

ORIGINAL ARTICLE

Nutrition education has significant impact on perceived barriers to healthy diet among adults with and without COVID-19 history

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Abstract. Healthy diet is an important tool to lower the risk and severity of COVID-19 infection. Low diet quality is usually caused by perceived barriers that stop people to do certain behavior. Perceived barriers can be overcome by implementing proper method such as conducting nutrition education. This study aimed to analyze the impact of nutrition education on perceived barrier to healthy diet among adults with and without covid-19 history in Padang, Indonesia. This study was a pre-experimental study using pre and post-design. This study was conducted on 70 adults with or without COVID-19 infection history, residing in Padang, Indonesia. The intervention was given in the form of nutrition education. Difference test was conducted to assess the impact of nutrition education on respondents' nutrition knowledge and perceived barriers. The majority of the respondents both with and without COVID-19 history (71.4 and 80%) had medium level of nutritional knowledge before the intervention. After the intervention, there was a significant ($P < 0.05$) improvement on respondents' nutritional knowledge for both groups (100%). The result also showed 40% of the respondents with COVID-19 history had medium level of perceived barriers, while 28.6% respondents without COVID-19 history (65.7%) had medium level of perceived barriers before the intervention. A significant improvement

($P < 0.05$) also showed on respondents' perceived barriers after the intervention. On both groups more 90% of the respondents only had low level of perceived barriers. The result shows that nutrition education has significant impact both on respondents' nutritional knowledge and perceived barriers.

Introduction

Healthy diet can be defined as diet which consist various kinds of foods in certain proportion and quantities that fulfill a person's nutritional needs. Healthy diet is an important tool to prevent not only malnutrition but also various diseases, such as COVID-19. Extensive evidence shows a strong correlation between healthy diet and COVID-19 infection (1-3). Previous studies showed that Healthy diet may lower the risk of COVID-19 infection by 0.91 and lower the severity COVID-19 infection by 0.59 (4). Healthy diet is associated with high consumption of vegetables, fruits, whole grains, legumes, nuts, and seeds as well as low consumption of added sugar, processed meats, and sugar-sweetened beverages. It will provide balanced nutrition to support immune system to fight against COVID-19 infection (5).

The problem is that there still a lot of people who has low adherence to healthy diet. Previous studies showed that the prevalence of low diet quality is still high among Indonesian citizens (6-8). The same result also observed during pandemic COVID-19. Even the study conducted by Fauziyana *et al* (2022); showed that 93% of elderly in Jakarta had poor diet quality during Pandemic COVID-19 even though they were at greater risk of COVID-19 infection.

Low adherence to healthy diet can be caused by many factors including people's perceived barrier regarding healthy diet (5). Perceived barrier is one of six concepts in Health Belief Model. Health Belief Model describes the influence of people's beliefs on their health-related actions and behaviors (9).

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1 Perceived barriers usually portray people's view regarding
2 obstacles that stand in the way of behavior change. Barriers
3 can be both tangible such lack of resources and intangible such
4 as psychological influences (10).

5 Perceived barriers is the most significant factor in deter-
6 mining behavior change. Strong barriers will stop people to
7 adopt the new behavior. Barriers will make people think the
8 benefits of the new behavior do not outweigh the consequences
9 of the old behavior. That's why it's important for people to
10 overcome their barriers (10).

11 There are many ways to overcome barriers. One of
12 them is through education. Education is a process in which
13 set of learning experiences is delivered. To overcome
14 perceived barriers to healthy diet, nutrition education is
15 usually delivered. During the process materials regarding
16 eating other nutrition related material is usually delivered.
17 Through nutrition education people's knowledge regarding
18 nutrition and health will be improved. Improved knowl-
19 edge will lead to the improvement of nutrition and health
20 literacy. Improved nutrition and health literacy will improve
21 attitude towards nutrition and health behavior. In the end it
22 will also improve nutrition and health practices (11-13).

