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Research Article

Knowledge-attitude about toward sunlight exposure and lung function in construction workers

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ABSTRACT

The primary source of Vitamin D is sunlight, which plays a role in improving respiratory health. The level of knowledge and attitudes regarding sun exposure can affect daily lifestyle, thus affecting lung function. The research design was cross-sectional and, from April to June 2018, was conducted in Rungkut District, Surabaya. The construction workers were divided into with and without respiratory problems. The variables were knowledge and attitudes towards sun exposure related to vitamin D deficiency risk, with data collection using a questionnaire. The result showed that the level of knowledge (98.31%) and attitude (100%) was low. There was no significant difference in the level of knowledge p-value (0.161 > 0.05) between with and without respiratory problems. The correlation test of knowledge and attitudes towards sun exposure related to the risk of vitamin D deficiency cannot be carried out because there was no excellent attitude. Knowledge and attitudes towards sun exposure related to the risk of vitamin D deficiency tend to be low in construction workers. However, knowledge and attitude were not the main factors affecting lung function.

1. INTRODUCTION

A person's job is closely related to air pollution exposure experiences. The longer person is exposed to air pollution, the greater the impairment of lung function (Ardam, 2015). A work environment full of air pollution such as dust and sawdust/metal can also reduce lung function, disrupting the productivity and quality of life of its workers (Darmawan, 2013). The Commercial Property Price Index in the second quarter of 2019 grew by 0.14% quarterly, an increase compared to 0.12% in the previous quarter, mainly due to price increases in the industrial land segment (Bank Indonesia, 2019). This value will increase the number of the physical construction of buildings in Surabaya, which will also affect the performance of construction workers in Surabaya.

The high incidence of respiratory disorders in the community is influenced by vitamin D deficiency (Zhou, Luo & Qin, 2019). Studies conducted by Hejazi, Modarresi-Ghazani, and Entezari-Maleki (2016), showed a link between vitamin D deficiency and the risk of developing respiratory diseases, including asthma, chronic obstructive pulmonary disease (COPD), and tuberculosis. Similar results are supported by other studies conducted by Persson et al. (2012), which found a high prevalence of vitamin D deficiency in COPD patients. Epidemiological data indicate that low serum vitamin D levels are associated with impaired respiratory function, increased incidence of inflammation, and respiratory infections from influenza A and Mycobacterium tuberculosis (Herr et al., 2011; Finklea, Grossmann & Tangpricha, 2011) increase the risk of respiratory infections such as COPD and tuberculosis (Hejazi et al., 2016). Vitamin D is associated with inflammatory reactions, so that

vitamin D deficiency in people with respiratory problems will increase the risk of severe respiratory problems (Pfeffer & Hawrylowicz, 2012). Vitamin D has been shown to have immunomodulatory properties by stimulating the immune system to inhibit cytokine production from reducing inflammation (Bozzetto, Carraro, Giordano, Boner & Baraldi, 2012). Effects of vitamin D in the lungs include increased secretion of the antimicrobial cathelicidin peptide, chemokine production, inhibition of dendritic cell activation, and altered T-cell activation. This effect is essential for fighting infection and the development of allergic lung diseases such as asthma (Hansdottir & Monick, 2011). The effects of vitamin D supplementation during COVID-19 infection are controversial. In theory, vitamin D reduces the risk of microbial infection and death. Pathology of COVID-19 Complex interaction between COVID-19 and the immune system. However, vitamin D has several immunomodulating actions. Vitamin D supports the ability of macrophages to prevent and prevent macrophages from releasing too many inflammatory cytokines and chemokines. Additionally, vitamin D supplementation has shown beneficial effects on various viral infections (Murdaca, Pioggia, & Negrini, 2020).

The presence of respiratory disorders is characterized by decreased lung function. Based on the results of a data analysis survey from the Third National Health and Nutrition Examination Survey (NHANES III), it shows a significant relationship between levels of vitamin D (25-hydroxyvitamin D) and lung function values, especially FEV1 (Forced Expiratory Volume in one second) and FVC (Forced Vital Capacity) (Nolasco et al., 2017). Pulmonary dysfunction can be examined using spirometry by measuring the forced expiratory volume in the first second (FEV1). Spirometry is the most reproducible, objective, and non-invasive tool for measuring airflow limitations and is comfortable and ready to use (Global Initiative for Chronic Obstructive Lung Disease [GOLD], 2019). Spirometry is also the gold standard as a tool for measuring airflow limitations related to COPD. If FEV1 / FCV <0.7, it indicates limited airflow in the lungs (GOLD, 2019).

