

Effect of a community-based nutrition intervention program about dietary immunonutrients during COVID-19 pandemic

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Abstract:

The global agitation caused by the coronavirus disease of 2019 has emerged the need to make today's population more aware of immune health to protect against disease and illness. Thus, we conducted a community-based nutrition intervention program that puts forward immunonutrition in the limelight. To study the effects of a community-based nutrition intervention program on (a) the significance of immunonutrients, (b) its rich sources and (c) its role to boost immunity against viral infections and diseases among a local community in Chennai city. This study used the pretest-posttest design consisting of pre-and post-survey conducted from 400 active participants selected by the random sampling method. Pretest and posttest involved the assessment tools like the 4-point Likert scale and 7-item food frequency questionnaire. The employed intervention strategies include the distribution of informative pamphlets and offering individual nutrition counselling that highlights the benefits of consuming immunonutrients- rich foods. The mean pretest score based on the perception of participants on the importance of immunonutrients was 2.022 ± 0.856 . Significant associations between age, education level, and socioeconomic status with the perception levels of the participants were observed ($P < 0.001$). A mean difference of 1.1200 ± 0.0603 was observed when compared with the posttest responses conducted three months after the intervention, showing a significant increase in their perception level ($P < 0.001$). Additionally, the consumption of immunonutrients rich foods studied using the 7-item food frequency questionnaire, also increased. Our intervention program was found remarkably effective for improving the awareness and consumption level of locally available, cost-effective immune-boosting foods among the participants and their intention toward healthy eating behavior. Thus, a community-based nutrition intervention program would help upgrade awareness about the synergism of nutrition, immunity, and infection.

Keywords:

Coronavirus; immunonutrition; nutrition surveys; pamphlets; nutrition intervention

Introduction:

In late December 2019, an unidentified microbial agent caused viral pneumonia among patients in Wuhan, China. ^[1] Subsequently, the causative pathogen was identified to be a novel coronavirus and was provisionally named as 2019 novel coronavirus (2019-nCoV). ^[1] The virus has now emerged as a major public health concern and has posed a life-threatening situation around the world. As a result, it is becoming crucial for people to possess awareness and knowledge about coronavirus disease and preventive measures to help the body cope with such potentially virulent viruses.

The prevailing pandemic of COVID-19 (abbreviation designated by the World Health Organization) has not evidenced any presently available curative medicine and thus has increased the need for the promotion of healthy dietary practices to strengthen the immune system. ^[2] This has urged the need for 'Prehabilitation', the strategies that help improve a patient's response to a physiological stressor in advance, before witnessing the stressor. ^[3] Immunonutrition is considered to be a form of 'prehabilitation', as diet plays an important role in enhancing the immune responses of the body against disease-causing pathogens. ^[4] It is studied to possess a key role in preventing viral infections. ^[4]

The co-relationships that exist within dietary intake, nutritional status, immune system and infections are bi-directional, as a result of which static impact is shown by diet and nutrition on the immune system competence and the severity of infections. ^[5] The reduced risk of development and persistence of inflammation in the lungs due to the interaction between coronaviruses and the innate immune systems of the hosts has been witnessed by studies. ^[6] Persistent amendments in the homeostasis of these innate immune system cells, marked by nutrition metabolites can modulate their capacity to fight infections. ^[7] Such nutrition metabolites, classified under immunonutrients consist of several dietary vitamins, minerals and antioxidants that have a critical effect on immune function, especially in the pathogenesis of many viral infections. ^[8] The Intervention of immunonutrients like omega-3-fatty acids, Vitamin A, Vitamin C, Vitamin D, Vitamin E, Zinc and Selenium supervised as a general supportive treatment for COVID-19 are said to be effective in the management of other viral infections like Influenza virus, Coxsackievirus, Human Immunodeficiency Virus, Bovine and Avian coronavirus. ^[9]

