

Nutritional Status of Covid-19 Positive Patients

Stefania Pellino, Department of Prevention, Azienda Sanitaria Locale (ASL) Benevento, Benevento, Italy.
 Margherita Luciano, Department of Prevention, Azienda Sanitaria Locale (ASL) Benevento, Benevento, Italy.
 Rosamaria Luciano, Department of Prevention, Azienda Sanitaria Locale (ASL) Benevento, Benevento, Italy.
 Erika Mancini, Department of Prevention, Azienda Sanitaria Locale (ASL) Benevento, Benevento, Italy.
 Maria Concetta Conte, Health Direction, Azienda Sanitaria Locale (ASL) Benevento, Benevento, Italy.
 Gennaro Volpe, General Direction, Azienda Sanitaria Locale (ASL) Benevento, Benevento, Italy.
 Tommaso Zerella, Department of Prevention, Azienda Sanitaria Locale (ASL) Benevento, Benevento, Italy.

Abstract:- A good nutritional status has a beneficial influence on immune system. Nutritional status is determined by healthy food consumption, vitamins and microelements have an important role in supporting the immune system. Therefore, their deficiency could increase susceptibility to infections such as Covid-19 disease. The purpose of this study is to highlight how nutritional status affects the effectiveness of the immune response in Covid-19 positive patients.

The study was conducted from March 2020 to June 2020 at Health Prevention Department in Benevento (Campania Region, South Italy). 133 patients accepted the questionnaire in the form of telephone interview. Statistical test result using Odd test Ratio: 0,027 (IC 95%: 0,009- 0,082). The patients with a good nutritional status have 0,027 times to be asymptomatic compared to others with insufficient nutritional status.

Keywords:- Covid-19, Nutritional Status, Immune System.

I. INTRODUCTION

At the end of 2019 a new type of coronavirus was identified as the cause of a cluster of pneumonia cases in Wuhan, a city in the Hubei Province of China. It rapidly spread, resulting in an epidemic throughout China, followed by a global pandemic that was officially declared by the World Health Organization on the 11th of March 2020.

Coronavirus Disease (COVID-19) is asymptomatic or presents with mild/ moderate symptoms (fever, dry cough, fatigue, anosmia/dysgeusia) and heals without hospitalization but, in some patients, can cause bilateral interstitial pneumonia, respiratory distress syndrome up to death. Clinical features are determined above all by the underlying pathologies of the infected: the elderly and those who are already suffering from other diseases are certainly at greater risk of developing severe forms. Infection can have a different impact on the immune system, paving the way for a more or less serious form of Covid-19. The different course of the disease, regardless of the initial conditions of the infected, seems also guided by the immune response that is triggered in each patient. Therefore, in addition to strict compliance with the anti-contagion rules, it is essential to try to strengthen our immune system, which is closely linked to the intestinal microbiota.

Microbiota is the set of microorganisms that colonize the intestine and play a fundamental role in anti-inflammatory response against pathogens. 70-80% of the immune cells of our body are found in the intestine and, therefore, the efficiency of this activity depends on the variety of foods and the quality of the nutrients that we introduce daily with food.

Micronutrients, including vitamins (vitamins A, C, D, E) and trace elements (zinc, selenium, iron, magnesium), have an important role in supporting the immune system, therefore, their deficiency could increase susceptibility to infections.

For example, vitamin A is essential because it maintains the integrity of the skin and mucous membranes, which are the first barrier to external pathogens and some orange-colored foods such as carrots, pumpkin, apricots, egg yolk are rich of it.

Vitamin C cannot be synthesized by humans, so it is important to take it in the diet and it supports various cell defense mechanisms. A good vitamin C status counteracts common viral infections such as respiratory diseases and avoids the development of complications.

Vitamin D can modulate the innate and adaptive immune responses. Deficiency in vitamin D is associated with increased autoimmunity as well as an increased susceptibility to infection. Good sources of vitamin D are: oily fish (such as salmon, sardines, herring, mackerel) and egg yolks.

