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The Carnivore Diet and Gut Health: Mechanisms, Benefits and Risks

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Abstract

Introduction:
The carnivore diet, composed exclusively of animal-sourced foods, has gained attention both as a nutritional trend and as a potential therapeutic strategy for gastrointestinal conditions. It excludes plant-based foods, resulting in markedly reduced carbohydrate and fiber intake. While some studies suggest clinical benefits, the underlying mechanisms and long-term safety remain controversial.

Aim of the study:

This review aims to evaluate the effects of the carnivore diet on gut health by exploring its physiological mechanisms, clinical benefits in intestinal diseases, and associated risks.

Materials and Methods:

A literature review was conducted, analyzing data on the carnivore diet's influence on gut microbiota, inflammatory markers, nutrient status, and clinical outcomes in conditions such as inflammatory bowel disease (IBD), irritable bowel syndrome (IBS), and small intestinal bacterial overgrowth (SIBO). Publications from 2005 to 2025 were analyzed, with the majority from 2020 to 2024.

Results:

Evidence suggests that ketone bodies produced on a carnivore diet modulate inflammation through macrophage polarization and epigenetic pathways. Some case reports indicate symptom improvement in IBD and IBS, potentially due to reduced dietary antigens and fermentable carbohydrates. However, the diet’s exclusion of fiber impacts microbiome composition and short-chain fatty acid production, posing risks to mucosal integrity. Additionally, high consumption of red and processed meats may elevate cancer risk due to carcinogenic compounds and hormonal additives.

Conclusions:

While the carnivore diet may offer symptomatic relief in selected gastrointestinal disorders, its restrictive nature, potential nutrient deficiencies, and long-term health risks necessitate further controlled studies. Clinical implementation should be approached cautiously and under professional supervision.

Key words: Carnivore Diet; Inflammatory Bowel Diseases; Ketone Bodies; Intestinal Microbiota; Gastrointestinal Diseases; Dietary Proteins

Introduction

Meat consumption has been an integral part of the human diet for thousands of years. It is a rich source of amino acids, provides a broad spectrum of essential nutrients, and supports metabolic health as well as muscle mass development in the short term. Nevertheless, the role of meat in human nutrition remains controversial, with numerous voices raising concerns about its potential negative health effects [1].

In recent years, growing interest has been directed toward the so-called carnivore diet, which is based almost exclusively on animal-derived products and eliminates most, if not all, plant-based foods [2]. This dietary approach has gained attention not only as a nutritional trend but also as an experimental therapeutic option for a variety of conditions, including inflammatory bowel disease (IBD). Both the ketogenic and carnivore diets have shown promising outcomes in managing IBD, particularly ulcerative colitis (UC) and Crohn's disease.

These observations are supported by clinical literature indicating an inverse correlation between intestinal ketone body levels and the activity of inflammation in IBD. Moreover, elimination diets that are low in dietary residue may positively influence the metabolism of the colonic microbiota [3].

From a molecular perspective, studies from 2022 have shown that beta-hydroxybutyrate (BHB)—one of the primary ketone bodies—promotes the polarization of macrophages toward the M2 phenotype through the STAT6-dependent signaling pathway. This mechanism plays a key role in the resolution of intestinal inflammation and supports the repair of damaged intestinal tissues [4].

BHB is produced in the liver during metabolic adaptation to a ketogenic diet, which makes this dietary model particularly interesting in the context of inflammatory gastrointestinal disorders [5]. A similar effect may also be observed during adherence to a carnivore diet.

On the other hand, a diet based primarily on meat products may be associated with an increased risk of colorectal cancer. Potential carcinogenic mechanisms include the formation of harmful compounds during high-temperature cooking (e.g., grilling or frying), the presence of nitrates and nitrites in processed meat, elevated levels of heme iron, and a lack of dietary fiber, which plays a crucial role in maintaining intestinal health and microbiota balance [6,7].

In this study, we aim to review the literature on the effects of the carnivore diet on intestinal function. Although this topic remains relatively new and not yet well understood in the scientific literature, it is generating growing interest and provoking mixed opinions within both the medical and nutritional communities.

