ORIGINAL

Oral health status of pregnant women in the Republic of Kiribati

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Abstract : Prenatal dental examinations were performed from June 2012 to May 2013 in the Republic of Kiribati as a Japan International Cooperation Agency support program. We analyzed the examination data and compared it with Japanese data retrospectively to clarify the oral health condition of pregnant women in the Republic of Kiribati. We recorded the DMF index, gingival status, and calculus attachment, analyzed data of 512 pregnant women. We also compared the city and the rural group data. The average number of present teeth, decayed teeth, missing teeth and filled teeth was 26.9, 2.5, 1.1, 0.2, respectively. Pregnant Kiribati women had significantly more decayed teeth and fewer filled teeth, more severe periodontal condition, more calculus deposition, and more severe gingival swelling than pregnant Japanese women. No significant difference was found in missing and filled teeth, but pregnant women in the city group had significantly more decayed teeth and tooth stumps than those in the rural group. Our findings indicate that pregnant women in Kiribati have more decayed teeth, more missing teeth, fewer filled teeth, and more severe periodontal problems than their counterparts in Japan. Additionally, the oral health status of pregnant women in Kiribati could be subject to regional variations. J. Med. Invest. 70 : 110-114, February, 2023

Keywords **:** *Pregnant woman, Republic of Kiribati, Dental examination, Developing country*

INTRODUCTION

International cooperation is affected by the gap in economic status between developed and developing countries (1). Developing countries make up approximately 80% of the population in the world, but their total gross national product makes up only approximately 14% of the global figure. Developed countries monopolize over 80% of the world's wealth. The economic condition of a country has serious implications for the health of its population (1). Japan International Cooperation Agency (JICA) have been supporting for developing countries to dispatch numerous professionals and to perform lots of programs in multifield including health care as an international cooperation since 2003.

JICA dispatched a Japanese dental hygienist to the Republic of Kiribati from June 2012 to May 2013 as a part of support programs, and who examined oral health condition of Kiribati pregnant women. The Republic of Kiribati is a developing island-nation with 33 atoll islands, 730 km^2 area and around 110,000 people in the Pacific Ocean. The gross domestic product of Kiribati is US$1,640 per capita, ranking it 150th in the world in 2018 (2-4). While a Japanese dental hygienist working in Kiribati as Japan Overseas Cooperation Volunteers, it was observed the poor oral health of Kiribati pregnant women and recognized the need to provide oral health guidance to improve their knowledge and techniques of oral hygiene. The oral health of pregnant women affects the fetus, and poor oral health may result in premature birth and low birth weight infants. Offenbacher *et al*. mentioned that in pregnant women with more than 60% of teeth affected by periodontal disease, the risk of premature birth and low birth weight infants increased by a factor of 7.5 (5).

Therefore, we analyzed the Kiribati examination data retrospectively with comparing to Japanese data to clarify the oral health status of pregnant women in Kiribati. We also verified regional disparity of the oral health of them.

Received for publication June 15, 2022 ; accepted November 14, 2022.

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SUBJECTS AND METHODS

1. Subjects and study design

We retrospectively analyzed 512 pregnant women's dental examinations at 15 clinics on Tarawa Island in the capital of the Republic of Kiribati from June 2012 to May 2013.

2. Survey items for prenatal dental examination

1) Basic information

We interviewed each subject on age, gestational age, and the clinic visited.

2) Oral health status

We investigated the DMF tooth counts. The survey items were decayed teeth (D), missing teeth because of caries (M), and filled teeth (F). In additionally we investigated tooth stumps, dental calculus, and gingival swelling were also recorded to assess the periodontal condition. We assessed the amount of calculus deposition to the lingual side of the lower anterior teeth and the buccal side of the upper first molars without using a probe (0 : no calculus, 1 : mild calculus, 2 : moderate calculus, and 3 : severe calculus). The gingival tissue was visually evaluated for swelling, color, and degree of bleeding (0 : good, 1 : mild, 2 : moderate, and 3 : severe). The prenatal dental examination was conducted by a Japanese dental hygienist with 8 years of clinical experience.

3. Analysis method

1) Analysis I : Oral health status of pregnant women in the Republic of Kiribati

A simple tabulation was made of the total number of subjects, including the number of DMF teeth, tooth stumps, the degree of calculus deposition and the degree of gingival swelling.