Vitamin D is the only vitamin that can be produced by the body through sun exposure. However, unfortunately, most people tend to avoid it. A cross-sectional study in Saudi Arabia by Babelghaith et al. (2016) showed that 98.4% of participants knew about vitamin D, and almost all of them knew that sun exposure was the primary source of vitamin D. While only 46.4% of participants liked being in the sun. Some participants (13.7%) thought that the sun exposure they received was sufficient. Data in Indonesia areas in research conducted by Pratiwi, Lorensia, and Suryadinata (2018) and Suryadinata, Lorensia, and Aprilia (2017) regarding vitamin D in adult student respondents in Surabaya, showing that none of the respondents had vitamin D levels in the normal range, namely > 30 ng/mL. Environmental factors can influence vitamin D levels. Vitamin D deficiency can occur due to lack of vitamin D nutrition, sun exposure, obesity, liver and kidney disorders (Plum & Deluca, 2010; Holick, 2011).

Healthcare such as pharmacists can prevent vitamin D deficiency in society and improve perceptions of sun exposure, taking a major role in making people aware of the importance of vitamin D and its abundant resources, primarily through sunlight (Qureshi, Zia, Gitay, Khan & Khan, 2015). Pharmacists can provide education about self-management related to lung function health to avoid complications and maintain quality of life. The success of self-management lies in 2 things, namely knowledge (patients must learn what to do) and changes in attitudes (patients must act based on what they learn) (Kaptein, Klok, Moss-Morris & Brand, 2014). The level of knowledge and attitudes of a person towards sun exposure can be measured using a questionnaire that has been conducted by previous researchers (Bathi, Zayed, Qenai, Makboul & El-Shazly, 2012; Zhou, Zhuang, Yuan, Li & Cai, 2015; Arora, Dixit & Srivastava, 2016). Therefore, this study aimed to determine the relation between knowledge-attitude toward sunlight exposure and vitamin D deficiency risk to lung function in construction workers.

2. MATERIALS AND METHODS

The research design used in the study was cross-sectional. The construction workers were divided into two groups, those with respiratory problems and those without respiratory problems. Each subject was given a questionnaire about knowledge and attitudes towards sunlight exposure and vitamin D deficiency risk. The location of the research was conducted in Rungkut District, Surabaya. This study's variables were the value of lung function and the level of knowledge and attitudes towards sun exposure related to the risk of vitamin D deficiency. Respiratory disorders were assessed from the FEV value <70% condition on the measurement of pulmonary function by spirometry.

Knowledge in this study was the knowledge possessed by research subjects regarding sun exposure, which

was the primary source of vitamin D. Collecting data on this variable used a questionnaire from previous studies (Bathi et al., 2012; Zhou et al., 2015; Arora et al., 2016). The knowledge questionnaire questions consisted of eleven questions, which were structured using open and closed questions. The respondent's level of knowledge is assessed by calculating the total score of correct answers on each question, and each correct answer will be given a score of 1 so that the maximum total of the respondent's correct answers is a score of 11. In this study, the level of knowledge is categorized into two, namely the level of knowledge was high if the number is correct greater than six items and low knowledge level if the number of correct answers lower than six items. While the questions in the attitude questionnaire consisted of nine questions that could be used to assess the respondent's attitude towards sun exposure which were structured using open and closed questions. The attitude assessment was divided into two categories, namely the good attitude category and the bad attitude category. Each question item will be given a score of 2 points if the respondent was considered to have an attitude at risk of experiencing vitamin D deficiency. This questionnaire can produce a maximum value of 18 points; if the respondent's answer produces lower than 9 points, it can be categorized as a right attitude, but if greater than 9 points, the respondent's attitude is categorized as bad.

