



QUALITY IMPROVEMENT IN DENTAL AND MEDICAL KNOWLEDGE, RESEARCH, SKILLS AND ETHICS FACING GLOBAL CHALLENGES

Edited by

Armelia Sari Widyarman, Muhammad Ihsan Rizal,
Moehammad Orliando Roeslan & Carolina Damayanti Marpaung



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QUALITY IMPROVEMENT IN DENTAL AND MEDICAL KNOWLEDGE, RESEARCH, SKILLS AND ETHICS FACING GLOBAL CHALLENGES

The proceedings of FORIL XIII 2022 Scientific Forum Usakti conjunction with International Conference on Technology of Dental and Medical Sciences (ICTDMS) include selected full papers that have been peer-reviewed and satisfy the conference's criteria. All studies on health, ethics, and social issues in the field of dentistry and medicine have been presented at the conference alongside clinical and technical presentations. The twelve primary themes that make up its framework include the following: behavioral epidemiologic, and health services, conservative dentistry, dental materials, dento-maxillofacial radiology, medical sciences and technology, oral and maxillofacial surgery, oral biology, oral medicine and pathology, orthodontics, pediatrics dentistry, periodontology, and prosthodontics. This proceeding will be beneficial in keeping dental and medical professionals apprised of the most recent scientific developments.



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Quality Improvement in Dental and Medical Knowledge, Research, Skills and Ethics Facing Global Challenges

Edited by

Armelia Sari Widyarman, Muhammad Ihsan Rizal,
Moehammad Orliando Roeslan and Carolina
Damayanti Marpaung
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Preface

Faculty of Dentistry Universitas Trisakti (Usakti) presents FORIL XIII 2022 Scientific Forum Usakti conjunction with International Conference on Technology of Dental and Medical Sciences (ICTDMS) on December 8th–10th 2022. The theme of the conference is “Quality Improvement in Dental and Medical Knowledge, Research, Skills and Ethics Facing Global Challenges”.

The triennial conference has served as a meeting place for technical and clinical studies on health, ethical, and social issues in field medical and dentistry. It is organized around 12 major themes, including behavioral, epidemiologic, and health services, conservative dentistry, dental materials, dento-maxillofacial radiology, medical sciences and technology, oral and maxillofacial surgery, oral biology, oral medicine and pathology, orthodontics, pediatrics dentistry, periodontology, and prosthodontics.

The most recent findings in fundamental and clinical sciences related to medical and dental research will be presented in the conference that will be published as part of the conference proceeding. This proceeding will be useful for keeping dental and medical professionals up to date on the latest scientific developments.

Dr. Aryadi Subrata
Chairman FORIL XIII conjunction with ICTDMS



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Salivary interleukin (IL)-6 in elderly people with stomatitis aphthous and gingivitis associated with the occurrence of cognitive impairment

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ABSTRACT: The population of the elderly continues to increase globally, which includes Indonesia. Oral health is often poor in many elderly and has been associated with many health conditions, possibly due to infection. The aging process in itself also increases the vulnerability of elderly people to infections and is also associated with increased levels of interleukin (IL)-6. Stomatitis Aphthous and Gingivitis are well-known oral infection that seems to be mediated principally by the immune system and by Gram-positive and Gram-negative bacteria that contain several components that can enhance the pro-inflammatory cytokines, including interleukin (IL)-6. Recently, poor oral health has been associated with the risk of occurrence of cognitive impairment. However, the relation between stomatitis aphthous and gingivitis with cognitive impairment in the elderly is not well understood. This study aimed to evaluate salivary cytokines, interleukin (IL)-6, and their relation to cognitive impairment. A total of 133 respondents sample of those over 60 years old was collected in rural Borobudur in Central Java Indonesia. Each subject underwent detailed oral and dental examination, with a focus on oral infections in accordance with the Axell method. Medical examination and medical history were assessed by using standardized questions from the Cambridge Mental Disorder of the Elderly Examination (CAMDEX). Salivary IL-6 was determined by using enzyme-linked immunosorbent assay (ELISA). Statistical analysis was performed by use of descriptive statistics. A significant difference in salivary IL-6 for stomatitis aphthous was found ($P < 0.05$) as well as in respondents with gingivitis. Gingivitis was significantly associated with the occurrence of cognitive impairment ($p < 0.05$). We might conclude that elevated salivary IL-6 levels for stomatitis aphthous and gingivitis showed higher levels but only Gingivitis is related to cognitive impairments. However, this was not maintained in regression analyses.

