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BLOOD TYPE DIET: PERCEPTION IN DISEASE PREVENTION

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ABSTRACT

The Blood Type Diet proposes that the foods consumed should be tailored to one's blood type, which is believed to correspond to the dietary habits of respective ancestors, thus serving as a nutritional approach. The review investigates the perceptions surrounding the role of blood type diet in disease prevention, emphasizing its relevance to common health conditions such as obesity, diabetes mellitus, cardiovascular disease, cancer, ulcers, gynecological disorders and allergies, elucidating how dietary choices based on blood type may impact outcomes of a medical condition. For individuals with Type O blood group, a high protein, low carbohydrate diet is advised, potentially mitigating risks of thyroid disorders, peptic ulcers and inflammatory conditions. Conversely, type A individuals are steered towards a predominantly vegetarian diet to manage cardiovascular disorders and blood viscosity. People with type B are encouraged to encompass a comprehensive range of foods into their diet, paying attention to their lectin sensitivity and concerns regarding nutrient absorption. Type AB are recommended to adopt a blended diet, considering an immune response and gut microbiome dysbiosis. Further research in this realm holds promise for unraveling the fundamental mechanisms and refining dietary recommendations aligned with individual blood types, thus advancing personalized approaches to healthcare and promoting overall wellness.

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INTRODUCTION

Blood is a connective tissue. It flows through the circulatory system and plays an active role in cell physiology and pathology throughout the body. It carries vital elements like oxygen, nutrition, hormones, and waste materials. Blood is composed of erythrocytes, leukocytes, thrombocytes and plasma (Offner, 2015). Genes present in DNA determine the blood type of the individual. Adenine, Cytosine, Guanine, and Thymine are the four nucleotide bases that make up DNA, and a simple mutation in any one of these bases results in the development of a distinct blood type. Despite the rising number of variant forms of human genes identified, it is likely that more people around the world have been correctly classified for the ABO genes than for any other polymorphism trait (Watkins, 1980). The ABO system classifies blood into four major blood types: A, B, AB, and O, based on the presence or absence of two antigens: A and B (Offner, 2015). Blood type is a genetic powerhouse with a key influence on the immune system, metabolism, and digestive process, as well as a critical illness predictor and their relation has been studied in 1900s which suggest that the antigens and antibodies are inherited (Green, 1989). Due to lack of antigen in certain blood group, they are more vulnerable to certain type of infections and diseases (Watkins, 1980).

Specific lectins in food react with different blood types and can cause assimilation, dysbiosis, cardiovascular issues, ulcers, cancer, etc. Lectins are a class of proteins found in many foods, especially in grains, legumes and vegetables. They can bind to carbohydrates and have roles in plant defense, as well as potential effects on human digestion and health, with some people being sensitive to them. Lectins can interfere with nutrient absorption by binding to the lining of the gut, potentially affecting digestion and nutrient uptake (Abtar Mishra, 2019) resulting in obesity and other chronic conditions, such as heart disease, diabetes mellitus, arterial hypertension and some cancers (Bruce Y. Lee, 2017), (Jassim, 2012), (Joyce Yongxu Huang, 2017), (Massimo Franchini, 2015), (Arash Etemadi, 2015), (Chandra, 2012). Thus, the concept of a "blood type diet" is a dietary theory proposed by Dr. Peter J. D'Adamo in his book "Eat Right for Your Type," which was first published in 1996. The theory suggests that an individual's blood type (A, B, AB, or O) should determine their optimal diet for health and well-being. According to this theory, different blood types evolved at different times in human history, and certain foods are more compatible with specific blood types. Furthermore, the idea of nutrigenomics, or how food influences gene expression, strives to find the genes that affect the risk of diet-related disorders on a genome-wide scale as well as to comprehend the mechanisms underlying these genetic predispositions (Michael Müller,

2003). Each blood type reacts differently to drugs, diet, physical activity, and lifestyle, and is predisposed to certain diseases. As Dr. Peter noted, if the Blood Type Diet is tailored and particular to each person, it may aid in avoiding diseases.