Zinc is an essential mineral found in all organs, tissues and body fluids and is the second most abundant trace mineral after iron. A deficiency has been associated with many pathological conditions, including colds and pneumonia. Zinc is found in legumes, pine nuts, walnuts, almonds and hazelnuts.

Finally, magnesium is the cofactor of over 300 cellular enzymes and its deficiency is associated with a state of chronic inflammation.

The aim of this study is to highlight how nutritional status affects the effectiveness of the immune response in Covid-19 positive patients.

II. MATERIALS AND METHODS

This study was conducted on 133 patients, 60 females (45,1%) and 73 males (54,9%) with Sars-Cov-2 infection during the first wave of Covid-19 pandemic in Benevento, a city of Campania Region (South Italy). We proposed a questionnaire in the form of telephone interview to a group of 192 Covid-19 positive patients treated by Health Prevention Department. Only 133 patients accepted the interview.

Non- respondents (59 patients) had severe symptoms or they were hospitalized. Interview was conducted from March 2020 to June 2020. The age of 133 patients ranged from 3 years to 91 years (Table 1); under-18 patients answered with parentals authorization. The patients, non-hospitalized, were classified into three groups: asymptomatic; paucisymptomatic (patients with anosmia and/or dysgeusia and/or asthenia and/or low-grade fever and/or headache and/or myalgia); mild-moderate symptomatic (TB > 37,5 C° and/or cough and/or dyspnea). Patients answered questions about their eating practices and, in particular, about their habits of consuming: fruits and vegetables (sources of vitamins and minerals), oily fish, nuts and seeds (sources of omega-3 and vitamin D), yogurt (sources of probiotics), wholegrain cereals (sources of fibers and B vitamins). Each of the four categories of anti-inflammatory foods is assigned a value of 2,5. Overall score is equal to 10 for patients who regularly consume these products. Score is equal to 7,5 for patients who consume three of four foods categories. Score of 5 is assigned to patients who consume two groups of anti-inflammatory foods and score of 2,5 is for patients who consume only one of these groups. In addition, patients should indicate whether they are taking vitamin supplements.

Age	Male	Female	Total
0 - 9	1	0	1
10 - 19	6	6	12
20 - 29	12	9	21
30 - 39	10	4	14
40 - 49	10	15	25
50 - 59	17	17	34
60 - 69	11	5	16
70 - 79	1	1	2
80 - 89	4	3	7
90 +	1	0	1
Total	73	60	133

Table 1. Characteristic of Covid-19 positive patients.

III. RESULTS

133 patients were interviewed: 97 (73%) were asymptomatic, 23 (17%) pauci-symptomatic, 13 (10%) with symptoms mild- moderate. Among asymptomatic patients, 65 said they regularly consume each category of foods totaling (score 10/10). 18 patients totaled a score of 7.5 (3 food categories of 4 consumed habitually), 7 patients reported consuming two categories of anti-inflammatory foods, 2

patients consumed only one of these and 5 patients totaled a score of 0.

In the group of pauci-symptomatic patients, only 3 patients got a score of 7.5, the same for score of 5, only one got a score of 10. 2 patients not consumed nothing about anti-inflammatory foods groups. The remaining 14 declared that they regularly consume only one of the categories of food indicated (score 2.5).

Of the 13 patients with mild-moderate symptoms, 9 got a score of 0. Only one patient scored 2.5 and another totaled 10/10 score. 2 patients declared that they consume two categories of anti-inflammatory foods. Nobody scored 7.5 score (Table 2).

Also, 80% of patients declared that they are overweight.

	Asymptomatic	Paucisymptomatic	Symptomatic
score 10/10	65 (67%)	1 (4%)	1 (8%)
score 7.5/10	18 (19%)	3 (13%)	0 (0%)
score 5/10	7 (7%)	3 (13%)	2 (15%)
score 2.5/10	2 (2%)	14 (61%)	1 (8%)
score 0/10	5 (5%)	2 (9%)	9 (69%)

Table 2. Distribution of Nutritional Survey Score.