1 INTRODUCTION

The elderly population is increasing rapidly in many developed countries. The proportion of the older adult population will rise from 1 in 11 people to 1 in 6 people by 2050 (United Nations 2019). The trend in population growth of Indonesia within the first decade of the new millennium will show an older population equal to or exceeding the under-five children population (Bappenas and Statistic Office). Moreover, it is estimated that the proportion of

elderly people in the total population of Indonesia will be the largest country in the world with the greatest increase of elderly people (Ministry of Health 2012).

General health conditions have a very strong relationship with oral hygiene. Many studies have been conducted concerning the relationship of the status of oral hygiene. Bad oral hygiene may affect oral comfort, eating patterns, nutritional status, cognitive status (orientation, attention, language function, motoric control, among others), behavioral change, and quality of life (Newton 2006).

Oral disorders seen in the elderly among others are hypersalivation of the salivary gland up to a condition known as xerostomia, fluctuation of the number of *Candida* in the mouth, the presence of an infection as a result of bacteria and virus as well as *Candida*, the sensation of hot and sharp stinging pain, loss of all the teeth in one's mouth, lowered chewing functions, periodontal disease, dental caries and damage of the mucosa membrane (Samaranayake et al. 1995). A study on the occurrence of xerostomia found this in 20.4% up to 49.3% of the elderly (Matear 2006). Xerostomia is further associated with other oral problems such as dental caries, periodontal disease, and oral infections (Chan et al. 2021). According to Kenneth, the most common oral infection in the elderly was caused by fungi and virus, as well as bacteria, and was triggered by several factors, among others as a result of the influence of systemic factors. The increased risk of caries and periodontal disease may eventually lead to tooth loss. On the other hand, some oral diseases are interrelated with systemic diseases (Tavares et al. 2014). Diabetes and periodontal disease are known to have a bi-directional relationship and also the same relationship between rheumatoid arthritis and periodontal diseases (Hussain et al. 2020; Qiao et al. 2020). Oral diseases in older adults can adversely affect their general well-being and quality of life (Glick et al. 2016).

The immune system comprises all mechanisms that are utilized by the body as a total defense mechanism for protection against the danger that may be brought about by various materials from the environment (Trowbridge et al. 1997). Oral infections often lead to inflammation and are inseparable from the role of the immune factors. Cells of the immune system will be interacting with one another by releasing and increasing their solvent factors which are known as cytokines and were given the name of "interleukin" according to their role (Levine & Stillman 2004). Interleukin (IL-6) is a multi-functional cytokine and plays a role in the response to inflammation (Hussain et al. 2020). IL-6 in saliva as a biomarker of oral infection can identify the change in oral infections and systemic irregularity (Amerongen & Veerman 2002).

Recently, oral health status has also been associated with the occurrence of dementia and cognitive impairment. Early studies of the elderly living in Australia conducted by Chalmers et al. (2002) found that bad oral hygiene was a dementia risk, even though the mechanisms that related this to dementia were not quite clear yet. According to an initial study in Jakarta in 2007, 40% of the elderly had low cognitive function (and may have been at risk for dementia) as measured by Mini-Mental Status Examination (MMSE). Oral health (number of missing teeth) here was also related to cognitive impairment (Hogervorst et al. 2007).

2 METHODS

The respondents were gathered at a designated place at each of the research locations, which was at the home of one of the integrated health unit's administrators. Each respondent took their turns with a researcher measuring their height, weighing themselves and calculating their Body Mass Index. Then a cognitive status check was conducted on each respondent by using the MMSE. According to Folstein et al. (1977), the uneducated/illiterate respondents were modified. Afterward, a medical examination and a health resume were conducted based on the Cambridge Mental Disorder of the Elderly Examination (CAMDEX) (Roth et al. 2004).

A sample of the saliva was collected by making participants spit into a sterilized container that was readily available. Dental health and oral hygiene examinations were conducted through an interview using questionnaires. Clinical examinations to obtain a clinical description of the oral infection irregularities with regard to lesion diagnoses of the mouth mucosa based on Tony E Axéll et al. The examination was conducted to discover the pre-sence of any gingivitis inflammation by way of a Papilla Bleeding Index (PBI). Oral hygiene examination was conducted by measuring the Interdental Hygiene Index (HYG) according to Klaus et al. (1989).

3 RESULTS AND DISCUSSION

Based on the consecutive method at the four villages, Borobudur, Gejangan, Kujon, and Salam, Borobudur Subdistrict, in Magelang, Central Java, 133 respondents have fulfilled the inclusive criteria, and whose data was complete along with a saliva sample. The description of the individual characteristic is summarized in Table 1. This data is in line with the national data which indicated that the proportion of female elderly is higher than males.

In general, during their active days, these Javanese participants worked as farmers or laborers. This condition indicated that the subjects of the research were relatively homogeneous in education, ethnicity, as well as in their occupation.