Mechanisms of action of the carnivore diet on the gut

The main mechanisms of action of the carnivore diet on the gut are elimination of immune-triggering factors, increased ketone body production, reduced carbohydrate intake, lack of dietary fiber, effect on gut microbiome

Elimination of Immune-Triggering Factors - The carnivore diet eliminates plant-based foods, which reduces exposure to compounds that may act as antigens or trigger immune responses. This may have a beneficial effect on intestinal inflammation [3].

Increased Ketone Body Production - Following a carnivore diet leads to increased production of ketone bodies, which are powerful regulatory and signaling molecules. They reduce inflammatory responses by inhibiting inflammasome activation. Additionally, they influence metabolism by inhibiting histone deacetylase (HDAC) activity and through epigenetic regulation. In inflammatory bowel disease (IBD), levels of beta-hydroxybutyrate in the colonic mucosa are deficient. Exogenous beta-hydroxybutyrate has been shown to improve colitis by modulating macrophage function via the STAT6 signaling pathway [3].

Reduced Carbohydrate Intake - Lower carbohydrate intake may improve glycemic control, which is particularly relevant for individuals with diabetes or other metabolic disorders. It can also support weight loss in individuals with obesity [3].

Lack of Dietary Fiber - While a lack of fiber is commonly associated with negative effects on gut health, it may also have potential benefits. Studies have shown that in inflammatory bowel diseases, a fiber-free diet can lead to clinical improvement. In Crohn's disease, remission has been observed in 60–85% of cases on elemental diets. Although these are not carnivore diets, both are fiber-free, suggesting a potential benefit of the carnivore diet in Crohn's disease. There are also hypotheses that certain antinutrients found in plant foods—such as lectins, oxalates, phytates, phytoestrogens, and tannins—may impair the bioavailability of various minerals [3,8].

Gut Microbiome - As mentioned earlier, the absence of dietary fiber may disrupt the composition and function of the gut microbiota. Fiber is a primary energy source for gut bacteria and supports microbial diversity [9,10,11].

Micronutrient Deficiencies - The carnivore diet may lead to deficiencies in vitamin C, magnesium, calcium, and potassium. These deficiencies can negatively affect gastrointestinal function. For example, magnesium deficiency is often observed in individuals with gastrointestinal diseases such as Crohn's disease [8].

Carnivore diet characteristics and its influence on gut health

There is no standardized definition for a carnivore diet. Generally, it's a form of a very low-carbohydrate diet based entirely on animal sourced foods (ASFs). It mainly consists of meat,

fish, eggs and certain dairy products, excluding all plant-based foods making it typically ketogenic as a side effect. Similarly, no specific guidelines for macronutrient ratios have been yet assessed for this type of diet. Typically, carnivore diets may provide around 60–80% of energy from fats, 20–40% from proteins, with carbohydrate being below 5% of total caloric intake. Consumption of these macronutrients can differ depending on individual choices and preferences. Since there is very limited literature base on this topic as well as several versions of carnivore diet, it's challenging to objectively evaluate effects of this diet on the nutrition panel in the human body. However, some studies suggest that the main deficiencies observed during adherence to the carnivore diet involve thiamine, magnesium, calcium, and vitamins C, D, and E, as well as iron, folate, iodine, and potassium. [8,12]. The carnivore diet can have various effects on the human body, including significant changes in the intestinal microbiome. Reduced carbohydrate consumption impacts the gut microbiota composition, including growth of folate-producing bacteria *Streptococcus* and *Lactococcus,* which can contribute to increased folate levels. Other changes include- an increase in *Eggerthella* and decrease in the carbohydrate- degrading bacteria *Ruminococcus, Eubacterium, Clostridium* and *Bifidobacterium* [13]. Moreover, since the carnivore diet excludes plant-based foods and thus dietary fiber, there is a reduction in gut bacteria that rely on fiber as their primary substrate, such as Bifidobacteria and certain Lactobacillus species. Fiber functions as a complex polymer with diverse physicochemical properties: it undergoes bacterial fermentation, retains water, exchanges cations, and exhibits adsorptive capacity, all of which support microbial diversity and gut health. These bacteria are important for fermenting fiber and producing beneficial short-chain fatty acids (SCFAs) such as butyrate, that play a key role in maintaining the integrity of the gut lining [14,15]. Without fiber, fermentation and the production of SCFAs decreases significantly. Reduced fermentation creates a higher pH level which may favour the growth of certain pathogenic bacteria, while inhibiting beneficial ones [16]. SCFAs are also an important energy source for colonocytes (cells lining the colon). Reduced fermentation can impair the energy supply to these cells, affecting colon health [17]. It can weaken the gut barrier, potentially leading to increased intestinal permeability and inflammation as well as negatively impact metabolic health- especially blood sugar and cholesterol levels. Additionally low SCFAs levels are associated with an increased risk of conditions such as inflammatory bowel disease (IBD), irritable bowel syndrome (IBS), and colorectal cancer [18,19].