The population of this study was construction workers in East Surabaya. The subject was male construction workers aged 18-60 years, smokers, with a minimum length of work of 5 years, and did not have chronic lung function disorders. The population in this study is unknown, so the formula used to calculate the number of samples in this study is :

$$n = (Z^2_{1-\alpha/2}P(1-P))/d^2 \quad (1)$$

N : *Number of samples*

$Z^2_{1-\alpha}$: *Normal standard value (if α = 0.05 then Z = 1.960)*

$P(1-P)$: *Population proposal estimate (if P = 0.1 then P (1-P) = 0.09)*

d^2 : *Deviation tolerant (10%)*

Based on the above calculations results, the number of samples determined in this study was 35 respondents. So in this study, researchers must take data from at least 35 respondents. The research subjects were obtained using the purposive sampling method.

The questionnaire used in this study was a previous research questionnaire and validated twice. Firstly, we conducted an internal validation in which the questionnaire that has been obtained from previous research was translated into Indonesian first and the grammar would be re-validated by a peer-group. The second validation is external validation, which will be done by giving questionnaires to 30 respondents. Reliability was carried out on a validated questionnaire.

Data analysis to know the relationship between knowledge and attitudes towards lung function using the chi-square test.

3. RESULTS AND DISCUSSIONS

The research was conducted from April to June 2018. The respondents involved in the study were 118

Table 1. Profile of Subject Characteristic

Characteristics		Groups				Different test	
		Respiratory disorders (n: 58)		**Without Respiratory Disorders (n: 60)**		P-value	Conclusion
		Frequency	Percentage (%)	Frequency	Percentage (%)		
Age (years)	Late adolescence (17-25)	9	15.52	10	16.67	0.707	There was no difference between the two groups
	Early adulthood (26-35)	25	43.10	23	38.33		
	Late adulthood (36-45)	15	25.86	15	25.00		
	Early elderly (46-55)	9	15.52	10	16.67		
	Late elderly (56-65)	0	0.00	2	3.33		
BMI (kg/m^2)	Thin (≤18.5)	8	13.79	10	16.67	0.763	There was no difference between the two groups
	Normal (18,5-<25)	46	79.31	43	71.67		
	Overweight (25.0-<27)	2	3.45	3	5.00		
	Obesity (≥27.0)	2	3.45	4	6.67		

Table 2. Distribution of knowledge level on sun exposure

Number of Correct Answers	Category Knowledge Level on Sun Exposure	Groups			
		Respiratory disorders (n: 58)		Without Respiratory disorders (n: 60)	
		Frequency	Percentage (%)	Frequency	Percentage (%)
≥ 6	High	0	0	2	3.,33
< 6	Low	58	100	58	96.67

Table 3. Profile respondents' knowledge level on sun exposure

No.	Questions	Answers of Respondents	Groups			
			Respiratory disorders (n: 58)		Without Respiratory disorders (n: 60)	
			Frequency	Percentage (%)	Frequency	Percentage (%)
1.	Know about vitamin D.	Yes	19	32.76	19	31.67
		No	39	67.24	41	68.33
2.	Source of information on vitamin D*	Schools	7	12.07	8	13.33
		Family	2	3.45	5	8.33
3.	The sun is the largest source of vitamin D	Vegetables	4	6.90	5	8.33
		Sun	5	8.62	12	20
		Do not know	47	81.03	39	65
4.	Benefits of vitamin D for the body*	For health	3	5.17	3	5
		Do not know	52	89.65	47	
5.	Due to vitamin D deficiency*	Bone disease	1	1.72	11	18.33
		Increase in cholesterol	2	3.45	4	6.67
		Do not know	51	87.93	42	70
6.	Causes of the body's vitamin D deficiency *	Using an umbrella during the day	2	3.45	1	1.67
		Sunbathing on the beach	2	3.45	8	13.33
		Do not know	51	87.93	37	61.67
7.	Sunlight can help produce vitamin D.	Agree	39	67.24	41	68.33
		Disagree	13	22.41	15	25
		Do not know	6	10.34	4	6.67
	If agreed, the reason was	Can warm the skin	4	6.90	2	3.33
		No reason	30	51.72	32	53.33
8.	Is the sun harmful to the skin	Yes	7	12.07	13	21.67
		No	49	84.48	46	76.67
		Do not know	2	3.45	1	1.67
	If agreed, the reason was	Cause blacks during the day	3	5.17	4	6.67
		It is dangerous if exposed to it too often	2	3.45	1	1.67
	If not, the reason was	Already used to being exposed	5	8.62	5	8.33
		During the exposure, it never got sick	2	3.45	4	6.67
9.	A good time for the body to be exposed to direct sunlight *	08:00 a.m	48	82.76	53	88.33
		09:00 a.m	46	79.31	49	81.67
		07:00 a.m	45	77.59	48	80
10.	How long does it take for the body to be exposed to direct sunlight to get vitamin D?	30-60 minutes	30	51.72	21	35
		>60 minutes	11	18.96	15	25
11.	The amount of SPF that is good for the body was	<15	1	1.72	-	0
		>15	-	0	1	1.67
		Don't know	57	98.28	59	98.33