According to the intra-oral examination and clinical description, various types of oral infection were identified in the elderly (Figure 1), 83% had a coated tongue and 67% had gingivitis. This could possibly be a result of a pile-up of debris/food leftover and ignorance of the fact that the tongue's cleanliness must also be maintained, moreover, it could also be a result of the aging process which, among others, and the function of the saliva gland decreases resulting in xerostomia (Chan et al. 2021). The distribution of oral infections in this research is consistent with oral disease reported in the elderly, and is closely related to fungal and bacterial infections, manifested by the high proportion of white tongue and gingivitis. Stomatitis Aphthosa and Traumatic ulcer, although the amount is not too much, it is so disturbing that they interfere with the quality of life. The disease is probably mainly caused by infections, vascular, vitamin, and calcium deficiency, and poor health conditions that often appear in the elderly.

The result of the level of interleukin (IL)-6 examination of the saliva of the 133 respondents ranged from the lowest value of 1.78 (pg/ml) up to the highest value of 99 (pg/ml). By deciding the respondents into groups based on the number of oral infections, and the level of (IL)-6 in each group, it was shown that the lowest (IL)-6 level occurred in the 3 oral infections group (27.99 pg/ml), while the highest (IL)-6 level occurred in 5 oral infections group (55.94 pg/ml). However, there was much overlap between groups (see Figure 2) and this difference was not significant. Thus, IL-6 is not always a sign of infection of oral infections (Wray et al. 1999). According to Yamamoto et al. (1991), the increase in the level of interleukin (IL)-6 was one of the pathophysiological characteristics of an individual with oral disease. In this study, it is only represented by aphthous stomatitis and gingivitis.

The correlation between oral infection and the level of interleukin (IL)-6 is described in Table 2. Aphthous stomatitis and gingivitis is an infection of the oral cavity that is significantly related to levels of interleukin (IL)-6. Aphthous stomatitis and gingivitis are caused by Gram-positive and Gram-negative pathogens. Theoretically, these two types of bacteria contain several components that can enhance the pro-inflammatory cytokines, including interleukin (IL)-6 (Lesourd & Mazari 1999). With higher levels of interleukin in the group with aphthous stomatitis and gingivitis, the results of this study are consistent with the theory above but only as specifically related to these but not all infectious oral diseases (see Table 2).

Infections and immune reactions cause endothelial dysfunction, cell injury, and a pro-inflammatory environment, but whether the infection is a major factor in inflammation is

still not proven (Amerongen & Veerman 2002). Interleukin (IL)-6 is a pro-inflammatory cytokine responsible principally for the early response of the immune system. If the infection also triggers interleukin (IL)-6, this may be explained by the relationship between inflammation and infection, which in this study is indicated by Aphthous stomatitis and gingivitis.

On examination with the MMSE using a cut-off score of 24 images, rendered 58% who subjects experienced cognitive impairment. The result is shown in Figure 3.

As shown in Table 3, a description of the relationship between oral infection and cognitive impairment is given. Almost all the respondents who experienced oral infections had a tendency to the emergence of cognitive impairment. The proportion who experienced cognitive impairment based on oral infections were: In Stomatitis aphtosa, 75% had cognitive impairments; In Gingivitis, 51% had cognitive impairments; and in Herpes labialis, 100% had cognitive impairments.

When viewed from a statistical relationship, only gingivitis has a significant association with the emergence of cognitive impairment events. The results show that oral infections in relation to cognitive impairments are still unproven, although several prospective cohort studies conducted by Shimazaki et al. (2001) stated that the cause of poor oral health, especially in elderly with missing teeth and without dentures have a relationship with health status. Avlund et al. also found that elderly people with coronal caries and no periodical dental health services had a lower cognitive function.

Table 1. Characteristic of the respondents.

No.	Variable characteristic individual	N	(%)
1	Sex		
	- Male	52	39
	- Female	81	61
2	Age of respondents		
	- < 70 years	40	30
	- 70–79 years	64	48
	- ≥ 80 years	29	22
Mean ± SD = 73,2 ± 8,1years old median 73,0 years old			
3	Education		
	- Uneducated / Non graduate elementary	64	48
	- Graduated elementary school	53	40
	- Junior high school +	16	12
4	Occupation		
	- Unemployed	52	39
	- Farmer	60	45
	- Entrepreneur	21	15,8

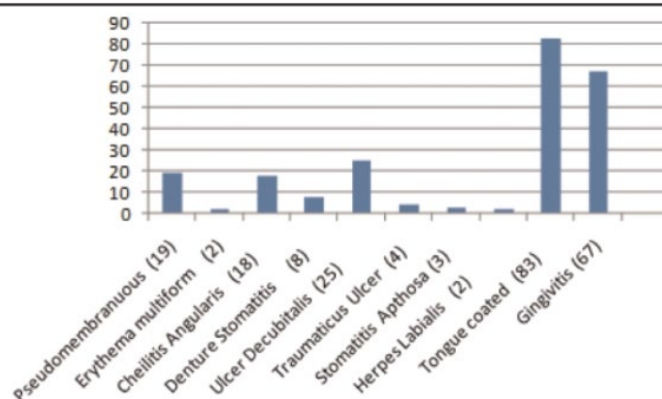


Figure 1. Graphic on the distribution of oral infection.