A balanced diet comprising immunonutrient rich foods, combined with adequate sleep, exercise and low stress, most effectively primes the body's immune system and determines the severity along with the risk of infections. ^[10] Hence, promoting immunonutrition as a part of public health policies is thus an alternative way to advocate prehabilitation and can reduce the thrust on healthcare systems. ^[3] Community-based intervention strategies and nutrition education at an individual level can provide a constructive effect on nutrition-related perceptions among the population. ^[11] However, to date, there are no related studies on intervention about immunonutrients in enhancing immunity that assessed the impact of nutrition education about immunonutrition on a local community in Chennai city. Thus, this study was proposed to target the following objectives:

- To assess the perception and awareness associated with the dietary immunonutrients and their potential ability to enhance immunity among the participants
- To provide them with nutrition intervention about the significance of strengthening immunity through healthy lifestyle and dietary practices.
- To encourage the consumption of foods rich in immunonutrients and provide knowledge on its dietary sources
- To evaluate the efficacy of the nutrition intervention program at an individual level on improving their awareness of immunonutrition and on increasing their consumption of immunonutrients rich foods.

Materials and Methods:

Experimental Design and Location of the study:

The study was conducted among 400 residents of Virugambakkam locality in Chennai city from April 2020 to June 2020. The simple random sampling method was used to select the participants for the pre-experimental research consisting of a one-group pretest-posttest design. Inclusion criteria for the participants were male and female adults assuring residence in the same area for the next three months, who were willing to participate in the study. The aims and methods of the study were clearly explained to all the participants and oral informed consent was obtained individually. Non-responders and children were excluded from the study.

Pretest Survey:

The pretest method involved an individual in-depth survey, supervised among the participants to derive the pre-requisite data for planning the intervention program. Strict social distancing protocols and hygienic practices were followed during the in-person visits. The socio-demographic characteristics of the participants including age, level of education, and socioeconomic status along with their level of awareness about the synergism between immune health and nutrition were obtained during the pre-survey. The first phase of the survey was focused to understand the general perception and awareness of the participants on the significance of immune health and the role of nutrition to strengthen it. During the second phase, the survey was narrowed to test their knowledge about the existence of various dietary immunonutrients and their rich food sources. Their verbal responses were recorded and categorized under a 4-point Likert scale as “not at all aware”, “slightly aware”, “moderately aware”, and “extremely aware” and were scored between 1-4 respectively. Following that, a food frequency questionnaire covering seven broad food categories rich in major immunonutrients such as millets, green leafy vegetables, other vegetables, citrus fruits, dairy products, fatty fish and nuts, was employed. Fatty fish were included in the questionnaire as all the participants of the community, were reported to be either non-vegetarians or pescatarians. The food frequency responses were categorized based on the three scales: “frequent”, “occasional” and “rare”. The one-in-one survey conducted during the pretest also aided to determine the language preferences and culturally appropriate methods for accessing the knowledge of the participants.

Nutrition Intervention Program:

Pretest data collected from the formative research was analyzed and was used to construct the tailored nutrition intervention program for the participants. As a part of the intervention strategies, personal nutrition education was delivered to each participant, through an in-person visit, concerning the current call for the intensification of immunity and suitable guidelines were established to promote healthy eating habits. The education included the nutrition recommendations at individual and community levels during the COVID-19 pandemic suggested under the Public Health Emergency COVID-19 initiatives.^[12] In addition, proper cooking methods to retain the nutritional benefits of foods were also explained during the nutrition education session. A Self-explanatory pamphlet was employed at the end of the session for each participant. Pamphlets were scripted in the local language of the community Tamil, which focused on major immunonutrients like Omega-3-Fatty acids, Beta Carotene, Vitamin-C, Vitamin-E, Proteins, Zinc, Selenium; their richest dietary sources and their roles in enhancing the immune system to prevent viral infections. As a majority of the participants belonged to low and middle socioeconomic status, low cost and easily available food sources of dietary immunonutrients were focused on in the pamphlets. Other guidelines to enhance immunity other than consumption of immunonutrients rich foods were also highlighted in the pamphlets, particularly the significance of probiotic foods; adequate intake of water; regular physical activity involving exercise and yoga; and the role of meditations along with relaxation techniques for a stress-free unconstrained mind. Thus the pamphlet served as a holistic education tool for empowering immunity as well as the overall well-being of the participants. After three months, a post-test was conducted to assess the effect of the nutrition intervention program using the same 4-point Likert scale and 7-item food frequency questionnaire, employed during the pretest.