History of Blood Type Diet: Based on ABO blood types, there were four previous diet-typing methods. The initial research was done in 1963 by two anthropologists named Kelso and Armelagos, who statistically matched ABO blood types to macronutrients for 31 different ethnic groups around the world. They discovered that type A's consumed more fat while type B's consumed more carbohydrates (Kelso J, 1963). The Answer Is In Your Blood Type, a well-known book written by Weissberg and Christiano, offers dietary advice based on blood type and blood nutrient levels (Weissberg SM, 1997). One Man's Food, a well-known book by James d'Adamo that made specific food suggestions based only on observation, was published in 1980 (D'Adamo J., 1980). Eat Right for Your Type (1996), written by his son Peter d'Adamo, also included lectins, however some of them did not match the lectins that had been identified in scientific literature (D'Adamo P, 1996).

Association between Blood Type and Clinical Disorder

Obesity: In line with WHO, weight gain that is abnormal or excessive and poses a risk to health is what is meant by the terms "overweight" and "obesity." Overweight is defined as a body mass index (BMI) of 25, and obesity as a BMI of greater than 30 (WHO). Obesity is a result of numerous interrelated elements, including social dynamics, geopolitical development, human behavior, physiology, and genetics, obesity is a complex, multidimensional, and systemic chronic health problem (Bruce Y. Lee, 2017). Blood group O had the largest prevalence (48.9%) and blood group AB had the lowest prevalence (3.7%) among participants, according to a study carried out in Brazil. The findings showed that there were different relationships between ABO blood group and BMI for men and women. Carrying blood groups O and B was connected with a higher probability of being classed as overweight or obese in women, but not in males (Flor, 2020). As stated in the findings of a study conducted in Saudi Arabia, blood group O was found to be the most prevalent blood type (46%) followed by blood type A (31.4%). Blood types B and AB were discovered in 16.1% and 6.5% of participants, respectively. Based on blood groups O, A, B, and AB, the prevalence of obesity (BMI 30) was 13.7%, 9%, 4.8%, and 2.2%, respectively. However, there was no statistically significant correlation between the rate of obesity or high BMI and ABO blood groups (Alwasaidi, 2017). In an Indian study, it was discovered that girls were more likely than boys to be overweight or obese, with 16% of schoolchildren overall falling into this category (19% girls and 14% boys). The same pattern was observed for obesity. The frequency of occurring obesity among all children was 5% (BMI percentile > 95), with 6% of girls and 4% of boys being obese (Krishnakanth, 2012). The blood type-specific weight gain varies in population owing to certain factors. The imbalance of thyroid hormones that might result from blood type O most likely leads to thyroid diseases, which can affect appetite control and result in hypothyroidism. In people with blood type O, foods like cabbage, brussel's sprouts, cauliflower, mustard greens, wheat, kidney beans, and navy beans can affect thyroid function and interact with metabolic hormones.

Sea vegetables like kelp and dulse, as well as turmeric, are foods that support healthy thyroid function. The hyperassimilator tendency of blood type B might result in excessive nutrition absorption and weight gain. Foods including peanuts, tomatoes, soy, cashews, corn, cornflour, black pepper, poppy seeds, pinto beans, maltodextrins and rhubarb might cause hyperassimilator tendencies in blood type B. However, mushrooms, blueberries, brussels sprouts, blackberries, grapes and whey can lower the rate of absorption. (D'Adamo PJ, 2002), (PJ., 2002), (PJ D. , 2002), (PJ D. , 2002), (J., 1980), (D'Adamo P, 1996).