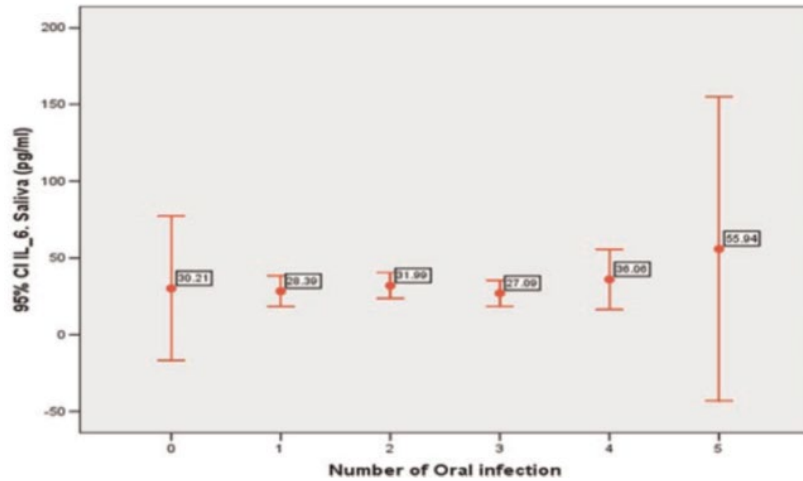


Figure 2. Level of (IL)-6 in each group oral infection.

Table 2. The correlation between oral infection and IL-6.

Type of oral infection	Yes/no	N	Std. Deviation	Mean of IL-6(pg/ml)	P Value (T-test)
Pseudomembranous	No	108	39	58	0,666
	Yes	25	45	69	
Erythema multiform	No	128	40	60	0,576
	Yes	5	34	24	
Angular cheilitis	No	107	38	58	0,604
	Yes	26	46	68	
Denture stomatitis	No	122	40	61	0,265
	Yes	11	46	68	
Decubitus ulcer	No	99	43	66	0,098
	Yes	34	29	34	
Traumatic ulcer	No	126	40	61	0,243
	Yes	7	22	12	
Aphthous stomatitis	No	127	37	55	0,002*
	Yes	6	123	127	
Herpes labialis	No	128	40	60	0,339
	Yes	5	13	10	
Coated tongue	No	25	28	23	0,069
	Yes	107	42	65	
Gingivitis	No	44	26	34	0,035*
	Yes	89	46	68	

Significant: $p < 0,05$ **

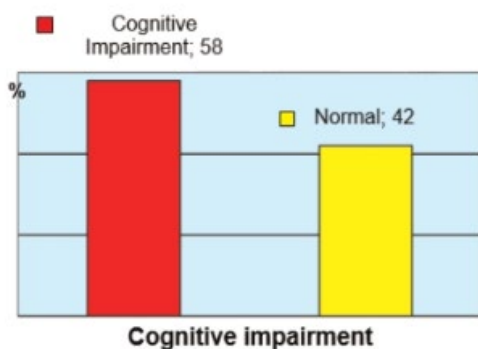


Figure 3. Graphic describing a cognitive impairment.

Table 3. The association between oral infection and cognitive impairment.

Types of oral infections		Cognitive status		OR (95% CI)	P value
		Normal	Cognitive impairment		
Pseudomembranous	No	47 (43%)	62 (57%)	1,26 (0,51–3,14)	0,39
	Yes	9 (37%)	15 (62%)		
Erythematous	No	55 (42%)	75 (58%)	1,47(0,13–16,58)	0,62
	Yes	1 (33%)	2 (67%)		
Angular cheilitis	No	47 (43%)	61 (56%)	1,37 (0,56–3,37)	0,32
	Yes	9 (36%)	16 (64%)		
Denture stomatitis	No	52 (42%)	72 (58%)	0,90 (0,23–3,53)	0,57
	Yes	4 (44%)	5 (55%)		
Decubitus ulcer	No	40 (40%)	60 (60%)	0,70 (0,32–1,56)	0,25
	Yes	16 (48%)	17 (51%)		
Traumatic ulcer	No	53 (41%)	75 (59%)	0,47 (0,07–2,92)	0,35
	Yes	3 (60%)	2 (40%)		
Apthous stomatitis	No	55 (43%)	74 (57%)	2,23 (0,23–22,02)	0,44
	Yes	1 (25%)	3 (75%)		
Herpes labialis	No	56 (43%)	74 (57%)	0,57 (0,49–0,66)	0,19
	Yes	0 (0%)	3 (100%)		
Coated tongue	No	9 (37%)	15 (62%)	0,79 (0,32–1,96)	0,39
	Yes	47 (43%)	62 (57%)		
Gingivitis	No	11 (25%)	33 (75%)	0,33 (0,14–0,72)	0,004*
	Yes	44 (49%)	45 (51%)		

