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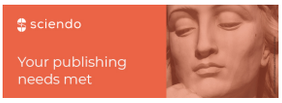

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Sociodemographic Factors and Nutritional Knowledge Impacts on Overall Vitamin B12 Intake in Older Women

Patwa Amani[1]*, Donna Adriani[1], Mustika Anggiane Putri[1], Yudhisman Imran[2], Irmiya Rachmiyani[3], Nany Hairunisa[3]

[1]Department of Physiology, Faculty of Medicine, Universitas Trisakti, Jakarta, Indonesia; [2]Department of Neurology, Faculty of Medicine, Universitas Trisakti, Jakarta, Indonesia; [3]Department of Obstetrics and Gynecology, Faculty of Medicine, Universitas Trisakti, Jakarta, Indonesia

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***Correspondence:** Patwa Amani, Department of Physiology, Faculty of Medicine, Universitas Trisakti, Jakarta, Indonesia. E-mail: patwa.amani@trisakti.ac.id
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Abstract

BACKGROUND: The older population is at high risk for vitamin B12 deficiency, leading to various significant and chronic health problems.

AIM: This study aimed to determine the association between sociodemographic characteristics, nutritional knowledge and overall vitamin B12 intake among older persons.

METHODS: An observational study with a cross-sectional design was directed to 69 older women aged > 50 years. Data was collected from subject responses to various questions on the google platform, guided by professional assistance.

RESULT: The study showed an inversed association between employment status ($p<0.05$), income level ($p<0.001$) and overall vitamin B12 intake, including dietary and supplement intake. The results provided new insights on monthly income level playing a crucial role in VB12 rich food consumption patterns in older persons, which were mostly unemployed.

CONCLUSION: Efforts are needed to increase the coverage of VB12 supplementation, either peroral or intramuscular injection, as a solution to meet the needs of VB12 source that is affordable and effective for the older population.

Introduction

The increase in life expectancy has an impact on the rise in the older population. This condition is a future challenge for health providers to help the elderly remain healthy and maintain their productivity also the quality of life. Vitamin B12 deficiency (VB12) is a condition that is often found in the elderly, with the population affected increasingly proportional to the age. Several studies have shown that the prevalence of VB12 deficiency in the elderly ranges from 5% to 40% depending on the age group and the type of VB12 test used [1], [2]. VB12 deficiency in the elderly is a significant health concern. It has a wide range of symptoms, often unrecognized by the health provider and causing chronic health problems, especially in the hematological and neurological systems [3].

Hematological manifestations in VB12 deficiency patients are related to megaloblastic anemia, causing general symptoms such as fatigue, dyspnoea, palpitations, and pallor [4]. The neurological symptoms include peripheral neuropathy, irritability, areflexia, proprioceptive disorders, even cognitive impairment in the form of dementia, and acute psychosis in severe deficiency conditions [5]. The clinical consequence of VB12 deficiency that has an impact on the elderly but is not widely known is hyperhomocysteinemia, an independent risk factor for cardiovascular diseases [1], [6]. Studies in both animal and human models have shown that VB12 deficiency increases the risk of cardiac arrhythmias, myocardial infarction, ischemic stroke, liver steatosis, even renal abnormality[7], [8], [9], [10], [11].

VB12 deficiency in the elderly is mainly due to lack of intake and impaired absorption due to the aging process. The low food intake in the elderly can be caused by a lack of appetite or chewing problems due to oral function impairment [12]. Internal factors and external factors can cause VB12 absorption impairment. Internal factors common in the elderly include atrophic gastritis, pernicious anemia, gastrointestinal infections, and increased gastrin secretion. External factors that affect VB12 absorption are long-term consumption of metformin, histamine, proton-pump inhibitors, and

acid-lowering agents, which is a common condition in the elderly [2], [6].

VB12 is a water-soluble vitamin that is not produced in the human body. Because VB12 intake solely relies on animal food sources, it is essential for the elderly to consume VB12-rich foods that meet daily needs to prevent the deficiency [13], [14]. However, several factors affecting dietary behavior in the elderly, such as physical, mental, social, economic, etc. [15]. A study analyzed the sociodemographic factors that determine diet quality in the elderly in four different European countries. The results showed that education level, female gender, and not living alone had positive associations with diet quality. On the other hand, food availability is negatively associated with diet quality [16]. Reports from the focus group discussion study on the subjects over 65 years old stated that there were three main determinants of protein-rich food consumption patterns; product-based, environment-based, and cognitive-based. However, the report concluded that further studies on these three determinants are needed to assess the importance and priority factors among the elderly [12]. This study aimed to determine the association between sociodemographic aspects and nutritional knowledge with VB12 dietary behavior and supplementation among the elderly.

Methods

Research design

This research was an observational study with a cross-sectional design, held in Maret–April 2021 in Mampang Village, South Jakarta, Indonesia.