The results of statistic test using Odd test Ratio are: 0,027 (IC 95%: 0,009- 0,082). A good nutritional status have 0,027 times to be asymptomatic compared with patients with insufficient nutritional status (Table 3). Nutritional status of Covid-19 patients is unknown but these results suggest that a deficiency of vitamins and minerals may decrease the immune defenses against Covid-19. However, more precise studies are needed.

Nutritional Status	Symptomatic	Asymptomatic
Good	5 (3,8%)	83 (62,4%)
Insufficient	31 (23,3%)	14 (10,5%)
Total	36 (27,1%)	97 (72,9%)

Table 3. Analysis of nutritional status in Covid-19 positive patients from March 2020 to June 2020).

This study had several limitations that are worth noting. First, it was a study conducted at a single province with a relatively small number of patients. Second, in this study many indicators of nutritional status were not measurable such as vitamin D level or minerals level. Third, this study not included patients with several symptoms.

IV. DISCUSSION

Nutritional status can affect the body's immune response to viral infections.

The ingestion of meals with a high energy content (fats and sugars) is able to trigger a metabolic and immune response in the body and over time to determine a chronic

inflammatory status. Adipose tissue, in particular adipose visceral tissue, causes an increase in the cytokines involved in the inflammatory pathways (TNF α , MCP-1, IL6, leptin, resistin, adiponectin, etc). Conversely, a diet rich in vitamins, antioxidants, minerals and omega-3 reduces the levels of pro-inflammatory cytokines.

Omega 3 are polyunsaturated fatty acids deriving from alpha linolenic acid. They are contained in large quantities in bluefish. They are precursors of anti-inflammatory molecules and perform cardio protective functions resulting in less platelet aggregation. The latter capacity is fundamental in counteracting prothrombotic activity in SARS COVID-19 infection. Fundamental are natural antioxidants such as vitamins A, C, E, selenium, carotenoids, lycopene, coenzyme Q-10 and lipoic acid. They are primarily present in fresh fruit and vegetables. These elements are able to counteract, slow down or neutralize the formation of oxygen radicals. Oxygen radicals, known as free radicals, can cause damage to various molecules and cell structures, primarily DNA.

In recent years, the importance of using probiotics and prebiotics has increasingly emerged. Probiotics are living and active microorganisms (especially bacteria) capable of benefiting the host. They are naturally contained in yogurt and live lactic ferments. Prebiotics, instead, are those non-digestible organic substances that promote the growth of good bacteria and therefore the general well-being of the organism. Prebiotics are introduced into the diet through foods rich in fiber.

Probiotics and prebiotics modulate the immune and inflammatory response by interacting mainly with epithelial cells, dendritic cells and lymphoid follicles (Peyer's plaques) at the level of the intestine (microbiota). It has also been shown that they stimulate the production of cytokines by Th-1 lymphocytes (IFN-gamma, IL-2, IL-12, TNF-alpha), Th-17 (IL-17, IL-22), T-reg (IL-10, TGF-beta), and instead decrease that by Th-2 (IL-4).

A good nutritional status and healthy eating habits, as demonstrated in our study, resulted in a better immune response with a reduction / absence of symptoms in patients with scores 10/10 and 7.5 / 10 compared to patients with scores 5/10, 2.5 / 10 or 0/10. Furthermore, we can hypothesize that patients with excellent nutritional status took fewer days to heal.

V. CONCLUSION

The relationship between immunity and nutrition is well known. The daily intake of foods rich in vitamins, minerals, fiber and probiotics supports to enhance the intestinal microbiota who is essential for immune defenses. This suggests that a more effective immune response may be evidenced in patients with an optimal nutritional status. However, more precise studies and additional research are needed.

Conflict of Interest

The authors have nothing to disclose.