Data Analysis:

A descriptive and inferential statistical analysis was made with the Statistical Package for Social science (SPSS) Statistics software version 25.0 [IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp] to study the effect of the intervention program. The pretest and posttest scores obtained from pre-and post-survey, recorded under the 4-point Likert scale were calculated and were analyzed using paired samples t-test to assess the effectiveness of the intervention program. One-way ANOVA was employed to the pretest scores with the socio-demographic characteristics of the participants to study its association. The scores obtained from the 7-items food frequency questionnaire to study the impact of the intervention program to change the frequency of dietary intake of immunonutrients rich food was calculated and analyzed using the Paired t-test for within-group differences of categorical variables. The significance level was set to $P < 0.001$ for all the tests.

Results and Discussion:***Demographic distribution of the participants***

Four hundred participants were studied under the intervention program using the pretest-posttest design consisting of the pre-and post-survey method. Participants were distributed based on different socio-demographic variables like age, gender, socio-economic

status and education level which are represented in Tables 1.1, 1.2, 1.3 and 1.4. People in the age group between 20 and 50 years showed greater interest to participate in the study. The study evidenced more male participants (69%) than female participants (31%). As the intervention was conducted in a local community, participants from the different hierarchies of socioeconomic status were recorded, out of which participants belonging to the middle class were significantly high (74.5%). About 8% of the population did not receive any formal education. However, they could read and understand the local language of the community.

Table 1.1 : Distribution of participants based on their age:

S.no	Category	Number	Percentage
1	≤ 19 Years	71	17.8
2	20-50 years	235	58.8
3	51-65 years	87	21.8
4	≥ 66 Years	7	1.8

Table 1.2: Distribution of participants based on their gender:

S.no	Category	Number	Percentage
1	Men	276	69
2	Women	124	31

Table 1.3: Distribution of participants based on their socioeconomic status:

S.no	Category	Number	Percentage
1	Lower class	61	15.3
2	Middle class	298	74.5
3	High class	41	10.3

Table 1.4: Distribution of participants based on their education Level:

S.no	Category	Number	Percentage
1	No formal education	32	8
2	Basic	66	16.5
3	High school	153	38.3
4	Graduates	149	37.3

Awareness of immunonutrients and their role in enhancing the immune system:

The mean pretest and post-test scores of the participants obtained from the pre-and post-survey data were calculated using the paired sample t-test. It is depicted in Table 2. Initially, the mean test score of the pretest survey data was very low (2.022 ± 0.856) depicting the inadequate awareness of dietary immunonutrients and their role in strengthening immunity among the participants. About 24% of participants were observed to be not at all aware of dietary immunonutrients. Only 7.3% of participants reported that they were extremely aware of immunonutrients and wished to learn more about them through the program.

At the end of the intervention, a mean difference of 1.120 ± 0.060 was analyzed between the pretest and post -test scores. Participants who were completely unaware of the co-relationships existing between nutrition and the immune system decreased from 96 (24%) to 13 (3.3%); participants who were slightly aware decreased from 211 (52.8%) to 79 (19.8%); those who were moderately aware increased from 64 (16%) to 146 (36.5%) and those who were extremely aware of the importance of immunonutrition raised from 29 (7.2%) to 162 (40.5%). Overall our intervention program resulted in a statistically significant increase in the level of awareness among the participants ($P < 0.001$).