* Significant: $p < 0,05$

4 CONCLUSION

This study concluded that the most common oral infections in the elderly are coated tongue and gingivitis. The result of the saliva levels of interleukin IL-6 has a wide range from the lowest value of 1.78 pg/ml up to the highest value of 99 pg/ml. The association between oral infections and IL-6 overall was not significant, except for apthous stomatitis and gingivitis

which showed higher levels of Il-6, but this was not found in other oral infectious diseases. The association between risk factors and oral infection are occupational status, level of education, gender, and missing teeth. None of the oral infections, except gingivitis, were related to cognitive impairment. However, this was not maintained in regression analyses. Age, education level, and teeth loss contribute independently to cognitive impairment. The higher age and missing all teeth would increase the risk of the emergence of cognitive impairment. Missing teeth may be a potential marker for long-term previous oral infectious disease. Alternatively, inadequate nutritional intake associated with teeth loss may explain this association.

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Salivary interleukin (IL)-6 in elderly people with stomatitis aphthous and gingivitis associated with the occurrence of cognitive impairment

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Salivary interleukin (IL)-6 in elderly people with stomatitis aphthous and gingivitis associated with the occurrence of cognitive impairment

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ABSTRACT: The population of the elderly continues to increase globally, which includes Indonesia. Oral health is often poor in many elderly and has been associated with many health conditions, possibly due to infection. The aging process in itself also increases the vulnerability of elderly people to infections and is also associated with increased levels of interleukin (IL)-6. Stomatitis Aphthous and Gingivitis are well-known oral infection that seems to be mediated principally by the immune system and by Gram-positive and Gram-negative bacteria that contain several components that can enhance the pro-inflammatory cytokines, including interleukin (IL)-6. Recently, poor oral health has been associated with the risk of occurrence of cognitive impairment. However, the relation between stomatitis aphthous and gingivitis with cognitive impairment in the elderly is not well understood. This study aimed to evaluate salivary cytokines, interleukin (IL)-6, and their relation to cognitive impairment. A total of 133 respondents sample of those over 60 years old was collected in rural Borobudur in Central Java Indonesia. Each subject underwent detailed oral and dental examination, with a focus on oral infections in accordance with the Axell method. Medical examination and medical history were assessed by using standardized questions from the Cambridge Mental Disorder of the Elderly Examination (CAMDEX). Salivary IL-6 was determined by using enzyme-linked immunosorbent assay (ELISA). Statistical analysis was performed by use of descriptive statistics. A significant difference in salivary IL-6 for stomatitis aphthous was found ($P < 0.05$) as well as in respondents with gingivitis. Gingivitis was significantly associated with the occurrence of cognitive impairment ($p < 0.05$). We might conclude that elevated salivary IL-6 levels for stomatitis aphthous and gingivitis showed higher levels but only Gingivitis is related to cognitive impairments. However, this was not maintained in regression analyses.

1 INTRODUCTION

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The elderly population is increasing rapidly in many developed countries. The proportion of the older adult population will rise from 1 in 11 people to 1 in 6 people by 2050 (United Nations 2019). The trend in population growth of Indonesia within the first decade of the new millennium will show an older population equal to or exceeding the under-five children population (Bappenas and Statistic Office). Moreover, it is estimated that the proportion of

elderly people in the total population of Indonesia will be the largest country in the world with the greatest increase of elderly people (Ministry of Health 2012).

General health conditions have a very strong relationship with oral hygiene. Many studies have been conducted concerning the relationship of the status of oral hygiene. Bad oral hygiene may affect oral comfort, eating patterns, nutritional status, cognitive status (orientation, attention, language function, motoric control, among others), behavioral change, and quality of life (Newton 2006).