Positive impact of carnivore diet in intestinal diseases

The carnivore diet has gained attention for its potential benefits, particularly for individuals suffering from various intestinal diseases. While research on this diet is still emerging, many individuals report significant improvements in their symptoms. Diet with a very low carbohydrate intake is a well-established treatment option for pediatric epilepsy and popularized in a management of obesity and diabetes [20]. However it's becoming progressively more popular for medical conditions such as small intestinal bacterial overgrowth (SIBO), irritable bowel syndrome (IBS) and inflammatory bowel diseases (IBDs) - Crohn's disease (CD), ulcerative colitis. The clinical improvement from the carnivore diet in patients with those conditions may derive from three different aspects of this diet. The first being weight loss and improvement in blood sugar levels due to carbohydrate reduction. Second being the restrictive nature of the diet, which may reduce exposure to foods that can act as immune triggers (fiber, lectins and certain carbohydrates- e.g. FODMAPs-fermentable oligosaccharides, disaccharides, monosaccharides and polyols). Finally, since a carnivore diet usually induces a

state of ketosis, there is a rise in ketone bodies produced by the liver. They function not only as energy sources but also as powerful regulatory and signaling molecules, comparable to hormones in their effects. They play a critical role in modulating the immune system and metabolism through various mechanisms, including interactions with cell surface receptors, suppression of histone deacetylase (HDAC), and epigenetic regulation [3].

The pathogenesis of IBD is thought to result from a complex interplay of genetic predispositions, disruptions in the gut microbiome (dysbiosis), environmental triggers, and an abnormal immune response. With epidemiologic studies linking diet to the onset of IBD, there is increasing interest in exploring dietary changes as a modifiable factor for both preventing and managing the condition [3]. Similarly, proper diet stands out as a notable treatment option in IBS- a functional bowel disorder in which abdominal pain or discomfort is associated with disordered bowel habits [21].

Here, we explore some of the potential benefits of the carnivore diet for those dealing with intestinal health issues. One of the most notable benefits of the carnivore diet is its potential to reduce inflammation. Many individuals with autoimmune-related intestinal diseases, such as Crohn's disease and ulcerative colitis, have reported relief from symptoms after adopting this diet. By eliminating all plant-based foods, individuals may reduce exposure to certain anti-nutrients and inflammatory compounds (like fiber and carbohydrates) that can exacerbate intestinal issues. For individuals with compromised digestive systems, this simplified dietary framework can make meals easier to digest. The lower fiber content may help alleviate gastrointestinal discomfort, which is often a concern for those with intestinal diseases. Moreover, animal proteins and fats are generally easier to digest than complex plant fibers, which can be problematic for individuals with compromised digestive systems. This elimination can lead to improved gut health and a reduction in symptoms like gastrointestinal discomfort, diarrhea, and abdominal pain, allowing for a better overall quality of life [3,22]. By excluding all plant-based foods, the carnivore diet inherently removes FODMAPs, as they are primarily found in fruits, vegetables, grains, and legumes. This makes it a far more restrictive version of low FODMAP diet- one of the most widely recognized dietary approaches for managing intestinal diseases with the evidence base being sufficiently strong to support its broad application. Low FODMAP diets limit the intake of fermentable oligosaccharides (fructans and galactans), disaccharides (lactose), monosaccharides (fructose) and polyols. It is primarily known for its effectiveness in managing IBS. Its role in IBD is still being explored, however research has shown that restricting the intake of these carbohydrates as a whole (rather than individually) has been shown to reduce functional gut symptoms effectively in both IBS and IBD. This improvement is long-lasting and can be reversed when these carbohydrates are reintroduced [23,24]. However it's vital to always remember to take a personalized approach, as a low FODMAP diet can result in loss of beneficial microbial populations, raising concerns about long-term outcomes [21]. While the low FODMAP diet is widely recognized as an effective intervention for gut health problems, the carnivore diet doesn't yet hold strong enough scientific evidence to support its use in these health conditions.