A total of 69 subjects were recruited by consecutive non-random sampling with inclusion criteria of women aged >50 years, able to communicate, no memory impairment, and consented as respondents in the study by signing an informed consent form. The exclusion criteria were communication problems with the subject or the subject that cannot answer the questionnaire completely. This recruited all women subjects to minimize memory bias because women mostly prepared food in the family.

Data collection

Data were collected from respondents using a Google form-based questionnaire. Professional assistants assist respondents who cannot fill out the Google form by themself. In general, the questionnaire was divided into three main parts to assess the sociodemographic characteristics, nutritional knowledge of VB12, dietary behavior of VB12-rich food, and VB12-related supplements.

The sociodemographic characteristics collected in the questionnaire were ethnicity, educational level, employment status, level of income, home-ownership status, and exposure level to health information from health providers. Health information exposure status was obtained by asking the frequency of visiting health facilities, consulting, or participating in health-literacy-related activities with health providers in the last past year. A score of zero if the frequency is <6 times a year and a score of 1 if more than 6 times a year.

In the second part of the questionnaire, respondents were given 12 questions regarding the nutritional aspects of VB12, including various questions related to the benefits of VB12, VB12 food sources and VB12 deficiency high-risk populations. Questions in the knowledge section are taken from information on the official website of the World Health Organization/ Food and Agriculture Organization (WHO/FAO) of the United Nations [17]. The validity of the questionnaire was analyzed by a professional team of reviewers consisting of general practitioners, specialists, epidemiologists, and physiologists. A score of one was given for the correct answer and a score of zero for the incorrect one. The maximum score in this section is 12 points. These results then determined the respondent's nutritional knowledge status, categorized into poor knowledge for score 0–6 and good knowledge for score 7–12.

In the third part of the questionnaire, respondents were given eight questions to determine the dietary behavior of VB12 foods source and supplements. Those questions were requiring the respondents to recall their diets and supplementation intake in the past 4 weeks. The time frame of 4 weeks was chosen to ensure that the respondents can remember well enough to minimize the false memory. The respondents were given questions about the frequency of consumption of certain VB12 foods source and VB12 supplements. A score of zero was given if the respondent had not consumed it in the past 4 weeks, a score of one was given when the respondent consumed 1–3 times/week, and a score of two if consumed more than 3 times/ week. The data of VB12 oral supplement consumption also taken following those rules. VB12 injection status was determined by the frequency over the past year, a score of two if the respondent received VB12 injection more than 3 times in a year, a score of one if 1–3 times/ year, and a score of zero if never accepted the injection. The total score for this section was 16 points. These results then determined the respondent's VB12 dietary behavior and supplementation (VB12 intake status), categorized into poor behavior (score 0–8) and good behavior (score 9–16).

Statistic analysis

Descriptive analysis was carried out by calculating the number of respondents (n) and percentage (%) on each parameters. The association between sociodemographic aspects and nutritional knowledge with VB12 dietary behavior and supplementation was analyzed using Chi-square bivariate analysis. Statistical analysis used SPSS 20.0 version software, $p < 0.05$ was determined as significant.

Ethical approval

This study received ethical approval from the Medical Research Ethics Commission, Universitas Trisakti, through ethical clearance letter number 008/KER/FK/III/2021.

Results

Sociodemographic aspects

The data of the sociodemographic aspects are presented in Table 1.

Table 1: Sociodemographic aspect (n = 69)

Variables	n	%
Age		
50–60 years	34	49.27
More than 60 years	35	50.72
Ethnicity		
Javanese	42	60.87
Sundanese	10	14.49
Betawi	13	18.84
Balinese	2	2.90
Malay	1	1.45
Minang	1	1.45
Educational level		
Bachelor graduate	4	5.80
Diploma graduate	5	7.25
Senior high school graduate	28	40.58
Junior high school graduate	15	21.74
Elementary school graduate	12	17.39
Not complete elementary School	5	7.25
Employment status		
Working	57	82.61
Unemployment	12	17.39
Monthly Income		
Under Rp. 4,000,000	51	73.91
Rp. 4,000,000 – Rp. 10,000,000	13	18.84
More than Rp. 10,000,000	5	7.25
Home-ownership status		
Owning	50	72.46
Renting	19	27.54
Health information exposure		
More than 6 times/year	31	44.93
<6 times/year	38	55.07

In terms of age variable, the subjects were of equal proportion between the 50–60 year (49.27%) and over 60 year (50.72%) age groups. The data on ethnicity showed predominantly Javanese compared to other ethnic groups (60.87%). Most of them had high school education (40.58%), with the lowest not graduated from elementary school (7.25%), and the highest educational level was bachelor graduates (5.80%). Because all respondents are elderly, most are unemployed (82.61%). In terms of monthly income, most of the subjects have income <4 million/month (73.91%), with mostly home-owner (72.46%).