23 COVID-19 is still being a major problem in Indonesia
24 till today. It is important to improve the diet quality of its
25 people to lower the risk and severity of COVID-19 infection.
26 Overcoming barriers become an important factor to achieve
27 the improvement in diet quality. Thus, appropriate action is
28 needed to be taken such implementing nutrition education
29 which already proved to be able to overcome barriers signifi-
30 cantly. Therefore, this study aimed to analyze the impact of
31 nutrition education on perceived barrier to healthy diet among
32 adults with and without covid-19 history in Padang, Indonesia.
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34 **Material and methods**

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36 The present pre-experimental study used pre and post-test
37 design. The intervention was conducted in the form of nutrition
38 education. This study was conducted on total of 70 adults with
39 or without COVID-19 history, residing in Padang, Indonesia.
40 The study was conducted from June to November 2022.
41 Respondents aged 18-59 years old were included in this study.
42 This study was part of major study entitled *Application of*
43 *Health Belief Model towards Nutrition Education Intervention*
44 *to Improve Supplement and Nutrients Intake of Adults with*
45 *and without Covid-19 History* and approved by Health
46 Research Ethical Clearance Commission of the Faculty of
47 Dental Medicine, Airlangga University, Surabaya, Indonesia
48 number 362/HRECC.FODM/VI/2022.
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50 *Nutrition education.* The intervention of the present study was
51 given in the form nutrition education. There were three mate-
52 rials delivered during the intervention. They were Balance
53 Nutrition and Health Belief Model COVID-19 Pandemic, The
54 Role of Health Supplements in Improving Immune System,
55 and Nutrition and Immunity. The educations were conducted
56 in group, once every two weeks week for total of six meet-
57 ings. Each education materials were delivered twice. The
58 educations were not only given in the form of counseling but
59 also independent modules study. Respondents were given
60 pre-test before education and post-test after education. The

61 pre and post-test consisted of ten questions for each material 61
62 with maximum total score of 10 to determine the nutritional 62
63 knowledge level of the respondents. The nutritional knowledge 63
64 levels were classified based on following cut-off points; high 64
65 level (>8), medium level (6-8), and low level (<6) (14). 65
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67 *Perceived barriers.* Perceived barriers was analyzed using ten 67
68 structured question related to barriers regarding healthy diet. 68
69 Respondents were given five choices of opinion for each ques- 69
70 tion. The choices range from strongly agree, agree, neutral, 70
71 disagree, and strongly disagree. Scoring was also given for 71
72 each choice range from 5 for strongly agree and 1 for strongly 72
73 disagree. Strongly agree described strong barrier for each 73
74 question. The maximum total score for perceived barriers was 74
75 50 which then classified based on following cut-off points; 75
76 strong (>40), medium (30-40), and low (<30). 76
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78 *Data analysis.* The data were analyzed using IBM SPSS 78
79 software version 23 (IBM Corp., Armonk, New York, United 79
80 States of America). Descriptive statistic was conducted to 80
81 dissect respondents' characteristics and perceived barriers. 81
82 Independent t-test was carried out to analyze the perceived 82
83 barriers level between respondents with and without 83
84 COVID-19 history groups. Paired t-test analysis was also used 84
85 to analyze the impact of nutrition education on respondents 85
86 perceived barriers on the same group. 86
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88 **Results**

89
90 This study was conducted on 70 adults with or without 90
91 COVID-19 infection history. The result showed that majority 91
92 of the respondents (81.4%) were age 18-39 years old or on their 92
93 early adulthood (15). 70% of them were also female. Most of 93
94 the respondents (45.8%) had high education level with them 94
95 being university graduates. The data on COVID-19 infection 95
96 history showed that half of the respondent were infected by 96
97 COVID-19. The result also showed that most of the respon- 97
98 dents (37.1%) had normal nutritional status but the obesity 98
99 prevalence was found 10% higher than the prevalence in 2018 99
100 (Table I) (16). 100