Oral disorders seen in the elderly among others are hypersalivation of the salivary gland up to a condition known as xerostomia, fluctuation of the number of *Candida* in the mouth, the presence of an infection as a result of bacteria and virus as well as *Candida*, the sensation of hot and sharp stinging pain, loss of all the teeth in one's mouth, lowered chewing functions, periodontal disease, dental caries and damage of the mucosa membrane (Samaranayake et al. 1995). A study on the occurrence of xerostomia found this in 20.4% up to 49.3% of the elderly (Matear 2006). Xerostomia is further associated with other oral problems such as dental caries, periodontal disease, and oral infections (Chan et al. 2021). According to Kenneth, the most common oral infection in the elderly was caused by fungi and virus, as well as bacteria, and was triggered by several factors, among others as a result of the influence of systemic factors. The increased risk of caries and periodontal disease may eventually lead to tooth loss. On the other hand, some oral diseases are interrelated with systemic diseases (Tavares et al. 2014). Diabetes and periodontal disease are known to have a bi-directional relationship and also the same relationship between rheumatoid arthritis and periodontal diseases (Hussain et al. 2020; Qiao et al. 2020). Oral diseases in older adults can adversely affect their general well-being and quality of life (Glick et al. 2016).

The immune system comprises all mechanisms that are utilized by the body as a total defense mechanism for protection against the danger that may be brought about by various materials from the environment (Trowbridge et al. 1997). Oral infections often lead to inflammation and are inseparable from the role of the immune factors. Cells of the immune system will be interacting with one another by releasing and increasing their solvent factors which are known as cytokines and were given the name of "interleukin" according to their role (Levine & Stillman 2004). Interleukin (IL-6) is a multi-functional cytokine and plays a role in the response to inflammation (Hussain et al. 2020). IL-6 in saliva as a biomarker of oral infection can identify the change in oral infections and systemic irregularity (Amerongen & Veerman 2002).

Recently, oral health status has also been associated with the occurrence of dementia and cognitive impairment. Early studies of the elderly living in Australia conducted by Chalmers et al. (2002) found that bad oral hygiene was a dementia risk, even though the mechanisms that related this to dementia were not quite clear yet. According to an initial study in Jakarta in 2007, 40% of the elderly had low cognitive function (and may have been at risk for dementia) as measured by Mini-Mental Status Examination (MMSE). Oral health (number of missing teeth) here was also related to cognitive impairment (Hogervorst et al. 2007).

2 METHODS

The respondents were gathered at a designated place at each of the research locations, which was at the home of one of the integrated health unit's administrators. Each respondent took their turns with a researcher measuring their height, weighing themselves and calculating their Body Mass Index. Then a cognitive status check was conducted on each respondent by using the MMSE. According to Folstein et al. (1977), the uneducated/illiterate respondents were modified. Afterward, a medical examination and a health resume were conducted based on the Cambridge Mental Disorder of the Elderly Examination (CAMDEX) (Roth et al. 2004).

A sample of the saliva was collected by making participants spit into a sterilized container that was readily available. Dental health and oral hygiene examinations were conducted through an interview using questionnaires. Clinical examinations to obtain a clinical description of the oral infection irregularities with regard to lesion diagnoses of the mouth mucosa based on Tony E Axéll et al. The examination was conducted to discover the pre-sence of any gingivitis inflammation by way of a Papilla Bleeding Index (PBI). Oral hygiene examination was conducted by measuring the Interdental Hygiene Index (HYG) according to Klaus et al. (1989).

3 RESULTS AND DISCUSSION

Based on the consecutive method at the four villages, Borobudur, Gejangan, Kujon, and Salam, Borobudur Subdistrict, in Magelang, Central Java, 133 respondents have fulfilled the inclusive criteria, and whose data was complete along with a saliva sample. The description of the individual characteristic is summarized in Table 1. This data is in line with the national data which indicated that the proportion of female elderly is higher than males.

In general, during their active days, these Javanese participants worked as farmers or laborers. This condition indicated that the subjects of the research were relatively homogeneous in education, ethnicity, as well as in their occupation.

According to the intra-oral examination and clinical description, various types of oral infection were identified in the elderly (Figure 1), 83% had a coated tongue and 67% had gingivitis. This could possibly be a result of a pile-up of debris/food leftover and ignorance of the fact that the tongue's cleanliness must also be maintained, moreover, it could also be a result of the aging process which, among others, and the function of the saliva gland decreases resulting in xerostomia (Chan et al. 2021). The distribution of oral infections in this research is consistent with oral disease reported in the elderly, and is closely related to fungal and bacterial infections, manifested by the high proportion of white tongue and gingivitis. Stomatitis Aphthosa and Traumatic ulcer, although the amount is not too much, it is so disturbing that they interfere with the quality of life. The disease is probably mainly caused by infections, vascular, vitamin, and calcium deficiency, and poor health conditions that often appear in the elderly.

