation or cooking of the meat. Meat cooked at high temperatures contains a class of carcinogens called heterocyclic amines (HCAs) [38–40]. These are produced when meat is heated above 180°C for long periods, and these HCAs have consistently been identified in well-done meat products from the North American diet [40, 41]. The poor electricity supply in most rural and urban areas in this country (Nigeria) does not allow proper refrigeration of meat, thus many households deep-fry meat for preservation and consumption. Meat grilled or barbecued contains the highest amount of polycyclic aromatic hydrocarbons (PAHs) because of the exposure to smoke formed from the pyrolysis of fatty juices that drip down onto the heat source [40]. Maybe this may have a role to play in some of the colon cancers seen in these parts. Indeed, some authors have alluded to the carcinogenic properties of charcoal-roasted meat called “suya” in Nigeria [42, 43]. However, meat intake forms a small part of the Nigerian diet, consequently exposure to PAHs and HCAs is likely to be minimal and not in the magnitude at which Caucasians are exposed to these carcinogens.

The carbohydrate-based diet of Nigerians had been mentioned earlier, and this has been shown to be protective against the development of colon cancer. The human colonic bacteria ferment starch and nonstarch polysaccharides to short-chain fatty acids, mainly acetate, propionate, and butyrate [44]. Butyrate has been found to be a preferred substrate for colonocytes and appears to promote a normal phenotype in these cells [44, 45]. Resistant starch fermentation favours butyrate production and may be more protective against colorectal cancer than nonstarch polysaccharides which are the major components of dietary fiber [44–48]. Also the resistant starch from maize has been shown experimentally to produce more “colon-friendly” butyrate than that of potato starch [45]. Cassava may also, by a different mechanism, be protective against cancer because it contains a chemical called tamarin which is responsible for the production of hydrocyanide. This tamarin has been shown in vitro to cause death of cancer cells by self-toxicity with

hydrocyanide [49]. The Nigerian diet favours a variety of maize- and cassava-based bolus meals.

2.3. Spices and Phytonutrients. Epidemiological data supports the fact that the lowest incidence rates of colorectal cancer are found in India, Asia, and Africa [50–53]. These are also the places where foods are hot and spicy. The typical Nigerian stews are hot and spicy with a base of ground tomatoes, red chilli peppers, and onions (in various proportions depending on the individual or community preference) which are then cooked in palm oil or vegetable oil till everything blends. This has led to a closer look at these phytonutrients as they are now called and their mode of protection against colorectal cancer. Turmeric (curcumin), which is an ingredient in Indian curry, has anticancer properties [54–57]. Curcumin is diferuloylmethane, and it targets multiple signalling pathways that may protect the colon by decreasing the activity of beta-glucuronidase and mucinase [54, 55]. Other anticancer properties of curcumin include inhibition of lipoxygenase activity, specific inhibition of cyclooxygenase 2 expression, and the promotion/progression stages of carcinogenesis [55, 56].

Garlic and onions, which contain diallyl sulphide, were found to suppress cell division in human colon tumor cells [57]. Onions have an additional anticancer property as a result of their high antioxidant property (due to their wide content of flavonoids) [58], and they are much more widely used in Nigeria than garlic; indeed, raw onions are commonly eaten with charcoal-roasted meat called “suya.” All stews and soups cooked in Nigeria have onions as essential ingredients. Curcumin which is in Indian curry is also widely used in cooking in Nigeria but not as much as Indian cooking. Red pepper which is used widely in Nigerian cooking has been shown to protect against colorectal carcinoma [59, 60]. The main ingredient of red chili pepper is capsaicin, and this is known to cause death of colon cancer cells [60].

2.4. Body Weight/Size and Physical Activity. Increased caloric intake and reduced physical activity seems to be the sign of improved economic development and civilization, and this leads to obesity which is a common ailment in the United States [61]. Many studies have shown a link between an increase in body size and colorectal cancer [61–65]. Those who indulge in a lot of physical activity have a lower chance of developing colorectal cancer [61, 63]. In the developing countries, the level of poverty precludes the luxury of overindulgence in food and ensures continuous physical activity either from farming, manual labour, or self-employment. For in the developing countries, one starves if one does not work. Ironically, this has now been seen to reduce the chance of developing colorectal cancer because obesity and lack of physical activity are not as common in West Africans in general and Nigerians in particular when compared to the population of the United States [63].

2.5. Malabsorption/Lactose Intolerance. Lactose intolerance is seen more in the African race than in Caucasians. Interestingly, the malabsorption that this causes has now been

hypothesized to be a protective factor against the development of colorectal cancer [66]. This “protective factor” stems from the fact that malabsorption increases the concentration of fermentable substances reaching the colon and shortens the intestinal transit time [67]. The maintenance of a normal phenotype in colon cells is said to be influenced by short-chain fatty acids, especially butyrate, which are formed in the colon from fermentation of carbohydrates, especially resistant starch [44, 45]. Supporting this is the fact that short-chain fatty acid production is significantly higher in native Africans than in Caucasians [68]. Asians and Africans, as earlier mentioned, have the lowest incidences of colorectal cancer worldwide, and reports have shown that 90% of Asians and Africans are said to lack the lactase enzyme [66]. In terms of the history of dairying in Africa, it was determined that Nigeria straddles the boundary between the traditional zones of milking and nonmilking. The Fulanis, mainly cattle rearers, who lived in the north were milk users and were found to be lactose absorbers in contrast to the Yorubas in southern Nigeria who lived in a nonmilking zone and were predominantly lactose intolerant. The prevalence of lactose intolerance has been estimated at 52% for the Fulani, 85.9% for the Yoruba and Ibo, and 76% for the Hausa in Nigeria [69, 70]. Majority of South African blacks are lactose intolerant irrespective of tribe of origin, and this is attributed to origination and migration of South African blacks from the west and central African zone of nonmilking [70].

2.6. Sunlight and Vitamin D. West Africa is blessed with sunlight all year round. Sunlight is important in the peripheral manufacture of vitamin D in the human body. Vitamin D and calcium have been shown to be protective against colorectal cancer [71, 72]. Countries that receive the highest amount of sunshine annually include those in West and North Africa, the Middle East, and Pakistan [73], and these are the places that have very low incidences of colorectal cancer [52, 53, 74]. Thus, geographical serendipity also plays a part in the provision of factors that keep the incidence of colorectal cancer low in West Africans.

To conclude, one may infer that the explanation why the incidence of colorectal cancer in West Africans as a whole and in Nigerians specifically remains low is rooted in (a) the rarity of adenomatous polyposis syndromes, (b) the protective effects of our starch-based, vegetable-based, fruit-based, and spicy, peppery diet, and (c) our geographical location which ensures sunshine all year round.

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