workers, including experienced respiratory problems (58 subjects) and without experience respiratory problems (60 subjects). The number of workers who refused to be interviewed was 20 people, and two people did not meet the inclusion criteria.

Subject Characteristics

In both groups, most were early adults and had an average weight. Based on the results of different tests, it is known that there is no difference between the two groups in the characteristics of age and BMI, which

Table 4. Distribution of answers regarding attitudes toward sun exposure

Number of Correct Answers	Category Attitude Level on Sun Exposure	Groups			
		Respiratory disorders (n: 58)		Without Respiratory disorders (n: 60)	
		Frequency	Percentage (%)	Frequency	Percentage (%)
≤ 9	Well	0	0	0	0
> 9	Bad	58	100	60	100

Table 5. Profile respondents' attitude level on sun exposure

No.	Questions	Answers of Respondents	Groups			
			Respiratory disorders (n: 58)		Without Respiratory disorders (n: 60)	
			Frequency	Percentage (%)	Frequency	Percentage (%)
1.	Often travel or take walks in direct sunlight	Yes	55	98.83	57	95
		No	3	5.17	3	5
2.	Length per day you get sun exposure* (minutes)	>30	53	91.38	48	80
		20-30	4	6.90	4	6.67
		Didn't know	1	1.72	1	1.67
3.	Avoid exposure to direct sunlight	Yes	14	24.14	27	45
		No	44	75.86	33	55
	If" yes"o, the reason*	In order to avoid heat	7	12.07	15	25
		Causes black skin	5	8.62	11	18.33
	If "no," the reason*	Always exposed to light working conditions	32	55.17	27	45
		Without giving a reason	8	13.79	3	5
4.	a. Use skin protective equipment to avoid sun exposure	Yes	52	89.65	58	96.67
		No	6	10.34	2	3.33
	b. What kind of protective equipment do you use*	Hat	49	84.48	57	95
		Long sleeved shirt	8	13.79	10	16.67
5.	The reason you use skin protection*	In order to avoid the hot sun	33	56.90	28	46.67
		Without giving a reason	8	13.79	12	20
6.	Take supplements	Yes (contains vitamins D)	-	0	-	0
		Yes (no contains vitamins D)	3	5.17	3	5
		No	55	94.83	57	95
7.	The goal of taking vitamin D supplements	THERE ARE NO RESPONDENTS THAT CONSUME VITAMIN D				
8.	The need for vitamin D in the body is sufficient	Yes	30	51.72	29	48.33
		No	18	31.03	15	25
		Didn't know	10	17.24	16	26.67
	If "yes," the reason*	Feel healthy	16	27.59	16	26.67
		Without giving a reason	14	24.14	11	18.33
	If "no," the reason*	Without giving a reason	15	25.86	11	18.33
		feel unwell	2	3.45	2	3.33
9.	Have an interest in knowing more about vitamin D.	Yes	40	68.96	46	76.67
		No	18	31.03	14	23.33
	If "yes," the reason*	Just curious	12	20.69	13	21.67
		Without giving a reason	13	22.41	16	26.67
	If "no," the reason*	Not interested	17	29.31	11	18.33
		No time	1	1.72	3	5

means that the age factor and BMI do not affect the study variables (**Table 1**).