Nutritional knowledge of VB12

The data of respondent's nutritional knowledge on VB12 are presented in Table 2. Most of the respondents claimed that they heard and knew about VB12 (81.16%). The questions mostly answered incorrectly by respondents (>60%) were regarding the presence of VB12 in vegetables and fruits (73.91%) responded incorrectly, and the question whether regular VB12 tablet consumption or VB12 injection is beneficial for the elderly (68.12%) gave wrong answers. Of the respondents, 47 subjects were categorized as having poor VB12 knowledge, and 22 subjects had good VB12 knowledge status.

VB12 dietary behavior and supplementation status

In general, our data showed the most common sources of VB12 originating from red meat, chicken, eggs, and fish (more than 50% of respondents consume more than 3 times/week). VB12 sources from milk, dairy products, and seafood were relatively low consumed by the respondents (Table 3). Our data showed that regular VB12 tablet supplementation was uncommon among the respondents, 31.88% consumed VB12 more than 3 times/week, but 47.83% did not consume it at all. VB12 injection was also an uncommon procedure for the respondent of our study (95.65% of them did not get it in the past year). Of the respondents, subjects were categorized as poor VB12 knowledge status, and 22 subjects had good VB12 knowledge status. Among the respondents, 48 subjects (69.56%) were categorized poor VB12 intake status.

VB12 source and tablet supplement consumption scoring: Score 2 if consume >3 x/week, score 1 if consume 1–3 x/week, score 0 if did not consume at all VB12 injection scoring: score 2 if injection >3 x/year, score 1 if injection 1–3 x/year, and score 0 if never got an injection.

The association between sociodemographic aspects and nutritional knowledge with VB12 intake status

Statistical analyses were conducted to assess the association between sociodemographic characteristics and nutritional knowledge with VB12 dietary consumption and supplementation pattern (Table 4). A significant positive association was found between educational level, employment status, and income level with VB12 intake status ($p = 0.01$, $p = 0.003$ and $p = 0.000$). However, VB12 nutritional

Table 2: Nutritional knowledge of vitamin B12 (n = 69)

No	Knowledge aspect	Responses[a]	Frequency	%
1	Have you ever known about VB12?	Score 1	56	81.16
		Score 0	13	18.84
2	VB12 cannot be produced by our own bodies.	Score 1	35	50.72
		Score 0	34	49.28
3	Fish and meat are good sources of VB12.	Score 1	31	44.93
		Score 0	38	55.07
4	Cheese and milk are good sources of VB12.	Score 1	33	47.83
		Score 0	36	52.17
5	Fruits and vegetables are not VB12 sources	Score 1	18	26.09
		Score 0	51	73.91
6	VB12 is beneficial for our body nerve health	Score 1	66	95.65
		Score 0	3	4.35
7	VB12 is beneficial for heart and blood vascular health	Score 1	53	76.81
		Score 0	16	23.19
8	VB12 is essential for children and pregnant woman	Score 1	37	53.62
		Score 0	32	46.38
9	Strict vegetarianism is high risk for VB12 deficiency	Score 1	34	49.28
		Score 0	35	50.72
10	The elderly population is at high risk for VB12 deficiency	Score 1	57	82.61
		Score 0	12	17.39
11	Prolong of acid lowering-agent consumption is a risk factor for VB12 deficiency	Score 1	47	68.12
		Score 0	22	31.88
12	Taking VB12 tablet supplements or regular VB12 injection is beneficial for elder health	Score 1	22	31.88
		Score 0	47	68.12

Table 3: VB12 dietary behavior and supplementation (n = 69)

No	Dietary and Supplementation Behavior	Responses	Frequency	%
1	Milk and dairy product consumption	Score 2	25	36.23
		Score 1	15	21.74
		Score 0	29	42.03
2	Red meat consumption	Score 2	39	56.52
		Score 1	4	5.80
		Score 0	26	37.68
3	Chicken consumption	Score 2	44	63.77
		Score 1	21	30.43
		Score 0	4	5.80
4	Seafood consumption	Score 2	0	0.00
		Score 1	29	42.03
		Score 0	40	57.97
5	Egg consumption	Score 2	39	56.52
		Score 1	28	40.58
		Score 0	2	2.90
6	Fish consumption	Score 2	40	57.97
		Score 1	21	30.43
		Score 0	8	11.59
7	VB12 tablet supplement consumption	Score 2	22	31.88
		Score 1	14	20.29
		Score 0	33	47.83
8	VB12 injection procedure	Score 2	0	0.00
		Score 1	3	4.35
		Score 0	66	95.65

knowledge and health information exposure level, which hypothetically was associated with VB12 intake scores, was not significant (p = 0.766 and p = 0.696).