The result of the level of interleukin (IL)-6 examination of the saliva of the 133 respondents ranged from the lowest value of 1.78 (pg/ml) up to the highest value of 99 (pg/ml). By deciding the respondents into groups based on the number of oral infections, and the level of (IL)-6 in each group, it was shown that the lowest (IL)-6 level occurred in the 3 oral infections group (27.99 pg/ml), while the highest (IL)-6 level occurred in 5 oral infections group (55.94 pg/ml). However, there was much overlap between groups (see Figure 2) and this difference was not significant. Thus, IL-6 is not always a sign of infection of oral infections (Wray et al. 1999). According to Yamamoto et al. (1991), the increase in the level of interleukin (IL)-6 was one of the pathophysiological characteristics of an individual with oral disease. In this study, it is only represented by aphthous stomatitis and gingivitis.

The correlation between oral infection and the level of interleukin (IL)-6 is described in Table 2. Aphthous stomatitis and gingivitis is an infection of the oral cavity that is significantly related to levels of interleukin (IL)-6. Aphthous stomatitis and gingivitis are caused by Gram-positive and Gram-negative pathogens. Theoretically, these two types of bacteria contain several components that can enhance the pro-inflammatory cytokines, including interleukin (IL)-6 (Lesourd & Mazari 1999). With higher levels of interleukin in the group with aphthous stomatitis and gingivitis, the results of this study are consistent with the theory above but only as specifically related to these but not all infectious oral diseases (see Table 2).

Infections and immune reactions cause endothelial dysfunction, cell injury, and a pro-inflammatory environment, but whether the infection is a major factor in inflammation is

still not proven (Amerongen & Veerman 2002). Interleukin (IL)-6 is a pro-inflammatory cytokine responsible principally for the early response of the immune system. If the infection also triggers interleukin (IL)-6, this may be explained by the relationship between inflammation and infection, which in this study is indicated by Aphthous stomatitis and gingivitis.

On examination with the MMSE using a cut-off score of 24 images, rendered 58% who subjects experienced cognitive impairment. The result is shown in Figure 3.

As shown in Table 3, a description of the relationship between oral infection and cognitive impairment is given. Almost all the respondents who experienced oral infections had a tendency to the emergence of cognitive impairment. The proportion who experienced cognitive impairment based on oral infections were: In Stomatitis aphtosa, 75% had cognitive impairments; In Gingivitis, 51% had cognitive impairments; and in Herpes labialis, 100% had cognitive impairments.

When viewed from a statistical relationship, only gingivitis has a significant association with the emergence of cognitive impairment events. The results show that oral infections in relation to cognitive impairments are still unproven, although several prospective cohort studies conducted by Shimazaki et al. (2001) stated that the cause of poor oral health, especially in elderly with missing teeth and without dentures have a relationship with health status. Avlund et al. also found that elderly people with coronal caries and no periodical dental health services had a lower cognitive function.

Table 1. Characteristic of the respondents.

No.	Variable characteristic individual	N	(%)
1	Sex		
	- Male	52	39
	- Female	81	61
2	Age of respondents		
	- < 70 years	40	30
	- 70–79 years	64	48
	- ≥ 80 years	29	22
Mean ± SD = 73,2 ± 8,1years old median 73,0 years old			
3	Education		
	- Uneducated / Non graduate elementary	64	48
	- Graduated elementary school	53	40
	- Junior high school +	16	12
4	Occupation		
	- Unemployed	52	39
	- Farmer	60	45
	- Entrepreneur	21	15,8

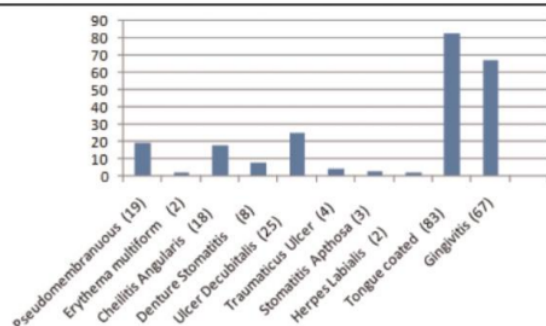


Figure 1. Graphic on the distribution of oral infection.