2) Analysis II : Comparison of the oral health status of pregnant women between the Republic of Kiribati and Japan

The oral health of pregnant women was compared between the Republic of Kiribati and Japan for each of the survey items. Japanese data on the number of DMF teeth were from dental examinations of pregnant women in Tokushima Prefecture in 2009 (6) (Japan†1) and in Kobe City in 2016 (7) (Japan†2). These data are shown in the table 1†1. Student's T test was used to compare the results from Kiribati with Japan†1, and the chi-square test was used to compare the Kiribati results with Japan†2. The number of missing teeth of Japan†2 did not include teeth replaced by a prosthesis. There were no Japanese data for tooth stumps, so no comparisons could be made. Furthermore, Data from dental examinations of 1,098 hospitalized postpartum women with the mean age 27.7 ± 4.1 years in Okayama City in 2001, which assessed the degree of calculus deposition and gingival swelling (9) (Japan†3), were also used. The Chi-square test was used to compare the results from Kiribati with those from Japan†3.

3) Analysis III : Regional differences in the oral health status of pregnant women in urban and rural areas

Kiribati region was divided into two sections consisting of 4 urban areas and 11 rural areas. We compared each survey item between the two areas, using Student's T test for the number of DMF teeth and using the chi-square test for the tooth stumps, the degree of calculus deposition and the degree of gingival swelling.

Statistical analysis was performed using the analysis software IBM SPSS Ver21 (IBM Japan, Tokyo, Japan) with a significance level of 5%.

4. Ethical considerations

This study was conducted with the approval of the Ethics Committee of the Tokushima University Hospital (approval number : 3352). Since this is a retrospective study, we opted out of the research implementation report in fifteen clinics in Kiribati, the site of the pregnant women's dental examinations. We have obtained written permission to use the data from the MINISTRY OF HEALTH AND MEDICAL SERVICE Kiribati Dental Department and JICA.

Table 1. The number of DMF teeth in pregnant women.

	Kiribati (n = 512)	Japan†1 (n = 739)
number of Decayed tooth (mean ± SE)	2.5 ± 3.7	2.0 ± 3.0
number of Missing tooth (mean ± SE)	1.1 ± 1.9	0.7 ± 1.5
number of Filled tooth (mean ± SE)	0.2 ± 0.6	11.1 ± 5.6

Japan†1 : Japanese data on the number of DMF teeth were from dental examinations of pregnant women in Tokushima Prefecture in 2009 (6).

Table 2. The prevalence of DMF teeth in pregnant women.

	Kiribati (n = 512)	Japan†2 (n = 4276)
prevalence of Decayed tooth (%)	60.0	44.6
prevalence of Missing tooth (%)	39.6	6.2
prevalence of Filled tooth (%)	8.9	91.3

Japan†2 : Japanese data on the prevalence of DMF teeth were from dental examinations of pregnant women in Kobe City in 2016 (7).

RESULTS

1) Basic information

No subjects opted out of the study. The average age of the 512 subjects was 26.6 ± 6.0 years, and the gestation stage was 6.4 ± 1.5 months.

2) Oral health status

1. Analysis I : Oral health status of pregnant women in the Republic of Kiribati

The average number of teeth was 26.9 ± 2.0 teeth, the average number of decayed teeth was 2.5 ± 3.7 teeth, the average number of missing teeth was 1.1 ± 1.9 teeth, the average number of filled teeth was 0.2 ± 0.6 teeth, and 26% of subjects had retained root stumps.

Only 18% of subjects had no calculus, 42% had mild calculus, 27% had moderate calculus, and 13% had severe calculus. The rate of gingival swelling was scored as good (18%), mild (49%), moderate (24%), and severe (9%).

2. Analysis II : Comparison of the oral health status of pregnant women between the Republic of Kiribati and Japan

Figure 1 shows the results of a comparison of DMF scores in pregnant women between the Republic of Kiribati and Japan†1. The number of decayed teeth and missing teeth were significantly higher ($p<0.01$, $p<0.001$), and the number of filled teeth was significantly lower ($p<0.001$) in the Republic of Kiribati than in Japan.

Figure 2 shows the results of a comparison of the prevalence

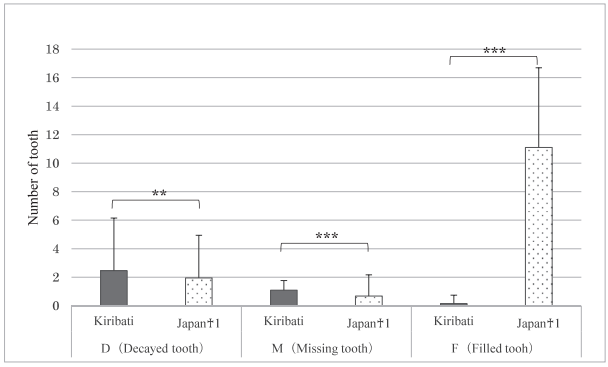

Fig 1. Comparison of DMF scores in pregnant women between the Republic of Kiribati and Japan†1.
Japan†1 : Japanese data on the number of DMF teeth were from dental examinations of pregnant women in Tokushima Prefecture in 2009 (6).
$^{**}p<0.01$; $^{***}p<0.001$.