Discussion

The elderly are vulnerable to chronic and degenerative diseases that significantly affect their quality of life. Therefore, understanding the pattern of disease and how to prevent it is crucial to reduce morbidity in the elderly at a much lower cost than treating the disease. VB12 deficiency is a condition that is often found in the elderly, with the population affected is increasing with age manner [18]. This condition is mainly due to lack of intake and age-related digestive impairment, such as inadequate oral condition, gastric atrophy, or gastrointestinal infection. VB12 deficiency can be worsened by long-term use of metformin and acid-lowering agents, which are very common in the elderly [2]. According to the Regulation of the Minister of Health of the Republic of Indonesia Number 28 of 2019 about the recommended nutritional adequacy rate for the Indonesian people, VB12 daily intake recommendation for the elderly population (>50 years) is at least 4 mcg/day [13]. Animal products are the only natural source of VB12 for the human body. The most commonly consumed sources of VB12 are red meat (2–5 mcg/100 g), fish (2–8 mcg/100 g), milk (1.5 mcg/100 mL), cheese (1–2 mcg/100 g), and eggs (2 mcg/100 g). Although VB12 is abundant in animal-source food, not all amounts can be cellularly active (holotranscobalamin form). The complexity of the VB12 absorption process, involving multi-step and multi-organ, causes the absorption and bioavailability rate in the plasma to tend to be low even under normal conditions (around 3 mcg of VB12 can be absorbed per meal). In conditions of gastrointestinal disorders or improper absorption, like the elderly, this number will be lower [4], [19]. Therefore, it is important to ensure the elderly get adequate daily VB12 intake.

Table 4: The association between sociodemographic aspects and nutritional knowledge with VB12 intake status (n = 69)

Variable	VB12 Intake Status				OR	95% CI		p-value
	Poor		Good					
	n	%	n	%		Lower	Upper	
Age								
Under 60 years	14	41.2	20	58.8	1	0.957	8.192	0.056
More than 60 years	7	20.0	28	80.0	2.800			
Educational level								
High	6	66.7	3	33.3	1	1.333	26.999	0.011*
Low	15	25.0	45	75.0	6.000			
Employment status								
Working	8	66.7	4	33.3	1	1.754	26.120	0.003*
Unemployment	13	22.8	44	77.2	6.769			
Income level								
High	17	94.4	1	5.6	1	20.83	1915.03	0.000**
Low	4	7.8	47	92.2	199.7			
Home-ownership status								
Owning	16	32.0	34	68.0	1	0.404	4.294	0.647
Renting	5	26.3	14	73.7	1.318			
Health information exposure								
More than 6 x/year	10	32.3	21	67.7	1	0.418	3.270	0.766
>6 x/year	11	28.9	27	71.1	1.169			
VB12 nutritional knowledge status								
Good	15	31.9	32	68.1	1	0.407	3.835	0.696
Poor	6	27.3	16	72.7	1.250			

This study analyzed VB12 intake status from natural sources (daily diets) and unnatural sources (supplementation). We also analyzed its relation with sociodemographic and nutritional knowledge aspects. In terms of sociodemographic aspect, income level is the most significant variable with p = 0.000 (OR = 199.7 [95% CI: 20.83–191.5]). The employment status variable also showed a significant relationship with the status of B12 intake in the elderly with p = 0.003 (OR = 6.769 [95% CI: 1.754–26.120]). This data is in concordance with [15] and [12], which states that economic and employment status plays a significant role in elder food choice behavior. Most of the elderly population are no longer working. Therefore, monthly income mostly relies on pensions or other family members' income. For this reason, the elder tends to choose cheaper foods such as vegetables or fruit, which not containing VB12.

Another highlight result in this study is about VB12 supplementation behavior. Our data showed that regular VB12 tablet supplementation was uncommon among the respondents, 31.88% consumed VB12 more than 3 times/week, but 47.83% did not consume it at all. VB12 injection was also an uncommon procedure for the respondent of our study (95.65% of them did not get it in the past year). VB12 supplementation practice is actually well established, with the common routes being peroral and intramuscular injection. However, regular VB12 supplementation in the elderly, especially without comorbid diseases, is still rare. There is still an assumption that food consumption from natural ingredients is better than factory-based supplementation products. Most of the elderly are also not familiar with VB12 injection, although its effectiveness is much better than oral. Some of the reasons suggested are to avoid inconvenience, worries of side effects, and high costs. This condition causes the coverage of supplementation to be still relatively low, even in the elderly who have VB12 deficiency symptoms [20].

As stated before, monthly income level plays a crucial role in the VB12 food source consumption in our subjects. Based on our findings, a supplementation program could be an excellent intervention to keep the elder well-nourished without spending much money. Peroral or intramuscular VB12 supplementation is proven effective in preventing and cure VB12 deficiency symptoms in the elderly population. Another consideration is the nature of VB12, which is water-soluble, make it safe with no toxic effect even when administered higher than the recommended daily allowance [1], [21]. We believe that our study was novel and has a significant impact on providing a different insight from previous study, which primarily emphasizes the practice of VB12 intake from daily products and not supplementary products.

Conclusion

This study concluded that monthly income level plays a crucial role in the VB12 intake behavior in the elderly population. Efforts are needed to increase the coverage of VB12 supplementation, either peroral or intramuscular injection, as a solution to meet the needs of VB12 sources, an affordable and effective intervention to prevent and treat VB12 deficiency in an elderly population.