Diabetes Mellitus: Hyperglycemia is brought on by impaired insulin production and/or elevated cellular insulin resistance. Although environmental circumstances certainly play a part in the genetic expression of diabetes mellitus, the condition has a hereditary predisposition. Blood groups are genetically predetermined, like many other hereditary features, and may therefore be related to diabetes mellitus. According to a study conducted in 2011, individuals with blood groups A and B are less likely to get Diabetes Mellitus, whereas those with blood group AB are more likely, but blood group O has no effect. There is also a link between Rh negative blood types and diabetes (Tahir, 2012). In 2014 an interpretation was reported that subjects with the O blood group had the lowest risk of getting type 2 diabetes. When the Rhesus factor was taken into consideration, it was observed that those with the blood groups A+, A-, B+, and AB+ had a higher risk of acquiring type 2 diabetes than universal donors (group O). Although the associations did not reach statistical significance, adjusting for fasting plasma glucose and lipid concentrations did not substantially alter the observed associations in the nested case-control study (Fagherazzi, 2015). The few studies that have looked at the relationship between ABO blood groups and the risk of diabetes have yielded contradictory results. Blood types A and B people are more likely to develop type 1 diabetes because they produce less insulin, the hormone that the pancreas produces as a result of the loss of beta cells, which impairs insulin release. In an Iraqi community, persons with the blood group O have been found to have higher total cholesterol, glucose levels, and blood pressure, with a decreasing tendency from those with blood group A to B, and then to AB. Similar results were also seen in countries like Malaysia (Kamil, 2010), (Rahman, 1976). In type 2 diabetes, the blood sugar levels are frequently high, as tissue lacks insulin sensitivity. This is consequence of a diet and can be seen in Type O people who have consumed dairy, wheat, and maize products for a long time. Type A people who have consumed large amounts of meat and dairy products exhibit same outcomes. Antioxidant quercetin has demonstrated some potential in preventing a number of long-term diabetes consequences, including cataracts, neuropathy, and cardiovascular issues. Some dietary lectins found in fava beans and silver dollar mushrooms are known to have the ability to regenerate beta cells, which are responsible for creating insulin. Fava beans for types A & B and silver dollar mushrooms for types O & AB are suggested (D'Adamo PJ, 2002), (PJ., 2002), (PJ D. , 2002), (PJ D. , 2002), (J., 1980), (D'Adamo P, 1996).

Cardiovascular Disease: A collection of illnesses known as cardiovascular diseases (CVDs) affect the heart and blood arteries. Coronary Artery Disease (CAD), High Blood Pressure, Heart Failure, Arrhythmias, Valvular Heart Disease, Peripheral Artery Disease (PAD), Stroke, Congenital Heart

Defects, Cardiomyopathy, Inflammatory Heart Diseases, and Aneurysms are examples of frequent cardiovascular ailments. Cardiovascular disorders can have a variety of causes. Artery-narrowing fatty deposits cause atherosclerosis. Hypertension, poor diet, lack of exercise, smoking, obesity, diabetes, family history, excessive alcohol use, and age (risk rises with age) are risk factors. Another factor that affects CVDs is gender (men at higher risk, women after menopause) (Gaziano T, 2006), (Anderson, 1991). According to the "Blood-Type" diet, people should eat in accordance with their ABO blood type to enhance their health and lower chance of developing chronic diseases like cardiovascular disease. High consumption of cereals, fruits, and vegetables is advised by the Type-A diet. The Type-B diet suggests consuming a lot of dairy products and a lot of other food groups in moderation. Similar to the Type-B diet, the Type-AB diet places greater limits on particular foods. For group AB persons, for instance, the only suggested sources of meat are eggs and fish. The Type-O diet encourages a high meat intake and discourages the use of grains (D'Adamo PJ, 2002), (PJ., 2002), (PJ D. , 2002), (PJ D. , 2002), (J., 1980), (D'Adamo P, 1996). The 'Blood-Type' diet concept is not supported by a study that found that following specific 'Blood-Type' diets were related with favorable effects on some cardiometabolic risk variables, but these relationships were independent of an individual's ABO genotype. Lower BMI, waist circumference, blood pressure, serum cholesterol, triglycerides, insulin, HOMA-IR, and HOMA-Beta were all linked to Type-A diet adherence (P0.05). With the exception of BMI and waist circumference, Type-AB diet adherence was likewise linked to reduced levels of these biomarkers (P0.05). Lower triglycerides were linked to Type-O diet adherence (P 0.0001). It was discovered by examining the 'Blood-Type' diets in a population with various ABO genotypes that following the Type-A, Type-AB, or Type-O diets had positive impacts on the levels of specific indicators of cardiometabolic disease risk (Wang J. G.-B.-S., 2014). But neither the degree of physical activity nor the amount of stress is addressed in the studies cited above. The Blood Type food has demonstrated in numerous case studies that CVD effects can be mitigated and a normal life can be led with correct food, physical activity, and stress management.

