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Review Article

Antibodies and immune-enhancing compounds: A comprehensive review

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Abstract

The immune system is a complex network of cells, tissues, and organs that safeguards the body against harmful environmental factors and maintains overall health. Its primary function is to mount an immune response to prevent infections and ensure the body's well-being. This defense mechanism involves the collaboration of white blood cells, the thymus gland, spleen, lymphatic glands, stem cells, proteins, and antibodies, among other components. White blood cells act as the front line of defense by identifying and eliminating pathogens. The thymus gland plays a crucial role in the development and maturation of T-cells, which are vital for adaptive immunity. The spleen filters the blood and removes old or damaged blood cells, while lymphatic glands serve as reservoirs for immune cells and filter lymph fluid. Stem cells contribute to the continuous renewal of immune cells. Proteins, including antibodies, play a critical role in identifying and neutralizing specific pathogens. Understanding the intricate workings of the immune system, along with the development of immune-enhancing compounds and antibodies, is essential for enhancing our ability to combat infections and maintain overall health.

Keywords: Antibodies, Different Types of Antibodies, Immune-Boosting Substances, and Immunity

Introduction

The immune system is a complex network of cells, tissues, and organs that work together to defend the body against harmful invaders, such as viruses, bacteria, and other pathogens. It plays a critical role in maintaining the body's overall health and preventing the development of various diseases. The immune system also helps the body to recognize and remove abnormal cells, such as cancer cells, before they can cause harm (Janeway et al., 2001). The goal of the study is to shed light on the immune system and its components, and the foods that contribute to boosting immunity."

An Antibody

An antibody is a part of the immune system in the body that takes the form of either T or Y. There are several types of antibodies that are primarily composed of four protein chains, with disulfide bonds between these chains. These four chains are divided into two matching groups: the first is a group of

light chains, and the second is a group of heavy chains. There is a joint between the two heavy chains called the Hinge region that connects them. At the amino end of the peptide chain of antibodies, there is a variable region, also called Fab, which contains a significant amino acid difference. The importance of this region is its ability to bind to disease-causing foreign substances in the human body. There are five types of antibodies in the body, each with its own specific task (Abbas et al., 2012).

Types of Antibody

The type of antibody produced by B cells may vary depending on the type of antigen and the presence of helper T cells, which is useful in the immune response. Having different types of antibodies contributes to better fighting certain antigens (Smith and Johnson, 2020). There are several types of antibodies, including Fig. 1.

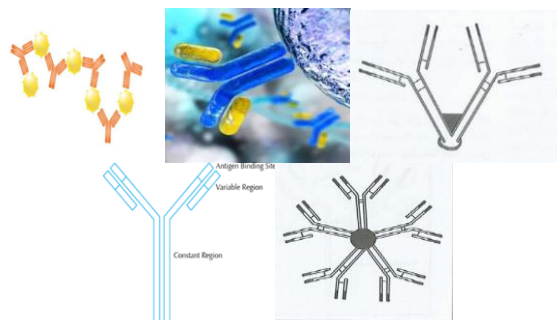


Fig. 1 Forms of some antibodies

IgG antibody

It contains heavy gamma immunoglobulin chains and is an antibody that exists as single molecules. It is the most flexible antibody and can perform all the functions of Ig immunoglobulin molecules. It is also the largest protein in serum and is found outside the bloodstream. It is the only antibody capable of crossing the placenta and activating complement molecules, binding to cells, and enhancing phagocytosis (Meyer and De Mey, 1990).

IgA Antibody

It contains alpha immunoglobulin heavy chain and is an antibody present in secretions in the form of dimers. It contains a chain and is capable of traversing mucous membranes without being degraded. It is the second most abundant antibody class in serum and the most abundant class of Ig present in secretions such as tears, saliva, colostrum (first breast milk), mucus, and others. It is also important for mucosal immunity and is associated with PMN cells, lymphocytes, and complement system activation (Cerutti and Rescigno, 2008).

IgM Antibody

It contains mu immunoglobulin heavy chain and has an additional domain on the mu chain (CH4). It binds with another protein through a disulfide bond and exists in the form of pentamers. IgM is the first antibody produced by the fetus and the third most abundant antibody in the serum. It activates the complement system and is effective in removing microbes. IgM also has the ability to bind to some cells through Fc receptors (Sohnle and Hunter, 2009).

IgD antibody

These antibodies contain the delta chain of heavy immunoglobulin and are present as single antibodies with low serum levels. They are mainly found on the surface of B cells and function as antigen receptors for antibody generators and do not activate the complement system (Kurosawa, 2017).

IgE antibodies

These antibodies contain the epsilon chain of heavy immunoglobulin and are the least common in serum. They strongly bind to Fc receptors on basophilic cells before interacting with antibody generators, and thus are involved in allergic reactions and play a role in diseases caused by parasitic worms (Kaplan, 2005).

How are antibodies produced?

The production of antibodies begins immediately when foreign substances such as toxins, viruses, bacteria, parasites, and other organisms enter the body. Routine materials are released as a defensive mechanism first by immune cells. The foreign substances are engulfed and chemically processed until they are destroyed completely and eliminated from the body (Tonegawa, 1983).

Mechanism of Antibody Action

Antibodies are large proteins with three axes that bind to a central point. These antibodies bind to antigens present on the surface of microorganisms that invade the body. When they bind to the antigen, it prevents the microorganism from reproducing or entering the body's cells. This stimulates a type of large immune cell called macrophages to search for and engulf these microorganisms bound to the antibodies (Nimmerjahn and Ravetch, 2010).