Table 2: Comparison of test scores of pre- and post- intervention survey responses

Table 2: Comparison of test scores of pre- and post- intervention survey responses								
Scores	Not at all aware	Slightly aware	Moderately aware	Extremely aware	n	Mean ± SD	Mean difference± SE	P value
Pre-intervention	113 (28.2%)	194 (48.5%)	64 (16%)	29 (7.2%)	400	2.022±0.856	1.120±0.060	<0.001*
Post-intervention	13 (3.3%)	79 (19.8%)	146 (36.5%)	162 (40.5%)	400	3.142±0.844		
Note: *P<0.001, Paired samples <i>t</i> -test. <i>t</i> , dF=18.575,399. SD: Standard deviation, SE: Standard error								

Pretest responses and their correlation with the socio-demographic characteristics:

The influence of different socio-demographic characteristics on the pretest scores of the participants is represented in Table 3

Gender:

The pretest responses were not significantly affected by the gender of the participants

Age:

Age showed a statistically significant correlation with the pretest responses of the participants. The geriatric population between 50 and 60 years evidenced no participants who were unaware of immunonutrients. However, the younger generation of age between 19 and 30 years evidenced the highest number of participants who were either not at all aware or slightly aware of the roles and benefits of immunonutrients.

Socio-economic status:

The study revealed a statistically significant association with the socio-economic status of the participants. The highest proportion of participants who were not at all aware of immunonutrients belonged to the lower socio-economic status group. Most of the participants belonging to a high socioeconomic status were found to have sound knowledge about the roles and benefits of immunonutrients.

Education level:

A statistically significant correlation was found to be existing between the education level and the pretest response of the participants. Almost all the participants with basic education reported that they were not at all aware of immunonutrients. However, about 21% of participants with no formal education were found to be extremely aware of the immunonutrients and were able to list out a few immunonutrients rich foods. This is in contradiction to the fact that people with no formal education have less awareness about nutrition than those with basic education.

Table 3: Pretest responses and its correlation with the demographic characteristics:

Demographic Characteristics	Likert scale indications				Total	p-value
	Not at all aware	Slightly aware	Moderately aware	Extremely aware		
Gender						
Male	68	146	44	18	276	0.040
Female	45	48	20	11	124	
Total	113	194	64	29	400	
Mean ± SD Standard error	1.40±0.492 0.046	1.25 ± 0.433 0.046	1.31±0.467 0.058	1.38 ± 0.494 0.092		
Age						
Less than 19	61	1	2	7	71	0.001*
20-50 years	52	167	16	0	235	
51-65 years	0	26	46	15	87	
Above 60 years	0	0	0	7	7	
Total	113	194	64	29	400	
Mean ± SD Standard error	1.46 ± 0.501 0.047	2.13± 0.351 0.025	2.69 ± 0.531 0.066	2.76 ± 1.091 0.203		
Socio-economic status						
Low class	34	19	2	6	61	0.001*
Middle class	79	175	41	3	298	
High class	0	0	21	20	41	
Total	113	194	64	29	400	
Mean ± SD Standard error	1.70± 0.461 0.043	1.90±0.298 0.021	2.30 ± 0.525 0.066	2.48 ± 0.829 0.154		

Education level						
No formal education	21	2	2	7	32	0.001*
High school	66	0	0	0	66	
Basic education	14	125	14	0	153	
Graduates	12	67	48	22	149	
Total	113	194	64	29	400	
Mean $\pm$ SD	2.15 $\pm$ 0.847	3.32 $\pm$ 0.532	3.69 $\pm$ 0.639	3.28 $\pm$ 1.306		
Standard error	0.080	0.038	0.080	0.243		

Note: * $P < 0.001$ ANOVA. SD: Standard deviation

Changes in the frequency of consumption of dietary immunonutrients rich foods:

The 7-items food frequency questionnaire employed during the pretest revealed that most of the immunonutrients rich food groups were consumed either occasionally or rarely. It is evident from Table 7 that the intake of other vegetables and green leafy vegetables was high among the participants (77.8% and 45% respectively). However, the in-depth individual pre-intervention survey revealed that faulty cooking methods were employed by most of the participants. Following this, dairy and dairy products recorded the second-highest proportion of intake among the participants. While other food groups had an average distribution of intakes ranging from frequent to occasional, nuts, millets and fatty fishes met the highest proportions for being consumed rarely (67.8%, 44.3%, 41.8% respectively).