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14. Hasil Turnitin Sociodemographic Factors and Nutritional Knowledge Impacts on Overall Vitamin B12 Intake in Older Women

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Sociodemographic Factors and Nutritional Knowledge Impacts on Overall Vitamin B12 Intake in Older Women

Patwa Amani[1]*, Donna Adriani[1], Mustika Anggiane Putri[1], Yudhisman Imran[2], Irmiya Rachmiyani[3], Nany Hairunisa[3]

[1]*Department of Physiology, Faculty of Medicine, Universitas Trisakti, Jakarta, Indonesia;* [2]*Department of Neurology, Faculty of Medicine, Universitas Trisakti, Jakarta, Indonesia;* [3]*Department of Obstetrics and Gynecology, Faculty of Medicine, Universitas Trisakti, Jakarta, Indonesia*

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***Correspondence:** Patwa Amani, Department of Physiology, Faculty of Medicine, Universitas Trisakti, Jakarta, Indonesia. E-mail: patwa.amani@trisakti.ac.id
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Abstract

BACKGROUND: The older population is at high risk for vitamin B12 deficiency, leading to various significant and chronic health problems.

AIM: This study aimed to determine the association between sociodemographic characteristics, nutritional knowledge and overall vitamin B12 intake among older persons.

METHODS: An observational study with a cross-sectional design was directed to 69 older women aged > 50 years. Data was collected from subject responses to various questions on the google platform, guided by professional assistance.

RESULT: The study showed an inversed association between employment status ($p<0.05$), income level ($p<0.001$) and overall vitamin B12 intake, including dietary and supplement intake. The results provided new insights on monthly income level playing a crucial role in VB12 rich food consumption patterns in older persons, which were mostly unemployed.

CONCLUSION: Efforts are needed to increase the coverage of VB12 supplementation, either peroral or intramuscular injection, as a solution to meet the needs of VB12 source that is affordable and effective for the older population.

Introduction

The increase in life expectancy has an impact on the rise in the older population. This condition is a future challenge for health providers to help the elderly remain healthy and maintain their productivity also the quality of life. Vitamin B12 deficiency (VB12) is a condition that is often found in the elderly, with the population affected increasingly proportional to the age. Several studies have shown that the prevalence of VB12 deficiency in the elderly ranges from 5% to 40% depending on the age group and the type of VB12 test used [1], [2]. VB12 deficiency in the elderly is a significant health concern. It has a wide range of symptoms, often unrecognized by the health provider and causing chronic health problems, especially in the hematological and neurological systems [3].

Hematological manifestations in VB12 deficiency patients are related to megaloblastic anemia, causing general symptoms such as fatigue, dyspnoea, palpitations, and pallor [4]. The neurological symptoms include peripheral neuropathy, irritability, areflexia, proprioceptive disorders, even cognitive impairment in the form of dementia, and acute psychosis in severe deficiency conditions [5]. The clinical consequence of VB12 deficiency that has an impact on the elderly but is not widely known is hyperhomocysteinemia, an independent risk factor for cardiovascular diseases [1], [6]. Studies in both animal and human models have shown that VB12 deficiency increases the risk of cardiac arrhythmias, myocardial infarction, ischemic stroke, liver steatosis, even renal abnormality[7], [8], [9], [10], [11].

VB12 deficiency in the elderly is mainly due to lack of intake and impaired absorption due to the aging process. The low food intake in the elderly can be caused by a lack of appetite or chewing problems due to oral function impairment [12]. Internal factors and external factors can cause VB12 absorption impairment. Internal factors common in the elderly include atrophic gastritis, pernicious anemia, gastrointestinal infections, and increased gastrin secretion. External factors that affect VB12 absorption are long-term consumption of metformin, histamine, proton-pump inhibitors, and

acid-lowering agents, which is a common condition in the elderly [2], [6].

VB12 is a water-soluble vitamin that is not produced in the human body. Because VB12 intake solely relies on animal food sources, it is essential for the elderly to consume VB12-rich foods that meet daily needs to prevent the deficiency [13], [14]. However, several factors affecting dietary behavior in the elderly, such as physical, mental, social, economic, etc. [15]. A study analyzed the sociodemographic factors that determine diet quality in the elderly in four different European countries. The results showed that education level, female gender, and not living alone had positive associations with diet quality. On the other hand, food availability is negatively associated with diet quality [16]. Reports from the focus group discussion study on the subjects over 65 years old stated that there were three main determinants of protein-rich food consumption patterns; product-based, environment-based, and cognitive-based. However, the report concluded that further studies on these three determinants are needed to assess the importance and priority factors among the elderly [12]. This study aimed to determine the association between sociodemographic aspects and nutritional knowledge with VB12 dietary behavior and supplementation among the elderly.

Methods

Research design

This research was an observational study with a cross-sectional design, held in Maret–April 2021 in Mampang Village, South Jakarta, Indonesia.