Another condition which seems to benefit from a carnivore diet is SIBO. SIBO is defined by the overgrowth of bacteria in the small intestine, which ferment carbohydrates, therefore producing gas and causing symptoms like bloating, flatulence and abdominal pain [25]. While research on this is limited, the principles align with treatment strategies aimed at reducing bacterial fermentation in the intestines thereby decreasing severity of the symptoms. By removing carbohydrates and fiber, the carnivore diet deprives bacteria in the small intestine of

their primary energy source, which may contribute to a reduction in bacterial overgrowth [15,26]. However, a diet low in carbohydrates may promote an unfavorable change in the gut microbiota, potentially worsening the existing dysbiosis in SIBO patients [27]. In many patients it is necessary to increase calorie coverage by fat [25]. Lastly, some individuals with SIBO report symptom relief on a more restrictive diet, especially if they have not responded well to other dietary interventions like the low FODMAP diet or antibiotics. Currently available literature is not sufficient enough to evaluate the efficacy of low FODMAP or carnivore diet in managing SIBO. Future research is needed to determine the right dietary approach in patients with this condition [26,28].

In addition to its effects on gut health, the carnivore diet has also been studied in relation to overall health outcomes. Preliminary observations and personal accounts suggest that a carnivore diet may offer noticeable health benefits. For instance, a study published in Current Developments in Nutrition examined 2,029 adults who had followed this diet for at least six months. The findings were striking: 95% of participants reported improved overall health, 89% experienced increased energy levels, and 85% noted enhanced mental clarity. While these results are promising, it is important to note that the study relied on self-reported outcomes and lacked controlled experimental conditions, which limits its scientific strength. Therefore, although anecdotal and early evidence points to potential benefits, caution is warranted before endorsing such a restrictive diet [2].

Meat in the WHO-IARC carcinogenic classification (2015)

The International Agency for Research on Cancer (WHO-IARC) has classified processed meat as carcinogenic to humans (Group 1) and red meat as a probable carcinogenic agent (Group 2A). According to the International IRAC, cancer associated with processed meat consumption is most commonly colorectal cancer. Similarly, red meat has also been linked primarily to colorectal cancer, but associations have also been reported with pancreatic and prostate cancers. The recommended intake of red meat is less than 500 grams per week and less than 50 grams per day of processed meat [29,30].

Other studies have also linked the consumption of red meat to additional types of cancer. Recent scientific studies demonstrate that consumption of unprocessed red meat may be associated with an increased risk of breast cancer, endometrial cancer, colorectal cancer, colon cancer, rectal cancer, lung cancer, and hepatocellular carcinoma. Whereas, consumption of processed meat may be linked to the development of breast cancer, colorectal cancer, colon cancer, rectal cancer, and lung cancer. The studies also indicated that high consumption of red meat in combination with high consumption of processed meat is associated with a higher risk of colorectal cancer, colon cancer, rectal cancer, lung cancer, and renal cell cancer. Additionally, studies show a positive association between high intake of red and processed meat and an increased risk of developing esophageal squamous cell carcinoma and pancreatic cancer [6,7,31,32,33,34,35].