101 Intervention given during this study was in form of nutri- 101
102 tion education. The education was conducted once in every 102
103 two weeks resulting in 6 meetings for three months long. 103
104 Table II showed that majority of the respondents both with 104
105 and without COVID-19 history (71.4 and 80%) had medium 105
106 level of nutritional knowledge. Independent t-test also showed 106
107 there was no significant difference ($P=0.623$) in both group's 107
108 nutritional knowledge before the intervention. Table II also 108
109 showed that after intervention, 100% of respondents in both 109
110 groups had high level of nutritional knowledge. The average 110
111 total score of nutritional knowledge before intervention in both 111
112 groups were 6.7 ± 0.9 and 6.8 ± 1.0 respectively. The result also 112
113 showed a significant improvement ($P<0.05$) after intervention 113
114 in both group by 2.4 and 2.5 points respectively. 114

115 Perceived barriers is the most significant factor in deter- 115
116 mining behavior change. The stronger the barriers, the new 116
117 behavior will be more difficult to adopt (10). The present 117
118 study showed that 40.0% of the respondents with COVID-19 118
119 history had medium level of perceived barriers before the 119
120 intervention. Only 28.6% respondents without COVID-19 120

Table I. Characteristics of respondents.

Characteristics	n	%
Age		
Early adulthood (18-39 years old)	57	81.4
Midlife (40-59 years old)	13	18.6
Sex		
Male	21	30
Female	49	70
Education level		
Primary school graduate	1	1.4
High school graduate	26	37.1
Associate graduate	11	15.7
University graduate	32	45.8
COVID-19 infection history		
Yes		
No		
Nutritional status		
Underweight (<18,5 kg/m ²)	9	12.9
Normal (18,5-22,9 kg/m ²)	26	37.1
Overweight (23-24,9 kg/m ²)	13	18.6
Obesity (>25 kg/m ²)	22	31.4

history (65.7%) had medium level of perceived barriers before the intervention. The Nevertheless, there was no significant difference ($P=0.565$) on respondents' perceived barriers in both group before the intervention. Result also found respondents with strong level of perceived barriers before the intervention in both groups. The study showed that the intervention gave a significant impact ($P<0.05$) in both groups' perceived barriers. There were no respondents who had strong perceived barriers after the intervention and more than 90% of respondents in both groups only had low level of perceived barriers (Table III).

Table IV showed the dissection of respondents' perceived barriers. Before the intervention, most of the respondents (58.6%) stated that they could not adjust the portion of food according to dietary guidelines when they were busy working. 40% of the respondents also stated that in the of the month, they could not eat balanced nutritious food because of economic reason. Nevertheless, those statements were no longer found after intervention. Another barrier that mostly faced by respondents before intervention was the difficulty in adjusting portion sizes according to dietary guidelines when they were eating with their family (44.3%). The reason was because they felt bad for refusing the served foods. After the intervention, there was an improvement on given statement (24.3%).

Discussion

Nutrition education level is influenced by many factors such as education. Higher education is usually associated with higher nutrition knowledge. Higher education means taking forming education longer. People with higher education will have more knowledge since they have more access and exposures on

new information (17,18). The present study observed similar result. The result showed more than half of the respondents had higher education with them being associate and university graduates. Although we found no significant correlation between respondents' education level and their nutritional knowledge before the intervention, the results tended to show similar result. Before the intervention, both groups only had low prevalence of low level of nutritional knowledge.

Nutrition education will give more exposures on nutrition and health related information. Those exposures will increase people's knowledge. With increased knowledge, people will have a new view on the harms or benefits of certain nutrition and health related behavior including healthy diet (19-21).

Extensive evidence already showed that nutrition education is significantly improved knowledge, attitude, and practice (22-26). Similar results were observed in this study in both groups. Before the intervention, majority of respondents only had medium level of nutritional knowledge and only less than 10% who had high level of nutritional knowledge. Nutrition education in this study gave significant impact on both groups' nutritional knowledge. After the intervention, it was observed that all the respondents in both groups had high nutritional knowledge level.

Nutrition education can be delivered in many methods, but it will be more effective if it is delivered using mix methods and longer intervention times. Previous study showed that nutrition education which was given through nutrition counseling in addition of booklets gave better impact compared to with no nutrition counseling (27). The present study used the same methods. We combined the nutrition modules with nutrition counseling and we observed significant impact, the same as previous study.

Nutrition education will give more effective impact if it is delivered for longer times. The previous study showed that to obtain improvement not only in knowledge, but also attitude and practices, minimum of 3 months education is needed (28). With the same intervention time, we also observed the same result. We were only observed aa significant improvement in respondents' knowledge but also on respondents' perceived barriers to healthy diet.