A total of 69 subjects were recruited by consecutive non-random sampling with inclusion criteria of women aged >50 years, able to communicate, no memory impairment, and consented as respondents in the study by signing an informed consent form. The exclusion criteria were communication problems with the subject or the subject that cannot answer the questionnaire completely. This recruited all women subjects to minimize memory bias because women mostly prepared food in the family.

Data collection

Data were collected from respondents using a Google form-based questionnaire. Professional assistants assist respondents who cannot fill out the Google form by themself. In general, the questionnaire was divided into three main parts to assess the sociodemographic characteristics, nutritional knowledge of VB12, dietary behavior of VB12-rich food, and VB12-related supplements.

The sociodemographic characteristics collected in the questionnaire were ethnicity, educational level, employment status, level of income, home-ownership status, and exposure level to health information from health providers. Health information exposure status was obtained by asking the frequency of visiting health facilities, consulting, or participating in health-literacy-related activities with health providers in the last past year. A score of zero if the frequency is <6 times a year and a score of 1 if more than 6 times a year.

In the second part of the questionnaire, respondents were given 12 questions regarding the nutritional aspects of VB12, including various questions related to the benefits of VB12, VB12 food sources and VB12 deficiency high-risk populations. Questions in the knowledge section are taken from information on the official website of the World Health Organization/ Food and Agriculture Organization (WHO/FAO) of the United Nations [17]. The validity of the questionnaire was analyzed by a professional team of reviewers consisting of general practitioners, specialists, epidemiologists, and physiologists. A score of one was given for the correct answer and a score of zero for the incorrect one. The maximum score in this section is 12 points. These results then determined the respondent's nutritional knowledge status, categorized into poor knowledge for score 0–6 and good knowledge for score 7–12.

In the third part of the questionnaire, respondents were given eight questions to determine the dietary behavior of VB12 foods source and supplements. Those questions were requiring the respondents to recall their diets and supplementation intake in the past 4 weeks. The time frame of 4 weeks was chosen to ensure that the respondents can remember well enough to minimize the false memory. The respondents were given questions about the frequency of consumption of certain VB12 foods source and VB12 supplements. A score of zero was given if the respondent had not consumed it in the past 4 weeks, a score of one was given when the respondent consumed 1–3 times/week, and a score of two if consumed more than 3 times/ week. The data of VB12 oral supplement consumption also taken following those rules. VB12 injection status was determined by the frequency over the past year, a score of two if the respondent received VB12 injection more than 3 times in a year, a score of one if 1–3 times/ year, and a score of zero if never accepted the injection. The total score for this section was 16 points. These results then determined the respondent's VB12 dietary behavior and supplementation (VB12 intake status), categorized into poor behavior (score 0–8) and good behavior (score 9–16).

Statistic analysis

Descriptive analysis was carried out by calculating the number of respondents (n) and percentage (%) on each parameters. The association between sociodemographic aspects and nutritional knowledge with VB12 dietary behavior and supplementation was analyzed using Chi-square bivariate analysis. Statistical analysis used SPSS 20.0 version software, $p < 0.05$ was determined as significant.

Ethical approval

This study received ethical approval from the Medical Research Ethics Commission, Universitas Trisakti, through ethical clearance letter number 008/KER/FK/III/2021.

Results

Sociodemographic aspects

The data of the sociodemographic aspects are presented in Table 1.

Table 1: Sociodemographic aspect (n = 69)

Variables	n	%
Age		
50–60 years	34	49.27
More than 60 years	35	50.72
Ethnicity		
Javanese	42	60.87
Sundanese	10	14.49
Betawi	13	18.84
Balinese	2	2.90
Malay	1	1.45
Minang	1	1.45
Educational level		
Bachelor graduate	4	5.80
Diploma graduate	5	7.25
Senior high school graduate	28	40.58
Junior high school graduate	15	21.74
Elementary school graduate	12	17.39
Not complete elementary School	5	7.25
Employment status		
Working	57	82.61
Unemployment	12	17.39
Monthly Income		
Under Rp. 4,000,000	51	73.91
Rp. 4,000,000 – Rp. 10,000,000	13	18.84
More than Rp. 10,000,000	5	7.25
Home-ownership status		
Owning	50	72.46
Renting	19	27.54
Health information exposure		
More than 6 times/year	31	44.93
<6 times/year	38	55.07

In terms of age variable, the subjects were of equal proportion between the 50–60 year (49.27%) and over 60 year (50.72%) age groups. The data on ethnicity showed predominantly Javanese compared to other ethnic groups (60.87%). Most of them had high school education (40.58%), with the lowest not graduated from elementary school (7.25%), and the highest educational level was bachelor graduates (5.80%). Because all respondents are elderly, most are unemployed (82.61%). In terms of monthly income, most of the subjects have income <4 million/month (73.91%), with mostly home-owner (72.46%).