After the intervention program, the same questionnaire was employed during the posttest, and it was observed that the proportion of rare consumption of certain food groups reduced remarkably and was either occasionally or frequently consumed by the participants. The pretest and post-test scores categorized under “frequent”, “occasional” and “rare” accordingly, were calculated and analyzed using the Paired t-test (Table 4). A statistically significant increase was observed during the post-survey in the consumption of other vegetables, citrus fruits, dairy and dairy products, and fatty fish. On the other hand, there was no significant increase in the consumption of millets ($P=0.270$). Similarly nuts showed no statistically significant increase in their consumption among the participants ($P=0.078$). Green leafy vegetables did not show a significant increase. However the rare consumers of nuts and green leafy vegetables that showed statistically insignificant results, reduced from 271(67.8%) to 252(63%), and 60(15%) to 43(10.8%) respectively.

Table 4: Changes in the consumption of immunonutrients rich foods groups based on the responses recorded from the 7-item food frequency questionnaire during the pre- and post-survey (n=400)

S.no.	Food Groups	Categories	Pre-intervention		Post-intervention		P value
			N (%)	Mean $\pm$ SD	N (%)	Mean $\pm$ SD	
1	Millets	Frequent Occasional Rare	38(9.5) 195(48.4) 167(41.8)	2.322 $\pm$ 0.639	53(13.3) 156(39) 191(47.8)	2.345 $\pm$ 0.701	0.270
2	Green leafy vegetables	Frequent Occasional Rare	180(45) 160(40) 60(15)	1.700 $\pm$ 0.715	173(43.3) 184(46) 43(10.8)	1.675 $\pm$ 0.659	0.273
3	Other vegetables	Frequent Occasional Rare	311(77.8) 50(12.5) 39(9.8)	1.320 $\pm$ 0.643	329(82.3) 67(16.8) 4(1)	1.187 $\pm$ 0.415	0.000*
4	Citrus Fruits	Frequent Occasional Rare	74(18.5) 212(53) 114(28.5)	2.100 $\pm$ 0.679	282(70.5) 75(18.8) 43(10.8)	1.402 $\pm$ 0.675	0.000*
5	Dairy	Frequent Occasional Rare	205(51.3) 137(34.3) 58(14.5)	1.632 $\pm$ 0.723	293(73.3) 92(23) 15(3.8)	1.305 $\pm$ 0.536	0.000*
6	Fatty Fishes	Frequent Occasional Rare	64(16) 159(39.8) 177(44.3)	2.282 $\pm$ 0.723	89(22.3) 264(66) 47(11.8)	1.895 $\pm$ 0.574	0.000*
7	Nuts	Frequent Occasional Rare	48(12) 81(20.3) 271(67.8)	2.557 $\pm$ 0.698	54(13.5) 94(23.5) 252(63)	2.495 $\pm$ 0.722	0.078

Note: * $P < 0.001$, Paired sample t test. SD: Standard Deviation

On the effect of the intervention program, which emphasized proper processing and cooking methods of grains and vegetables to retain the maximal nutritional quality of the food, many of them reported that they have incorporated the guidelines in their daily cooking practices. Therefore, the community-based nutrition intervention program has imparted a constructive effect on the participants. It has been evidenced to improve their awareness of the importance of immune health; the role of dietary immunonutrients to maintain it and several culinary modifications focusing on the same.