Some immune-boosting food

Maintaining a healthy and balanced diet is one of the most important ways to keep the immune system healthy. There are also some foods that can help strengthen the immune system and prevent certain diseases. Fermented dairy products like yogurt, kefir, buttermilk, and cheese are rich in natural yeast, which plays a role in boosting the immune system, reducing cholesterol, and increasing beneficial microorganisms that reduce allergies, lower blood pressure, and decrease the risk of malignant tumors, intestinal ulcers, and diarrhea. It is recommended to consume low-fat yogurt, especially during illness, weakness, or recovery after surgery, and to have a cup or two with every meal (Han et al., 2020).

It is also important to consume plenty of fresh vegetables, fruits, and salads in every meal to enhance the efficiency of the immune system, especially for patients with digestive system disorders, and to cleanse the body. Important vegetables include radish, peppers, carrots, cauliflower, watercress, celery, parsley, onion, garlic, pumpkin, eggplant, tomatoes, green beans, potatoes, spinach, and turnips. As for fruits, pomegranate, orange, tangerine, strawberry, banana, grape, apple, pear, avocado, watermelon, berries, cherry, kiwi, pineapple, apricot, lemon, peach, and dates are all great choices (Rondanelli, 2018).

Water is also important in improving immunity. Drinking two to three glasses of water on an empty stomach in the morning

and additional amounts throughout the day, such as a glass of water 30 minutes before meals, helps digestion, a glass of water before showering helps reduce blood pressure, and a glass of water before bed helps prevent heart attacks. Increasing water intake also helps to hydrate the mucous membranes that line the respiratory system and helps to produce antibodies and white blood cells, which increase the performance of the immune system (Martens and Gysemans, 2019).

Peaches, strawberries, watermelon, cucumber, juices extracted from organic wheat plants, small barley leaves, oats, green leafy vegetables such as spinach, seaweed, and sea vegetables are all functional foods that improve immune function (Martens and Gysemans, 2019).

There are also functional foods that improve immune function such as dietary fibers, fish oils, shiitake mushrooms, turmeric, black and green tea, flaxseed oil, olive oil, corn oil, garlic, blueberries, ginger, and omega-3 rich seafood (tuna and salmon). In addition to the above, there are some vitamins that participate in improving immune function, including (E, D, A, Folic acid, B12, B6) and some minerals such as iron, zinc, selenium, and copper (Çelik et al., 2019).

Some essential oils and scents can also improve the immune system, such as coconut oil, chamomile oil, and lavender oil. A healthy and balanced diet, accompanied by simple exercise, especially walking for 20-30 minutes a day, along with exposure to indirect sunlight that helps to form vitamin D, can also help to enhance immunity and immune system efficiency. (Ahmed et al., 2019; Table 1).

Table 1. Some immune-boosting foods

Food item	Size	Weight	Protein (g)	Fat (g)	Carbohydrates (g)	Calories (kcal)	Sugar (g)
M&M's Regular	One sachet	48	3.02	10.66	32.74	228.48	
Rice (cooked)	One cup	158	4.25	0.44	44.51	205.4	
Avocado	Cup (slices)	146	2.9	21.4	12.5	233.6	1
Pineapple	Cup (cut)	155	0.8	0.2	20.3	77.5	14.4
Canned pineapple	One cup	255	0.89	0.28	51.51	198.9	
Omelette	One egg	61	6.5	7.3	0.4	95.8	0.4
Vanilla ice cream	Half a cup	90	4.62	14.52	31.15	265.32	
Strawberry ice cream	Half a cup	90	4.22	11.09	36.43	253.44	
Chocolate ice cream	Half a cup	91	4.2	14.9	20.2	232	
Ice cream sandwich	One piece	63	3	6	27	170	
Green peas	Cup	160	8.6	0.4	25	134.4	9.5
Orange	Medium one	131	1.2	0.2	15.4	61.6	12.2
Sweet potato	Medium one	130	2	0.1	26.2	111.8	5.4
Parsley	10 twigs	10	0.3	0.1	0.6	3.6	0.1
Thermos	Cup	166	25.8	4.8	16.4	197.5	
Dates	4 pills	32	0.8	0.1	24	90.2	20.3
Blueberry	Cup	145	1.1	0.5	21	82.6	14.4
Black raspberries	Cup	144	2	0.7	13.8	61.9	7
Cranberries	Cup	95	0.4	0.1	11.6	43.7	3.8
Fig	Medium one	50	0.4	0.2	9.6	37	8.1
Watercress	Cup	34	0.8		0.4	3.7	0.1
Peach	Medium one	150	1.4	0.4	14.3	58.5	12.6
Dried plums	Cup(halves)	160	5.8	1.2	98.1	382.4	66.8
Purslane	Cup	43	0.6		1.5	6.9	
Spinach	Cup	30	0.9	0.1	1.1	6.9	0.1
Cantaloupe	Cup (pieces)	177	1.5	0.3	14.4	60.2	13.9
Black beans	Cup	164	14.5	4.2	45	269	7.9

Conclusion

In conclusion, the immune system is a complex system composed of several components, including antibodies, which are crucial in fighting foreign substances that invade the body. There are five types of antibodies, each with its own unique function. Maintaining a healthy and balanced diet is one of the most important ways to keep the immune system healthy, and certain foods can help boost immunity. These foods include fermented dairy products, fresh vegetables, fruits, and water.

Drinking enough water is also important in improving immunity.

Conflict of Interest

The author hereby declares no conflict of interest.

Consent for publication

The author declares that the work has consent for publication.

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