Cancer: The relationship between blood type diet and cancer prevention is a complex topic and not fully understood. Some studies have suggested possible associations between blood type and certain types of cancer. The link between the ABO blood type and cancer was the focus of much research in the middle of the 20th century, interest has increased since the recent publication of studies showing a link between the ABO blood type and pancreatic cancer (Wolpin et al., 2010). Participants with blood categories A, AB, or B were more likely to acquire pancreatic cancer in comparison to those with blood group O (Wolpin et al., 2009). In this study only exocrine pancreatic cancer showed a statistically significant difference in the percentage of individuals with blood type O when compared to other cancers. Blood type O was linked to a 47% lower risk of exocrine pancreatic cancer overall. Age, a history of diabetes, and cigarette smoking, which are known risk factors for pancreatic cancer, did not alter this association (Iodice, 2010). A 2010 study that was conducted within a particular cohort of Swedish and Danish blood donors confirmed that blood group A is in fact associated with an elevated risk of gastric cancer (Study, 2010). Based on a 2012 study, blood group A was associated with a considerably increased incidence of gastric cancer than blood group

non-A (Wang Z. L., 2012). Some other research also have suggested a weak association between blood type A and an increased risk of gastric cancer. However, it's important to note that this association is relatively weak. Emphasis other factors such as diet, Helicobacter pylori infection, and family history play more significant roles in gastric cancer risk (Yang, 2005). The blood group A has been linked to an increased risk of a number of cancers, including those of the salivary glands, stomach, pancreas, kidney, bladder, ovary, uterus, and cervix. There is now no clear connection between blood types and colorectal cancer (Slater, 1993). Blood types AB and B were linked to a borderline significant higher incidence of ovarian cancer. The findings point to a potential connection between the B blood group antigen and a higher risk of ovarian cancer (Gates, 2010). In 2014, researchers found that blood group A was associated with a 12% higher risk of overall cancer as well as cancers of the stomach (18%), pancreas (23%), breast (12%), ovary (16%), and nasopharynx (17%). The risk of all cancers, including those of the gastric (16%), pancreatic (25%), breast (10%), colorectal (11%), ovarian (24%), esophagus (6%), and nasopharyngeal (19%) organs, was found to be 16% lower in people with blood group O (Zhiwei Wang, 2012). Blood type can influence clotting tendencies, with individuals with blood type A potentially having a slightly increased risk of blood clots. Blood clots, in some cases, can be a risk factor for certain types of cancer, as they can affect blood flow to tissues (Francesco Dentali, 2012). The fact that cancer risk is influenced by a wide range of individual-specific factors, and these factors can vary significantly from person to person. Genetic variation, family history, age, gender, health condition, lifestyle choices like smoking, diet, physical activity, and alcohol consumption. Exposure to environmental carcinogens, such as asbestos, radon, and certain chemicals, can increase the risk of cancer. The extent of exposure and individual susceptibility to these agents can vary widely (American Cancer Society, 2021), (National Cancer Institute: Diet and Cancer, 2021), (World Cancer Research Fund: Diet, Nutrition, Physical Activity, and Cancer: A Global Perspective). It was stated by Dr. Peter that there is a positive relation between lectins and cancer. They can be used to agglutinate cancerous cells which will activate and catalyze their immune system. He provided information on several foods and methods for Type A and Type AB to avoid or mitigate cancer.

Tofu and soybeans both include lectins, which make agglutinin which help immune system to find and destroy cancer cells. Additionally, it includes the estrogen-related substances genistein and daidzein. These substances can even regulate female estrogen levels and lessen tumor blood supply. Peanut when consumed with skin aids in agglutination as well. The T markers are suppressed by lectins found in fava beans and silver dollar mushrooms. The most potent lectin is found in lima beans, which affects both healthy and malignant cells and it should not be consumed as a preventative measure. Other foods that aid in controlling cancer include sprouted vegetables, lentils, wheat germ, snails (*Helix aspersa pomatia*), Quercetin found in yellow onion, and snails. Regular exercise and rest are essential. It's essential to emphasize that there is little scientific data to support the Blood Type Diet's suggestions for preventing cancer. Numerous variables, including genetics, dietary habits, environmental exposures, and family history, all have an impact on the chance of developing cancer. As a result, it's critical for anyone worried about cancer to speak with medical professionals

(D'Adamo PJ, 2002),(PJ., 2002),(PJ D. , 2002),(PJ D. , 2002), (J., 1980), (D'Adamo P, 1996).