Age was also associated with a decline in specific cognitive abilities, such as certain processing speed and

memory, visuospatial, and executive functioning abilities (Harada, Love & Triebel, 2014), as well as increasing age, affects the dynamics of airflow and lung capacity (Lowery, Brubaker, Kuhlmann & Kovacs, 2013). The age range 18-60 years old was due to the data's homogeneity in both the respiratory distress group and the non-respiratory distress group.

Smoking was a significant risk factor for COPD (GOLD, 2019). The nicotine in cigarettes plays a role in developing emphysema in smokers by decreasing elastin in the lung parenchyma and increasing alveolar volume. Nicotine stimulates the vagal reflex and parasympathetic ganglia and causes increased airway resistance by causing bronchoconstriction. The simultaneous effect of bronchoconstriction and apnea increases tracheal tension and causes several respiratory disorders (Mishra et al., 2015). Tobacco cigarettes here consist of two types, namely cigarettes with filters and non-filters. Filter smoking was positively associated with adenocarcinoma incidence, whereas non-filter smokers were positively associated with the incidence of squamous cell carcinoma (Song et al., 2017).

Validity and Reliability Test Results of Questionnaire

The validity test results of each question item on the questionnaire regarding knowledge of sun exposure related to vitamin D were declared valid because r count > 0.361. The reliability test results with the reliability value of Cronbach's alpha, the reliability value of the alpha coefficient is 0.758; so, the questionnaire regarding knowledge of sun exposure can be declared reliable (Lorensia, Raharjo & Gandawari, 2020).

Knowledge about sunlight exposure and vitamin D deficiency risk

The result of knowledge shows that all respiratory disorders have a low level of sun exposure knowledge (100%). Meanwhile, only 3.33% of the subjects who experienced respiratory problems had high knowledge. (**Table 2**).

Most of the subjects from the two groups did not know the definition of vitamin D. The benefits of vitamin D for the body are helping bone formation and maintenance, helping bone hardening (Plum & Deluca, 2020). The source of information regarding vitamin D obtained by the subjects did not come from health workers. The common source of information from health workers shows that health workers such as pharmacists in the community still lack in terms of health promotion. Seven stars of Pharmacist according to WHO, one of which is a teacher where pharmacists can be an educator for the public to convey information about sun exposure related to vitamin D. Effective education campaigns targeted at specific populations will raise awareness about the importance of adequate vitamin D, thereby improving health as a whole (Lhamo, Chugh, Gautam & Tripathi, 2017).

Humans produce 90% of vitamin D naturally from exposure to sunlight on the skin, particularly from exposure to UVB rays. Nearly 5-30 minutes of sun exposure at least two times per week to synthesize vitamin D in the skin (Qureshi et al., 2015), anything that blocks or interferes with the penetration of UVB radiation to the skin will affect the synthesis of vitamin D3 in the skin such as umbrellas and closed clothes. Increased skin pigmentation can reduce vitamin D3 synthesis. Likewise, sunscreen SPF (Sun Protection Factor) 15 can absorb 99% of UVB radiation. Thus, it will reduce the synthesis of vitamin D3 in the skin by 99% (Holick, 2013). Sunlight can be dangerous and can be harmless. Sunlight is harmful to the skin because it can cause skin cancer, while sunlight is not harmful to the skin because it can help produce vitamin D (Wacker & Holick, 2013). The results of the test with the chi-square method, the p-value obtained was 0.161 (p value >0.05), then H_0 was accepted, so it could be concluded that there was no significant difference in the level of knowledge between construction worker with respiratory problems and builders who did not experience respiratory disorders.

Attitude toward sunlight exposure and vitamin D deficiency risk

The attitude assessment results showed that all construction respondents, both those with respiratory problems and those without respiratory problems, had a bad attitude towards sun exposure (**Table 4**).

The correlation test of knowledge and attitudes towards sun exposure related to the risk of vitamin D deficiency cannot be carried out because there is no right attitude. None of the respondents in the respiratory disorders and non-respiratory disorders group have the right attitude. Hence, the correlation test uses the SPSS version of the software 24 for windows cannot be done.

4. CONCLUSIONS

There was no significant difference in knowledge and attitudes between construction workers with respiratory problems and builders without respiratory problems.