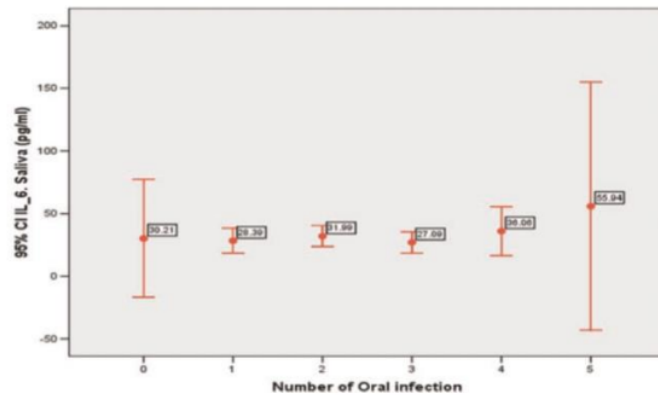


Figure 2. Level of (IL)-6 in each group oral infection.

Table 2. The correlation between oral infection and IL-6.

Type of oral infection	Yes/no	N	Std. Deviation	Mean of IL-6(pg/ml)	P Value (T-test)
Pseudomembranous	No	108	39	58	0,666
	Yes	25	45	69	
Erythema multiform	No	128	40	60	0,576
	Yes	5	34	24	
Angular cheilitis	No	107	38	58	0,604
	Yes	26	46	68	
Denture stomatitis	No	122	40	61	0,265
	Yes	11	46	68	
Decubitus ulcer	No	99	43	66	0,098
	Yes	34	29	34	
Traumatic ulcer	No	126	40	61	0,243
	Yes	7	22	12	
Aphthous stomatitis	No	127	37	55	0,002*
	Yes	6	123	127	
Herpes labialis	No	128	40	60	0,339
	Yes	5	13	10	
Coated tongue	No	25	28	23	0,069
	Yes	107	42	65	
Gingivitis	No	44	26	34	0,035*
	Yes	89	46	68	

Significant: $p < 0,05$ **

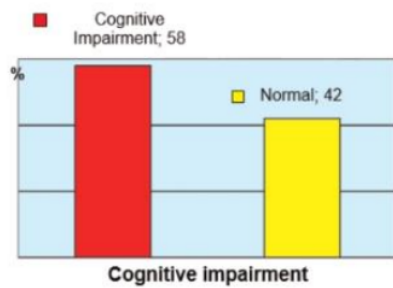


Figure 3. Graphic describing a cognitive impairment.

Table 3. The association between oral infection and cognitive impairment.

Types of oral infections		Cognitive status		OR (95% CI)	P value
		Normal	Cognitive impairment		
Pseudomembranous	No	47 (43%)	62 (57%)	1,26 (0,51–3,14)	0,39
	Yes	9 (37%)	15 (62%)		
Erythematous	No	55 (42%)	75 (58%)	1,47(0,13–16,58)	0,62
	Yes	1 (33%)	2 (67%)		
Angular cheilitis	No	47 (43%)	61 (56%)	1,37 (0,56–3,37)	0,32
	Yes	9 (36%)	16 (64%)		
Denture stomatitis	No	52 (42%)	72 (58%)	0,90 (0,23–3,53)	0,57
	Yes	4 (44%)	5 (55%)		
Decubitus ulcer	No	40 (40%)	60 (60%)	0,70 (0,32–1,56)	0,25
	Yes	16 (48%)	17 (51%)		
Traumatic ulcer	No	53 (41%)	75 (59%)	0,47 (0,07–2,92)	0,35
	Yes	3 (60%)	2 (40%)		
Aphthous stomatitis	No	55 (43%)	74 (57%)	2,23 (0,23–22,02)	0,44
	Yes	1 (25%)	3 (75%)		
Herpes labialis	No	56 (43%)	74 (57%)	0,57 (0,49–0,66)	0,19
	Yes	0 (0%)	3 (100%)		
Coated tongue	No	9 (37%)	15 (62%)	0,79 (0,32–1,96)	0,39
	Yes	47 (43%)	62 (57%)		
Gingivitis	No	11 (25%)	33 (75%)	0,33 (0,14–0,72)	0,004*
	Yes	44 (49%)	45 (51%)		

* Significant: $p < 0,05$

4 CONCLUSION

This study concluded that the most common oral infections in the elderly are coated tongue and gingivitis. The result of the saliva levels of interleukin IL-6 has a wide range from the lowest value of 1.78 pg/ml up to the highest value of 99 pg/ml. The association between oral infections and IL-6 overall was not significant, except for aphthous stomatitis and gingivitis

which showed higher levels of Il-6, but this was not found in other oral infectious diseases. The association between risk factors and oral infection are occupational status, level of education, gender, and missing teeth. None of the oral infections, except gingivitis, were related to cognitive impairment. However, this was not maintained in regression analyses. Age, education level, and teeth loss contribute independently to cognitive impairment. The higher age and missing all teeth would increase the risk of the emergence of cognitive impairment. Missing teeth may be a potential marker for long-term previous oral infectious disease. Alternatively, inadequate nutritional intake associated with teeth loss may explain this association.

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