The nutrition intervention program was conducted amidst the prevailing pandemic situation, in concern to the alarming address declared by the Food and Agricultural Organization (FAO) of the United Nation, regarding the impact of COVID-19 on food security and nutrition. According to FAO, people tend to shift diets to more affordable as well as more shelf-stable and pre-packaged foods (which can be less nutritious).^[13] Thus the significance to consume fruits, vegetables and other protective foods may become negligent among people. Even though the diets consumed across the world are poles apart, unbalanced diets are the chief

health threat during the COVID-19 pandemic and it impacts the death rates in addition to the quality of life. ^[14] The review of Gasmi et al. has highlighted that the range of clinical severity of COVID-19, whether the virus-contracted hosts are asymptomatic, mild, moderate or to death, was proportional to the metabolic conditions of the individuals which were highly influenced by their dietary intake, nutritional status, age, sex, medical conditions, lifestyle and environmental factors. ^[15] Maintaining the immune system effectively is vital which can be achieved by escaping the episodes of nutritional deficiencies which may impair the immune responses, immune cell interaction, proliferation and triggering.

In response to this, we administered nutrition intervention to 400 active participants, selected by the simple random sampling method, from a local community in Chennai city. The city was actively accounted for a majority of fresh coronavirus cases reported in Tamil Nadu. ^[16] The state saw the highest number of coronavirus cases with about 161 fresh cases during April month in 2020, in Chennai city itself had 138 cases depicting a clear peaking trend. ^[17] Due to his strict lock-down restrictions were imposed all over the city with limited food access. Lack of well-grounded food availability, increased practices of hoarding and panic-buy gave rise to concerns about food security among the localities. People were restrained to stay at home which had various influences on their lifestyle and dietary habits. This agitated the need for individual risk evaluation and prevention strategies at the community level. In a recent study by Otieno et al., it has been concluded that nutritional strategies for enhancing immunity are something to be explored for vulnerable populations. ^[18] Correspondingly, a study by Kritas et al. revealed that effective COVID-19 management can be employed by anti-inflammatory strategies consisting of either medications, food or nutrients. ^[19] Accordingly, our study involved nutrition intervention focusing on antioxidants rich dietary immunonutrients such as Omega-3-Fatty acids, Beta Carotene, Vitamin-C, Vitamin-E, Zinc, Selenium, in a local community in the city. Moreover, our current study is the first community-based nutrition intervention on immunonutrition in a local community in Chennai city.

The assessment tools used during the pretest were the 4-point Likert scale and a 7-item food frequency questionnaire. A 7-item food frequency questionnaire can correlate more accurately with the reference values, as concluded by a study that compared the effectiveness of a 7-item versus 31-item food frequency questionnaire. ^[20] It was observed that low-cost, seasonal vegetables were consumed at a higher rate among the community, as their locality was nearest to the city's largest wholesale market. It was noted that most of them include at least two varieties of vegetables in their daily diets. We conducted an in-depth survey during the pretest so that more data can be collected to structure the intervention program effectively. Consequently, we found that although participants reported consuming vegetables frequently, most of them followed improper processing and cooking methods such as washing vegetables after cutting them, deep frying and boiling vegetables for a long time followed by discarding the water. Based on their responses, it was also noted that poor consumption of nuts was due to their high cost in the markets. Participants expressed that millets have a nutty flavor and it involves difficult time-consuming methods to cook them properly. Despite being non-

vegetarians, most participants consumed fatty fish rarely, and those who frequently consume preferred deep fry cooking methods.