Nutritional knowledge of VB12

The data of respondent's nutritional knowledge on VB12 are presented in Table 2. Most of the respondents claimed that they heard and knew about VB12 (81.16%). The questions mostly answered incorrectly by respondents (>60%) were regarding the presence of VB12 in vegetables and fruits (73.91%) responded incorrectly, and the question whether regular VB12 tablet consumption or VB12 injection is beneficial for the elderly (68.12%) gave wrong answers. Of the respondents, 47 subjects were categorized as having poor VB12 knowledge, and 22 subjects had good VB12 knowledge status.

VB12 dietary behavior and supplementation status

In general, our data showed the most common sources of VB12 originating from red meat, chicken, eggs, and fish (more than 50% of respondents consume more than 3 times/week). VB12 sources from milk, dairy products, and seafood were relatively low consumed by the respondents (Table 3). Our data showed that regular VB12 tablet supplementation was uncommon among the respondents, 31.88% consumed VB12 more than 3 times/week, but 47.83% did not consume it at all. VB12 injection was also an uncommon procedure for the respondent of our study (95.65% of them did not get it in the past year). Of the respondents, subjects were categorized as poor VB12 knowledge status, and 22 subjects had good VB12 knowledge status. Among the respondents, 48 subjects (69.56%) were categorized poor VB12 intake status.

VB12 source and tablet supplement consumption scoring: Score 2 if consume >3 x/week, score 1 if consume 1–3 x/week, score 0 if did not consume at all VB12 injection scoring: score 2 if injection >3 x/year, score 1 if injection 1–3 x/year, and score 0 if never got an injection.

The association between sociodemographic aspects and nutritional knowledge with VB12 intake status

Statistical analyses were conducted to assess the association between sociodemographic characteristics and nutritional knowledge with VB12 dietary consumption and supplementation pattern (Table 4). A significant positive association was found between educational level, employment status, and income level with VB12 intake status ($p = 0.01$, $p = 0.003$ and $p = 0.000$). However, VB12 nutritional

Table 2: Nutritional knowledge of vitamin B12 (n = 69)

No	Knowledge aspect	Responses[a]	Frequency	%
1	Have you ever known about VB12?	Score 1	56	81.16
		Score 0	13	18.84
2	VB12 cannot be produced by our own bodies.	Score 1	35	50.72
		Score 0	34	49.28
3	Fish and meat are good sources of VB12.	Score 1	31	44.93
		Score 0	38	55.07
4	Cheese and milk are good sources of VB12.	Score 1	33	47.83
		Score 0	36	52.17
5	Fruits and vegetables are not VB12 sources	Score 1	18	26.09
		Score 0	51	73.91
6	VB12 is beneficial for our body nerve health	Score 1	66	95.65
		Score 0	3	4.35
7	VB12 is beneficial for heart and blood vascular health	Score 1	53	76.81
		Score 0	16	23.19
8	VB12 is essential for children and pregnant woman	Score 1	37	53.62
		Score 0	32	46.38
9	Strict vegetarianism is high risk for VB12 deficiency	Score 1	34	49.28
		Score 0	35	50.72
10	The elderly population is at high risk for VB12 deficiency	Score 1	57	82.61
		Score 0	12	17.39
11	Prolong of acid lowering-agent consumption is a risk factor for VB12 deficiency	Score 1	47	68.12
		Score 0	22	31.88
12	Taking VB12 tablet supplements or regular VB12 injection is beneficial for elder health	Score 1	22	31.88
		Score 0	47	68.12

Table 3: VB12 dietary behavior and supplementation (n = 69)

No	Dietary and Supplementation Behavior	Responses	Frequency	%
1	Milk and dairy product consumption	Score 2	25	36.23
		Score 1	15	21.74
		Score 0	29	42.03
2	Red meat consumption	Score 2	39	56.52
		Score 1	4	5.80
		Score 0	26	37.68
3	Chicken consumption	Score 2	44	63.77
		Score 1	21	30.43
		Score 0	4	5.80
4	Seafood consumption	Score 2	0	0.00
		Score 1	29	42.03
		Score 0	40	57.97
5	Egg consumption	Score 2	39	56.52
		Score 1	28	40.58
		Score 0	2	2.90
6	Fish consumption	Score 2	40	57.97
		Score 1	21	30.43
		Score 0	8	11.59
7	VB12 tablet supplement consumption	Score 2	22	31.88
		Score 1	14	20.29
		Score 0	33	47.83
8	VB12 injection procedure	Score 2	0	0.00
		Score 1	3	4.35
		Score 0	66	95.65

knowledge and health information exposure level, which hypothetically was associated with VB12 intake scores, was not significant (p = 0.766 and p = 0.696).