REFERENCES

- [1]. Calder P.C., Carr A.C., Gombart A.F., Eggersdorfer M. Optimal Nutritional Status for a Well-Functioning Immune System Is an Important Factor to Protect against Viral Infections. *Nutrients*. 2020;12(4)
- [2]. Chandra R.K. Nutrition, immunity, and infection: present knowledge and future directions. *Lancet*. 1983
- [3]. Grant W.B., Lahore H., McDonnell S.L., Baggerly C.A., French C.B., Aliano J.L. Evidence that vitamin D supplementation could reduce risk of influenza and COVID-19 infection and deaths. *Nutrients*. 2020;12(4):988.
- [4]. Hänsch R., Mendel R.R. Physiological functions of mineral micronutrients (Cu, Zn, Mn, Fe, Ni, Mo, B, Cl) *Curr. Opin. Plant Biol.* 2009;12:259–266.
- [5]. Banerjee A., Kulcsar K., Misra V., Frieman M., Mossman K. Bats and coronaviruses. *Viruses*. 2019;11:41.
- [6]. Shahidi F., Ambigaipalan P. Phenolics and polyphenolics in foods, beverages and spices: Antioxidant activity and health effects-A review. *J. Funct. Foods*. 2015;18:820–897.
- [7]. Rock C.L., Jacob R., Bowen P.E. Update on the biological characteristics of the antioxidant micronutrients: Vitamin C, vitamin E, and the carotenoids. *J. Am. Diet. Assoc.* 1996;96:693–702. doi: 10.1016/S0002-8223(96)00190-3.
- [8]. Huang C., Wang Y., Li X., Ren L., Zhao J., Hu Y., Zhang L., Fan G., Xu J., Gu X., et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet*. 2020;395:497–506. doi: 10.1016/S0140-6736(20)30183-5.
- [9]. Islam M.T., Sarkar C., El-Kersh D.M., Jamaddar S., Uddin S.J., Shilpi J.A., Mubarak M.S. Natural products and their derivatives against coronavirus: A review of the non-clinical and pre-clinical data. *Phyther. Res.* 2020 doi: 10.1002/ptr.6700.
- [10]. Maggini S., Pierre A., Calder P.C. Immune function and micronutrient requirements change over the life course. *Nutrients*. 2018;10:1531.
- [11]. Orhan I.E., Senol Deniz F.S. Natural Products as Potential Leads Against Coronaviruses: Could They be Encouraging Structural Models Against SARS-CoV-2? *Nat. Prod. Bioprospect.* 2020 doi: 10.1007/s13659-020-00250-4.
- [12]. Maggini S., Pierre A., Calder P.C. Immune function and micronutrient requirements change over the life course. *Nutrients*. 2018;10:1531.
- [13]. Maggini S., Wintergerst E.S., Beveridge S., Hornig D.H. Selected vitamins and trace elements support immune function by strengthening epithelial barriers and cellular and humoral immune responses. *Proc. Br. J. Nutr.* 2007;98:29–35.

- [14]. Gombart A.F., Pierre A., Maggini S. A review of micronutrients and the immune system—working in harmony to reduce the risk of infection. *Nutrients*. 2020;12:236.
- [15]. Food and Agriculture Organization of the United Nations (FAO) Maintaining a Healthy Diet during the COVID-19 Pandemic
- [16]. Martineau A.R., Jolliffe D.A., Hooper R.L., Greenberg L., Aloia J.F., Bergman P., Dubnov-Raz G., Esposito S., Ganmaa D., Ginde A.A., et al. Vitamin D supplementation to prevent acute respiratory tract infections: Systematic review and meta-analysis of individual participant data. *BMJ*. 2017;356 doi: 10.1136/bmj.i6583.
- [17]. Gay R., Meydani S.N. The Effects of Vitamin E, Vitamin B6, and Vitamin B12 on Immune Function. *Nutr. Clin. Care*. 2001;4:188–198.