Gastric and Peptic Ulcers: Gastric ulcers and peptic ulcers are often associated with the presence of *Helicobacter pylori* infection (P Malfertheiner, 2016) and the use of nonsteroidal anti-inflammatory drugs (NSAIDs) such as aspirin and ibuprofen (Guillermo García-Rayado, 2017). The relationship between blood type and the risk of developing gastric (stomach) and peptic ulcers has been a subject of research interest, but the evidence is not entirely straightforward. Gastric ulcers are open sores that form on the lining of the stomach. Some analysis has indicated that individuals with blood type O may have a higher risk of developing gastric ulcers compared to those with other blood types. One interpretation published in the *Journal of the American Medical Association (JAMA)* found that individuals with blood type O had a modestly increased risk of gastric ulcers when compared to those with blood type A or B (Gao, 2005). Another research indicated that individuals with blood type A may be at a slightly higher risk for gastric cancer, which can sometimes be associated with gastric ulcers (Gustaf Edgren, 2010). Peptic ulcers can occur in the stomach (gastric ulcers) or the upper part of the small intestine (duodenal ulcers). The associations between blood type and peptic ulcers are similar to those with gastric ulcers. Studies have proposed that individuals with blood type O may have a slightly higher risk of developing peptic ulcers, including duodenal ulcers. As indicated in 2019, the ABO blood group distribution of peptic ulcer patients was 19.04% (12/63), 19.04% (12/63), 11.11% (7/63), 50.79% (32/63) for blood group A, B, AB, and O, respectively, while among control groups it was 25.39% (16/63), 23.80% (15/63), 12.69% (8/63), and 38.09% (24/63) for blood group A, B, AB, and O, respectively. In 34.1% (22/63) of peptic ulcer patients, stomach ulcers were present, while in 65.9% (41/63) of cases, duodenal ulcers were present. Sex ($p=0.001$), NSAID use ($p=0.001$), cigarette smoking ($p=0.014$), alcohol use ($p=0.028$), and PUD all had a statistically significant connection (Yonas Teshome, 2019). While the Blood Type Diet does make dietary recommendations for individuals with different blood types in ulcers and disease prevention, there is limited scientific evidence to support the idea that these recommendations can significantly impact the risk or management of gastric and peptic ulcers. For people with Type O blood, it suggests a high-protein diet that places an emphasis on lean meats, poultry, and fish. Which implies that these people might be more prone to stomach problems and ulcers. Individuals with Type A blood are advised to follow a primarily vegetarian diet with an emphasis on plant-based foods. The diet imply that this may help reduce the risk of ulcers. The Blood Type Diet provides dietary recommendations for Type B and Type AB individuals but does not make specific claims about their susceptibility to ulcers. Seaweed bladderwrack is an inhibitor of *Helicobacter pylori* and can help in prevention of ulcers (D'Adamo PJ, 2002),(PJ., 2002),(PJ D. , 2002),(PJ D. , 2002), (J., 1980), (D'Adamo P, 1996). Also here are some evidence-based approaches that are widely accepted in medical practice for preventing and managing ulcers. Acid suppression medicines like histamine H₂-receptor antagonists and proton pump inhibitors (PPIs) are frequently recommended to lessen stomach acid production. These medications aid in symptom relief and ulcer repair

(NICE Clinical Guidelines, 2019). Alterations in lifestyle can be extremely important in avoiding and treating ulcers. This includes abstaining from activities that can worsen ulcer symptoms, such as smoking, drinking alcohol, and consuming too much coffee. Steering clear of acidic foods like citrus, carbonated drinks, and spicy foods. Refusing reflux-causing foods like coffee, alcohol, chocolate, and fatty foods and embracing lifestyle changes that can reduce the exposure of esophageal acid, like giving up smoking, decreasing weight, raising the head of the bed, and avoiding lying down for two to three hours after meals (Kahrilas, 2008). Although stress does not directly cause ulcers, it can worsen their symptoms and slow down the healing process. Techniques for reducing stress, like breathing exercises and cognitive-behavioral therapy can be helpful (Kiecolt-Glaser, et al., 1984).