As a part of the intervention program, education was employed, not only to increase their awareness about various easily available, cost-effective immunonutrient rich foods but also the culinary guidelines to retain their nutritional benefits. These strategies served as the basis of the changes observed in the food frequency pattern of the participants post-intervention. Similar interventions were incorporated in a study by Hasan et al. that evidenced improved attitudes, self-efficacy along with healthier dietary intake among the participants when culinary interventions were integrated with culinary interventions.^[21]

Online intervention through virtual education could have been used to safely approach participants in this pandemic situation. But in our study, face-to-face in-person education to each participant was supervised as a part of nutrition intervention, in contrast to a similar health intervention involving diabetes education program adopted by the K-State Research and Extension educators, through virtual delivery.^[22] Their program met technical difficulties in addition to the loss of personal contact of the participants.^[22] Similarly, the results of the studies by Kelders et al. , Postel et al. , Ludden et al. collectively revealed the key fact that computer-based interventions are more vulnerable to the discrepancy between the objectives of the intervention and that of the participants.^[23] Moreover, they are associated with higher attrition as they are less flexible in adapting the situations and user characteristics.^[23] Thus our present study involved an in-person education at the individual level, based on the recommended actions released by the International Federation of Social Workers (IFW) concerning the social service workforce safety and well-being during the COVID-19 response.^[24] Following their guidelines for in-person visits, provision of basic protective gear, alongside social distancing and proper hygienic practices such as hand washing and cleaning surfaces were observed throughout the intervention program.

We also distributed self-explanatory pamphlets at the end of the individual education session, summarizing major key points covered during the session. It proved to be an effective education tool to change their perception levels and many of the participants reported that they were following the lifestyle modifications mentioned in the pamphlets. A Similar impact was observed in a study by Ali et al., which assessed the effectiveness of educational pamphlets in improving knowledge among the adult population regarding the Human papillomavirus infection and its vaccination.^[25]

Our nutrition intervention is given to both community and individual involving nutrition education through in-person interviews and pamphlets indeed increased the awareness and dietary patterns among the residents of a local community in Chennai. The results of our studies correspond to those obtained in the nutrition intervention program on fruits and vegetable intakes conducted among adults who reported changes in dietary patterns, knowledge and attitudes through nutrition lectures and education tools like pamphlets.^[26]

The limitations of the intervention program are the curtailment to make the intervention more continuous with multidimensional assessments. Fear of infection among the participants imposed the condition to conduct personal interviews and nutrition education sessions for a

limited duration. The food frequency questionnaire could not exactly indicate the type of immunonutrients consumed at adequate levels. Despite the three months intervention changing the frequency of immunonutrients rich foods among the participants, it may not be representative of long term dietary habits as the community is exposed to various socio-economic as well as cultural changes. Availability of commodities and economic conditions were affected during the COVID-19 pandemic, hindering the consumption levels of these foods among the participants. Some of them reported that millets and nuts, could not be included in their diets due to the inadequate availability of commodities in markets during the pandemic situation.

A multi-level framework using the levels of ecological health model: individuality, community, national and global, is suggested to support nutrition and food safety during the COVID-19 pandemic. ^[12] Our study has focused on the promotion of these strategies at an individual as well as community level. Limited data is available that studied the efficacy of large-scale immunonutrition awareness interventions among common people. Hence, more studies must be developed to assess the effect of nutrition education on dietary immunonutrients. Besides, theory-driven approaches should be applied to a diverse and larger sample, which can facilitate public health educators to promote the importance of immunonutrition as a part of intervention strategies.

Conclusion:

Our study assessed the effect of the nutrition intervention program in a local community in Chennai city about the roles and benefits of immunonutrients. It indicated a significant increase in the level of awareness among the participants about the importance of dietary immunonutrients and other lifestyle modifications to boost their immunity. The intervention program has been conducted beyond the limits imposed by the outbreak of the novel COVID-19 on public healthcare systems. The dietary intakes of foods rich in immunonutrients were also increased. However, the frequency of millets and nuts intakes did not show much increase as a result of poor access to commodities coupled with socioeconomic constraints resulted due to the pandemic situation. A large-scale intervention involving many educational tools and techniques focusing on dietary immunonutrients and other dietary practices to strengthen immunity must be developed. Our present study reinforces that interventions focusing exclusively on immunonutrients must be an essential element of approaching public health-promoting strategies.

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Conflict of interests:

No conflicts of interest.

Reference:

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