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5. REFERENCES

Arora, H., Dixit, V., & Srivastava, N. (2016). Evaluation Of Knowledge, Practices Of Vitamin D and Attitude Toward Sunlight Among Indian Students. *Asian Journal of Pharmaceutical and Clinical Research, 9*(1), 308-13.

Ardam, K. A. Y. (2015). Hubungan Paparan Debu dan Lama Paparan dengan Gangguan Faal Paru Pekerja Overhaul Power Plant. *The Indonesian Journal of Occupational Safety and Health, 4*(2), 155-166.

Babelghaith, S. D., Wajid, S., Al-Zaaqi, M. A., Al-Malki, A. S., Al-Amri, F. D., Alfadly, S., ... & Alarifi, M. N. (2017). Knowledge and practice of vitamin D deficiency among people lives in Riyadh, Saudi Arabia-A cross-sectional study. *Biomedical Research, 28*(7), 3114-3118.

Bank Indonesia. (2019). *Perkembangan Properti Komersial (PPKOM)*. Jakarta, Indonesia: Authors.

Bathi, B. A., Zayed, K. E., Qenai, M . A., Makboul, G., & El-Shazly, M. K. (2012). Knowledge, attitude and practice of patients attending primary care centers toward vitamin D in Kuwait. *Alexandria Journal of Medicine, 48* (3), 277-282. doi:10.1016/j.ajme.2012.02.003

Bozzetto, S., Carraro, S., Giordano, G., Boner, A., & Baraldi, E. (2012). Asthma , allergy and respiratory infections: the vitamin D hypothesis. *Allergy, 67*, 10–17. doi:10.1111/j.1398-9995.2011.02711.x

Darmawan, A. (2013). Penyakit Sistem Respirasi Akibat Kerja. *Jambi Medical Journal, 1*(1), 68–83. doi:10.22437/jmj.v1i1.2691

Finklea, J. D., Grossmann, R. E., & Tangpricha, V. (2011). Vitamin D and Chronic Lung Disease : A Review of Molecular Mechanisms and Clinical Studies. *Advances in Nutrition, 2*(3), 244–253. doi: 10.3945/an.111.000398

Global Initiative for Chronic Obstructive Lung Disease. (2019). *Global Initiative for Chronic Obstructive Lung Disease A Guide for Health Care Professionals*. Fontana, WI: Authors.

Hansdottir, S., & Monick, M. M. (2011). Vitamin D Effects on Lung Immunity and Respiratory Disease. *Vitamins & Hormones, 86*, 217-237. doi:10.1016/B978-0-12-386960-9.00009-5

Harada, C. N., Love, M. C. N., & Triebel, K. (2014). Normal Cognitive Aging. *Clinics in Geriatric Medicine, 29*(4), 737-752. doi:10.1016/j.cger.2013.07.002

Hejazi, M. E., Modarresi-Ghazani, F., & Entezari-Maleki, T. (2016). Journal of Research in Pharmacy Practice Review Article A review of Vitamin D effects on common respiratory diseases : Asthma, chronic obstructive pulmonary disease, and tuberculosis. *Journal of Research in Pharmacy Practice, 5*(1), 7–15. doi:10.4103/2279-042X.176542

Herr, C., Greulich, T., Koczulla, R. A., Meyer, S., Zakharkina, T., Branscheidt, M., … & Bals, R. (2011). The role of vitamin D in pulmonary disease: COPD, asthma, infection, and cancer. *Respiratory Research, 12*(31), 1-9. doi:10.1186/1465-9921-12-31

Holick, M. F. (2011). Vitamin D: A D-Lightful Solution for Health. *Journal of Investigate Medicine, 59*(6), 872-880. doi:10.2310/JIM.0b013e318214ea2d

Kaptein, A. A., Klok, T., Moss-Morris, R., & Brand, P. L. P. (2010). Illness perceptions: Impact on self-management and control in asthma. *Current Opinion in Allergy and Clinical Immunology, 10*(3), 194-199. doi:10.1097/ACI.0b013e32833950c1

Lhamo, Y., Chugh, P. K., Gautam, S. R., & Tripathi, C. D. (2017). Epidemic of Vitamin D deficiency and its management: Awareness among Indian medical undergraduates. Journal of Environmental and Public Health, 2017, 2517207. doi:10.1155/2017/2517207

Lorensia, A., Raharjo, D. N., & Gandawari, N. (2020). Pengaruh Pengetahuan-Sikap Mengenai Vitamin D terkait Obesitas pada Mahasiswa. Journal Ilmiah Ibnu Sina, 5(1), 72-86. doi:10.36387/jiis.v5i1.388

Lowery, E. M., Brubaker, A. L., Kuhlmann, E., & Kovacs, E.J. (2013). The Aging Lung. *Clinical Interventions in Aging, 8*, 1489-1496.