Mechanisms of meat-induced carcinogenesis

There are three main factors associated with red meat consumption that may contribute to carcinogenesis: heme iron, thermal processing of meat, exogenous hormones.

Heme is found in hemoproteins (hemoglobin, myoglobin) and cytochromes. Red meat (including beef, lamb, pork, veal, mutton and organ meats) contains a high concentration of myoglobin, with the heme content being approximately ten times greater than that found in white meat. It is hypothesized that heme facilitates the endogenous formation of N-nitroso compounds (NOCs). As alkylating agents, NOCs have the potential to: induce mutations in the *KRAS* gene, contributing to oncogenic transformation in colonic epithelial cells, trigger mutations in the tumor suppressor gene *TP53*, interact with colonic epithelial DNA and promote the formation of promutagenic compounds [29,36]. Additionally, heme catalyzes lipid peroxidation, leading to the generation of free radicals and subsequent reactions with DNA in colonic epithelial cells, which may enhance mutagenicity and genotoxicity [29,36,37,38].

Multiple studies in PubMed link eating meat cooked at high temperatures to an increased risk of cancer. These studies show that high temperatures create chemical carcinogens like heterocyclic aromatic amines (HAAs) and polycyclic aromatic hydrocarbons (PAHs). HAAs are considered among the most mutagenic and carcinogenic compounds formed in heat-processed food products. Free amino acids found in muscle tissue, especially creatine and creatinine serve as the main precursors for the formation of HAAs. IARC has classified one HAA as Group 2A and nine others as Group 2B (possibly carcinogenic to humans) [39,40]. PAHs are generated as a result of the incomplete combustion of organic matter. The main dietary sources of PAHs are thermally processed, smoked, or dried meat products. Their lipophilic nature contributes to their toxicity through significant bioaccumulation and enhanced absorption via oral, respiratory, or dermal routes. The IARC has classified three PAHs as probably carcinogenic to humans (Group 2A) and three others as possibly carcinogenic to humans (Group 2B) [39,40]. Metabolic products of PAHs and HAAs may form DNA adducts, leading to mutations and abnormal gene expression. These metabolites also interact with proteins, which promotes the initiation of carcinogenesis [39].
An effective method for reducing the formation of HAAs and PAHs is enriching meat with plant-based products that have antioxidant characteristics. According to a report by the World Cancer Research Fund/American Institute for Cancer Research (WCRF/AICR), a diet enriched with plant products can lower the risk of cancer [41]. This category of products is a rich source of antioxidants, phytoestrogens, and flavonoids, particularly flavanones, which can help prevent cancer progression through anti-inflammatory effects, scavenging free radicals, or inhibiting the formation of carcinogens. Additional components in these foods, such as fiber, folate, vitamin C, vitamin A and beta-carotene, may also contribute to their anticancer properties [39,40,41].

Recently, increasing attention has been paid to the role of Hormonal Growth Promoters (HGPs) used in beef production in the USA and their potential link to cancer development. Estradiol-17β has been classified by the IARC as a carcinogen. Its role is particularly noted in the development of hormone-sensitive cancers, such as breast cancer and endometrial cancer. Estrogens, primarily estradiol-17β, are the most commonly used sex hormones promoting growth in cattle. Some of estrogen metabolites may lead to the formation of free radicals, epigenetic changes, immunotoxic and inflammatory responses, genotoxicity and hyperprolactinemia. Based on extensive scientific evidence, it is suggested that exogenous hormones used in the production of meat products may play a role in carcinogenesis [42,43,44].

Conclusion

Although some studies and personal accounts indicate potential benefits of the carnivore diet may offer benefits for individuals with intestinal diseases, it is essential to approach this diet with caution. The highly restrictive nature of the carnivore diet raises concerns about potential long-term effects and nutritional deficiencies. As research on this dietary pattern continues to evolve, it is advisable for individuals with existing health conditions to consult with healthcare professionals before making significant dietary changes.

Disclosure Author's contribution

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