Perceived barriers is related to a person's view and opinion which form their attitude regarding certain behavior (10). After the intervention, strong perceived barriers were no longer be found and more than 90% of the respondents' with and without COVID-19 infection history only had low perceived barriers to healthy diet.

The present study was not only observed intangible barriers on respondents but tangible ones, such as economic factor. COVID-19 Pandemic gave strong negative impacts on economic sectors. With job loss and reduced income, healthy food become less affordable for them especially during the end of the months. After the intervention, this barrier was no longer found so were another barriers (29).

This study not only supports previous studies reagrding the positive impacts of nutrition education on knowledge and perceived barriers, it also gives a new perspective during Covid-19 Pandemic setting. This study was also the first study that was conducted in Indonesia so that it can give the new perspective for Indonesia. Our study employed trained enumerators to minimalize measurement bias.

Table II. Nutritional knowledge of respondents.

Nutritional knowledge level	Before Intervention				After Intervention			
	With COVID-19 history		Without COVID-19 history		With COVID-19 history		Without COVID-19 history	
	n	%	n	%	n	%	n	%
Low (<6)	7	20.0	5	14.3	0	0	0	0
Medium (6-8)	25	71.4	28	80.0	0	0	0	0
High (>8)	3	8.6	2	5.7	35	100	35	100
Mean Score \pm SD	6.7 \pm 0.9		6.8 \pm 1.0		9.1 \pm 0.3		9.1 \pm 0.3	

Table III. Perceived barriers to healthy diet of respondents.

Perceived barriers level	Before Intervention				After Intervention			
	With COVID-19 history		Without COVID-19 history		With COVID-19 history		Without COVID-19 history	
	n	%	n	%	n	%	n	%
Low (<30)	19	54.3	23	65.7	32	91.4	33	94.3
Medium (30-40)	14	40.0	10	28.6	3	8.6	2	5.7
Strong (>40)	2	5.7	2	5.7	0	0	0	0
Mean Score \pm SD	28.0 \pm 5.8		26.8 \pm 6.2		22.1 \pm 5.2		21.4 \pm 5.1	

Table IV. Perceived barriers of respondents.

Perceived barriers questions	Percentage of respondents' agreement			
	Before Intervention		After Intervention	
	n	%	n	%
If today is the end of the month, I can't eat balanced nutritious food because it's expensive	28	40.0	0	0.0
I'm busy working so I can't adjust the portion of food according to the recommended balanced nutrition	41	58.6	0	0.0
I feel bad if I have to eat salad alone when my friends eat fast food.	24	34.3	11	15.7
I was opposed by my parents when I wanted to take supplements to boost my immunity	7	10.0	4	5.7
I have a hard time eating a balanced nutritious diet when I'm on vacation	24	34.3	14	20.0
I feel bad for refusing food so I can't adjust the portion sizes according to balanced nutrition guidelines when I'm eating with my family	31	44.3	17	24.3
I can't take supplements because I have a certain disease	15	21.4	9	12.9
I don't know the type and amount of supplements I should take	25	35.7	16	22.9
I am not familiar with the concept of balanced nutrition	24	34.3	16	22.9
Nutritious balanced meals can't be found in food delivery apps	22	31.4	16	22.9

Conclusions

Nutrition education gave positive impacts both on respondents' nutritional knowledge and perceived barriers. Through nutrition education, respondents' nutritional knowledge was improved significantly. Some statements regarding perceived barriers on healthy diet were still found after the intervention, especially the intangible ones. Nevertheless, nutrition education was able significantly improved respondents' perceived barriers. Thus, it is important for the government to increase nutrition education programs on healthy diet to lower people's perceived barriers in order to prevent COVID-19 infection.

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Ethical approval and consent to participate

The study was approved by the Health Research Ethical Clearance Commission of the Faculty of Dental Medicine, Airlangga University, Surabaya, Indonesia number 362/HRECC.FODM/VI/2022.

Conflict of interests

The authors declare no potential conflict of interest.

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