Mishra, A., Chaturvedi, P., Datta, S., Sinukumar, S., Joshi, P., & Garg, A. (2015). Harmful effects of nicotine. *Indian Journal of Medical and Paediatric Oncolology, 36*(1), 24-31. doi:10.4103/0971-5851.151771

Murdaca, G., Pioggia, G. & Negrini, S. (2020). Vitamin D and Covid-19: an update on evidence and potential therapeutic implications. *Clinical and Molecular Allergy, 18*, 23. doi:10.1186/s12948-020-00139-0

Nolasco, R., Moreira, L. D., Bocalini, D. S., Fronza, F. C., Marin, R. V., & Lazaretti-Castro, M. (2017). Effects of vitamin D supplementation on pulmonary function in postmenopausal women following an aquatic exercise program. *Archives of Endocrinology and Metabolism, 61*(1), 28-35. doi:10.1590/2359-3997000000211

Persson, L. J. P., Aanerud, M., Hiemstra, P. S., Hardie, J. A., Bakke, P. S., & Eagan, L. (2012). Chronic Obstructive Pulmonary Disease Is Associated with Low Levels of Vitamin D. *PloS one, 7*(6), 1-8. doi:10.1371/journal.pone.0038934

Pfeffer, P. E., & Hawrylowicz, C. M. (2012). Vitamin D and lung disease. *Thorax, 67*(11), 1018–1020. doi:10.1136/thoraxjnl-2012-202139

Plum, L. A., & DeLuca, H. F. (2010). Vitamin D, disease and therapeutic opportunities. *Nature reviews Drug discovery, 9*(12), 941-955. doi:10.1038/nrd3318

Pratiwi, S. R., Lorensia, A., & Suryadinata, R. V. (2018). Asupan Vitamin C dan E dengan SQ-FFQ terhadap Fungsi Paru Perokok dan Non-Perokok= Vitamin C and E Intake with SQ-FFQ towards Smokers' and Non-Smokers' Lung Function. *Media Kesehatan Masyarakat indonesia, 14*(2), 101-107.

Qureshi, A. Z., Zia, Z., Gitay, M. N., Khan, M. U., & Khan, M. S. (2015). Attitude of future healthcare provider towards vitamin D significance in relation to sunlight exposure. *Saudi Pharmaceutical Journal, 23*(5), 523-527. doi:10.1016/j.jsps.2015.01.004

Suryadinata, R. V., Lorensia, A., & Aprilia, A. P. (2017). Profil Vitamin D pada Pasien Asma dan Non-Asma Dewasa di Surabaya. *The Indonesian Journal of Public Health, 12*(1), 106–117.

Song, M., Benowitz, N. L., Berman, M., Brasky, T. M., Cummings, K. M., Hatsukami, D. K., ... & Shields, P. G. (2017). Cigarette Filter Ventilation and its Relationship to Increasing Rates of Lung Adenocarcinoma. *Journal of the National Cancer Institute, 109*(12), 1-18. doi:10.1093/jnci/djx075

Wacker, M., & Holick, M. F. (2013). Sunlight and Vitamin D: A global perspective for health. *Dermato-Endocrinology, 5*(1), 51-108. doi:10.4161/derm.24494

Zhou, M., Zhuang, W., Yuan, Y., Li, Z., & Cai, Y. (2015). Investigation on vitamin D knowledge , attitude and practice of university students in Nanjing , China. Public Health Nutrition, 19(1), 78-82. doi:10.1017/S1368980015000373

Zhou, Y., Luo, B., & Qin, L. (2019). The association between vitamin D deficiency and Community-Acquired Pneumonia. *Medicine, 98*(38), e17252. doi:10.1097/MD.0000000000017252