Gynecological disorders: Food decisions can affect reproductive health, including fertility and pregnancy outcomes. Potential associations between blood type and fertility are still evolving. A study published in the journal fertility and sterility in 2009 found that women with blood type O may have a lower ovarian reserve compared to those with blood types A or AB (Bellver, 2009). As mentioned in the *Journal of the American Medical Association (JAMA)* in 2000 suggested that women with blood type O may have a slightly higher risk of recurrent miscarriages (Rai, 2000). Blood type compatibility between the mother and the fetus can be important during pregnancy. Incompatibility, especially with the Rh factor (Rh-positive and Rh-negative), can lead to hemolytic disease of the newborn (HDN) (Flint, 2017). The relationship between male reproductive health and blood type have also been studied. Few studies have reported associations between blood type and fertility outcomes, while others have not found non-significant connections. Men with blood type O may have a higher risk of male factor infertility (Abdelrahman, 2008). The risk of specific birth abnormalities and blood type have been linked in some researches. For instance, a interpretation was issued in the journal *Pediatrics* in 2016 suggested a possible association between maternal blood type A and an increased risk of gastroschisis, a birth defect where the baby's intestines protrude through a hole in the abdominal wall (Waller, 2016). Another analysis by Agopian, A. J., et al. published in 2008 suggested that maternal blood type A might be associated with an increased risk of neural tube defects (e.g., spina bifida) in offspring (Agopian, 2008). Possible connections between a mother's blood type and the sex of her children has been noticed. In 1970 a study that appeared in the journal *Nature* stated that the mother's blood type and the gender of the kids, with a higher proportion of boys born to mothers with blood type A and a higher proportion of females born to mothers with blood type O (James, 1970).

Allergies and Infections: According to proponents of the Blood Type Diet adhering to the diet's recommendations can reduce the risk of allergies and improve symptoms of allergy by reducing inflammation and addressing issues of immune system (D'Adamo PJ, 2002),(PJ., 2002),(PJ D. , 2002),(PJ D. , 2002), (J., 1980), (D'Adamo P, 1996). Studies have revealed that people with blood type A may be slightly more likely to develop certain allergic disorders, such as hay fever (allergic rhinitis) or asthma. These connections, if any, are often unstable and may not hold consistently (Ciprandi, 2008). Conversely, there have been reports suggesting that individuals with blood type O may have a slightly reduced risk of developing certain allergies.

However the evidence for these correlations is weak and inconsistent among studies, which is a limitation of this study. A 2007 interpretation discovered that some biotypes score better for particular types of immune responses. For instance, blood types O, A, and Rh-negative had the highest Immunoglobulin G (IgG) responses. Blood types B and Rh-negative had substantially higher Immunoglobulin E (IgE) responses than other kinds. Since type AB binds to both type A and type B lectins, it had the highest number of lectin responses, with type O having the lowest number of lectin reactions among the ABO types (Power, 2012). Blood type alone has less of an impact on the development of allergies than other factors like genetics, environmental exposures, and personal immunological responses. Susceptibility to infectious diseases can vary among individuals. Genetic factors, including blood type, have been explored as potential contributors to this variability. *Helicobacter pylori* is a bacterium that can colonize the stomach lining and is associated with gastric ulcers and other digestive issues. Some studies imply that individuals with blood type O may have a higher risk of *H. pylori* infection compared to those with blood types A or B. The mechanism behind this association is not fully understood, but it may involve interactions between blood group antigens and *H. pylori* adhesions (Zeng, 2010).

Cholera is an infectious disease caused by the bacterium *Vibrio cholerae*. As mentioned in certain studies that individuals with blood type O may have an increased susceptibility to severe cholera infection compared to those with other blood types (Harris, 2005). Norovirus is a common cause of gastroenteritis (stomach and intestinal inflammation). The individuals with blood type B may be more susceptible to certain strains of norovirus (Lindsmith, 2003). Leishmaniasis is a parasitic disease transmitted by sandflies. Researchers have explored potential associations between blood type and susceptibility to cutaneous and visceral forms of leishmaniasis. However, the evidence for these associations is mixed and not consistent across all populations (de Carvalho, 2003). In 2009 associations between blood type and susceptibility to certain infectious diseases. Individuals with blood type O have been reported to have a reduced risk of severe malaria caused by *Plasmodium falciparum*, compared to those with other blood types. This association is related to the interaction between blood group antigens and the malaria parasite (Rowe, 2009). As stated by Lindsmith in 2003 suggested that individuals with blood type B may be more susceptible to certain strains of norovirus (Lindsmith, 2003). During the COVID-19 pandemic, there was interest in exploring whether blood type might influence susceptibility to the viruses. Some initial reports suggested that individuals with blood type A may have a slightly higher risk of contracting COVID-19 compared to those with other blood types. Conversely, individuals with blood type O were reported to have a slightly lower risk. These findings were based on observations of blood type distribution among COVID-19 patients. In addition to susceptibility, researchers have investigated whether blood type might influence the severity of COVID-19. Some studies have suggested that individuals with blood type A may be at a slightly higher risk of developing severe COVID-19 symptoms if they contract the virus, while those with blood type O may have a slightly lower risk of severe outcomes. However, the associations reported in these studies have generally been weak and may not apply universally (Ellinghaus, 2020), (Zhao, 2020).