Discussion

The elderly are vulnerable to chronic and degenerative diseases that significantly affect their quality of life. Therefore, understanding the pattern of disease and how to prevent it is crucial to reduce morbidity in the elderly at a much lower cost than treating the disease. VB12 deficiency is a condition that is often found in the elderly, with the population affected is increasing with age manner [18]. This condition is mainly due to lack of intake and age-related digestive impairment, such as inadequate oral condition, gastric atrophy, or gastrointestinal infection. VB12 deficiency can be worsened by long-term use of metformin and acid-lowering agents, which are very common in the elderly [2]. According to the Regulation of the Minister of Health of the Republic of Indonesia Number 28 of 2019 about the recommended nutritional adequacy rate for the Indonesian people, VB12 daily intake recommendation for the elderly population (>50 years) is at least 4 mcg/day [13]. Animal products are the only natural source of VB12 for the human body. The most commonly consumed sources of VB12 are red meat (2–5 mcg/100 g), fish (2–8 mcg/100 g), milk (1.5 mcg/100 mL), cheese (1–2 mcg/100 g), and eggs (2 mcg/100 g). Although VB12 is abundant in animal-source food, not all amounts can be cellularly active (holotranscobalamin form). The complexity of the VB12 absorption process, involving multi-step and multi-organ, causes the absorption and bioavailability rate in the plasma to tend to be low even under normal conditions (around 3 mcg of VB12 can be absorbed per meal). In conditions of gastrointestinal disorders or improper absorption, like the elderly, this number will be lower [4], [19]. Therefore, it is important to ensure the elderly get adequate daily VB12 intake.

Table 4: The association between sociodemographic aspects and nutritional knowledge with VB12 intake status (n = 69)

Variable	VB12 Intake Status				OR	95% CI		p-value
	Poor		Good					
	n	%	n	%		Lower	Upper	
Age								
Under 60 years	14	41.2	20	58.8	1	0.957	8.192	0.056
More than 60 years	7	20.0	28	80.0	2.800			
Educational level								
High	6	66.7	3	33.3	1	1.333	26.999	0.011*
Low	15	25.0	45	75.0	6.000			
Employment status								
Working	8	66.7	4	33.3	1	1.754	26.120	0.003*
Unemployment	13	22.8	44	77.2	6.769			
Income level								
High	17	94.4	1	5.6	1	20.83	1915.03	0.000**
Low	4	7.8	47	92.2	199.7			
Home-ownership status								
Owning	16	32.0	34	68.0	1	0.404	4.294	0.647
Renting	5	26.3	14	73.7	1.318			
Health information exposure								
More than 6 x/year	10	32.3	21	67.7	1	0.418	3.270	0.766
>6 x/year	11	28.9	27	71.1	1.169			
VB12 nutritional knowledge status								
Good	15	31.9	32	68.1	1	0.407	3.835	0.696
Poor	6	27.3	16	72.7	1.250			

This study analyzed VB12 intake status from natural sources (daily diets) and unnatural sources (supplementation). We also analyzed its relation with sociodemographic and nutritional knowledge aspects. In terms of sociodemographic aspect, income level is the most significant variable with p = 0.000 (OR = 199.7 [95% CI: 20.83–191.5]). The employment status variable also showed a significant relationship with the status of B12 intake in the elderly with p = 0.003 (OR = 6.769 [95% CI: 1.754–26.120]). This data is in concordance with [15] and [12], which states that economic and employment status plays a significant role in elder food choice behavior. Most of the elderly population are no longer working. Therefore, monthly income mostly relies on pensions or other family members' income. For this reason, the elder tends to choose cheaper foods such as vegetables or fruit, which not containing VB12.

Another highlight result in this study is about VB12 supplementation behavior. Our data showed that regular VB12 tablet supplementation was uncommon among the respondents, 31.88% consumed VB12 more than 3 times/week, but 47.83% did not consume it at all. VB12 injection was also an uncommon procedure for the respondent of our study (95.65% of them did not get it in the past year). VB12 supplementation practice is actually well established, with the common routes being peroral and intramuscular injection. However, regular VB12 supplementation in the elderly, especially without comorbid diseases, is still rare. There is still an assumption that food consumption from natural ingredients is better than factory-based supplementation products. Most of the elderly are also not familiar with VB12 injection, although its effectiveness is much better than oral. Some of the reasons suggested are to avoid inconvenience, worries of side effects, and high costs. This condition causes the coverage of supplementation to be still relatively low, even in the elderly who have VB12 deficiency symptoms [20].

As stated before, monthly income level plays a crucial role in the VB12 food source consumption in our subjects. Based on our findings, a supplementation program could be an excellent intervention to keep the elder well-nourished without spending much money. Peroral or intramuscular VB12 supplementation is proven effective in preventing and cure VB12 deficiency symptoms in the elderly population. Another consideration is the nature of VB12, which is water-soluble, make it safe with no toxic effect even when administered higher than the recommended daily allowance [1], [21]. We believe that our study was novel and has a significant impact on providing a different insight from previous study, which primarily emphasizes the practice of VB12 intake from daily products and not supplementary products.

Conclusion

This study concluded that monthly income level plays a crucial role in the VB12 intake behavior in the elderly population. Efforts are needed to increase the coverage of VB12 supplementation, either peroral or intramuscular injection, as a solution to meet the needs of VB12 sources, an affordable and effective intervention to prevent and treat VB12 deficiency in an elderly population.

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