Blood Type Diet: The blood type diet's suggested food parameters for each blood type are as follows:

Type O: The most common blood type in India is blood type O positive. People with type O blood are often advised to follow a high-protein, low-carbohydrate diet that includes lean meats, fish, and vegetables with intense physical and strength training. They are encouraged to avoid dairy and gluten-containing grains (D'Adamo PJ, 2002). It's often referred to as a "hunter-gatherer" diet. They have a higher concentration of intestinal alkaline phosphate and stomach acid thus they are more prone to peptic ulcers. This blood type is susceptible to thyroid disorders, intestinal dysbiosis, insulin resistance, and inflammatory disorders. They have low serum factor VIII due to which they may have thin blood. The high protein demand and enormous physical activity can lead to the state of Ketosis in which the body metabolize protein and fats into ketones and them instead of sugar to keep the glucose level steady (Michael Müller, 2003), (D'Adamo PJ, 2002), (PJ., 2002).

Type A: Its ranks 3rd in blood type among Indians. Individuals with type A blood are suggested to follow a primarily vegetarian diet. They are encouraged to consume fruits, vegetables, grains, and legumes while avoiding red meat with low intensity workout. This diet is often called a "vegetarian" or "agrarian" diet. They produce insufficient amounts of intestinal alkaline phosphate and HCl, which prevents them from properly absorbing foods high in protein, when taken, can result in an allergic reaction. They have a higher concentration of starch-splitting enzymes amylase for efficient carbohydrate digestion. Blood becomes viscous because of a higher level of the blood clotting factor VIII, which can cause cardiovascular issues and worsen circulation. Consuming animal protein can lead to higher thickening of blood. Cortisol regulation is crucial for maintaining stress. Type A blood have experienced lower elevation of cortisol but this elevation is persistent which can lead to weight gain and adrenal hormone (D'Adamo PJ, 2002), (PJ., 2002).

Type B: It is 2nd most common blood type that is found in Indians. People with blood type B frequently have a combination of traits that are frequently specific to them and occasionally mirror those of blood type O. They are genetically predisposed to being very malleable and able to adapt well to changing environments. However, they tend to be sensitive to anything that threatens to knock them off kilter. It is advised that people with type B blood consume a more diverse diet consisting of dairy products, meat (apart from chicken and pork), cereals, and certain fruits and vegetables. They should also combine high-intensity exercise with relaxing techniques. It's considered a "balanced" diet. Blood Type B is extremely lectin sensitive, and removing chicken from their diet is often the first thing they mention. Foods high in lectins, like peanuts, buckwheat, corn, wheat, and lentils, can make it difficult to lose weight by inducing fluid retention, exhaustion, and hypoglycemia—a sharp drop in blood sugar following a meal. Lectins, passing through the gut lining, enter the liver's detoxification areas, rich in galactose and galactose-like sugars, potentially causing liver issues during detoxification. Liver dysfunction may result from the Kupffer cell's inability to distinguish between self and non-self cells. Self cells are those that belong to an organism's own body, while non-self cells are foreign cells or substances that come from outside the organism.

Due to an excess of the alpha glucosidase enzyme in the body, hyper assimilator tendencies can result in the overabsorption of nutrients (D'Adamo PJ, 2002), (PJ D. , 2002).

Type AB: It is known as modern blood type. This blood type is often advised to combine elements of the type A and type B diets. The recommendations include a mix of vegetarian and omnivorous foods with low intensity calming workout. Due to lack of anti-other-blood-type-bodies many bacteria are generally tolerated by them which can lead to gut microbiome dysbiosis. They rely on there lymphocytes for better immune response as they lack antibodies.(D'Adamo PJ, 2002),(PJ D. , 2002).

Criticism and Setbacks: The Blood Type Diet has garnered both attention and criticism since its inception. Supporters claim that adhering to the diet based on one's blood type can lead to improved health, weight loss, and overall well-being. However, many criticisms have been raised, primarily based on the lack of scientific evidence to support Dr. D'Adamo's claims.

- **Lack of Scientific Evidence:** One of the most significant criticisms of the Blood Type Diet is the lack of rigorous scientific studies to validate its claims. Most studies on this topic have been small-scale and inconclusive, making it difficult to draw definitive conclusions.
- **Individual Variation:** Critics argue that individual variations in metabolism and dietary needs are more significant than blood type in determining what constitutes a healthy diet. Genetics, lifestyle, and overall health play a crucial role in determining dietary requirements.
- **Nutritional Imbalance:** Some experts argue that the diet's recommendations may lead to nutritional imbalances, particularly in the case of Type O, which emphasizes a high-protein, low-carbohydrate diet.
- **Overly Simplistic:** The Blood Type Diet's categorization of diets into just four types is criticized for oversimplifying a complex topic. Human dietary needs are influenced by numerous factors, including genetics, environment, and cultural practices.
- **Commercial Interests:** Critics also point out that Dr. D'Adamo has commercialized the Blood Type Diet through books, supplements, and other products, which raises questions about his motivation and objectivity (Pittman, 2013),(Jäger, 2015).

CONCLUSION

The Blood Type Diet offers personalized dietary recommendations based on an individual's blood type. This approach aims to optimize health by aligning dietary choices with genetic predispositions associated with each blood type. For individuals with type O blood, a high-protein, low-carbohydrate diet is suggested, mirroring a "hunter-gatherer" lifestyle. Type A individuals are encouraged to follow a primarily vegetarian diet, while type B individuals may benefit from a more diverse diet that includes dairy, meat, cereals, and certain fruits and vegetables. Type AB individuals are advised to combine elements of both type A and type B diets. These dietary recommendations are tailored to each blood type's unique characteristics, potentially promoting better digestion, nutrient absorption, and overall well-being. Additionally, incorporating appropriate exercise regimens complements the

dietary guidelines, further enhancing health outcomes. The Blood Type Diet offers individuals a holistic approach to nutrition that considers their genetic makeup, potentially empowering them to make informed choices to support their health and vitality. The association between blood type and various clinical disorders underscores the intricate interplay between genetic predisposition and environmental factors in determining disease susceptibility. While certain blood types may confer a higher risk for conditions such as obesity, diabetes mellitus, cardiovascular disease, cancer, reproductive health issues, allergies, and infections, further research is needed to fully elucidate the underlying mechanisms. For women with blood groups O and B were linked to an increased risk of being overweight or obese. Blood groups AB are more prone to develop diabetes mellitus than blood groups A and B. Certain cancers and blood types may be related. Blood type O may have a lower risk of certain malignancies, however blood type A has been associated with a higher risk of stomach cancer.

Those who have blood type O may be more susceptible to peptic and stomach ulcers. A decreased ovarian reserve and a higher chance of recurrent miscarriages may be linked to blood type O. Neural tube abnormalities and birth problems may also be associated with maternal blood type A. Allergies like hay fever may be slightly more common in those with blood type A. People with blood type O may be less likely to develop certain allergies. Blood type can affect an individual's susceptibility to many infectious diseases, including COVID-19, cholera, norovirus, malaria, and H. pylori infection. The findings presented in this review paper provide valuable insights into potential avenues for personalized preventive strategies and therapeutic interventions tailored to an individual's blood type. By leveraging this knowledge, healthcare professionals can optimize patient care and empower individuals to make informed lifestyle choices to mitigate their risk of developing chronic diseases. Continued interdisciplinary collaboration and robust scientific inquiry are essential for advancing our understanding of the intricate relationship between blood type and clinical disorders, ultimately paving the way towards more effective disease prevention and management strategies.

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