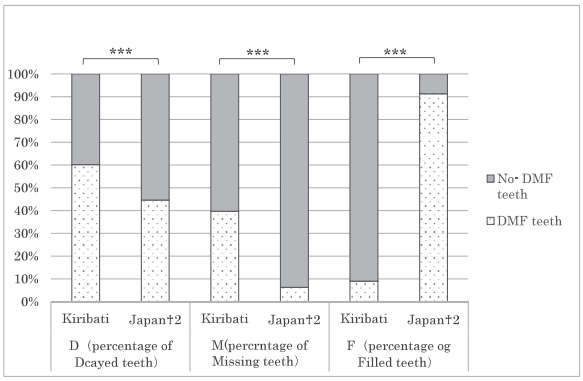

Fig 2. Comparison of the prevalence of DMF teeth in pregnant women between the Republic of Kiribati and Japan†2.
Japan†2 : Japanese data on the prevalence of DMF teeth were from dental examinations of pregnant women in Kobe City in 2016 (7).
$^{**}p<0.01$; $^{***}p<0.001$.

of DMF teeth in pregnant women between the Republic of Kiribati and Japan†2. The prevalence of decayed teeth and missing teeth were significantly higher in the Republic of Kiribati (both $p<0.001$), and the prevalence of filled teeth was significantly lower ($p<0.001$) than in Japan.

Figure 3 shows the results of a comparison of the amount of calculus deposition and gingival swelling in pregnant women between the Republic of Kiribati and Japan†3. The proportion of pregnant women with calculus deposition and gingival swelling was significantly higher in the Republic of Kiribati than in Japan ($p<0.001$).

3. Analysis III : Regional differences in the oral health status of pregnant women in urban and rural areas

Figure 4 shows the results of a comparison of the number of DMF teeth between urban and rural areas. The average number of decayed teeth was significantly higher in urban areas (3.1 ± 4.1 teeth) than in rural areas (2.0 ± 3.2 teeth). No significant difference was found between the two groups in the number of missing teeth or filled teeth.

Figure 5 shows that the prevalence of tooth stumps in pregnant women was significantly higher in urban areas than in rural areas ($p<0.001$). No significant difference was found between the two groups for calculus deposition and gingival swelling.

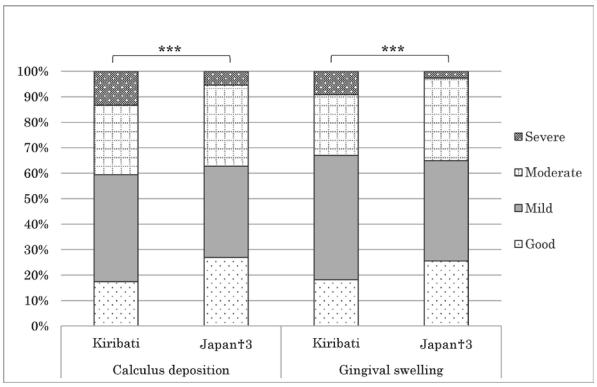

Fig 3. Comparison of the amount of calculus deposition and gingival swelling in pregnant women between the Republic of Kiribati and Japan†3.
Japan†3: Japanese data on assessed the degree of calculus deposition and gingival swelling in Okayama City in 2001 (9).
** $p<0.01$; *** $p<0.001$.

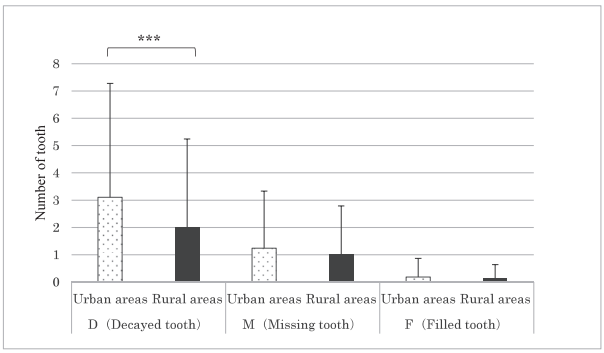

Fig 4. Comparison of the number of DMF teeth in pregnant women between urban and rural areas in the Republic of Kiribati.
*** $p<0.001$.

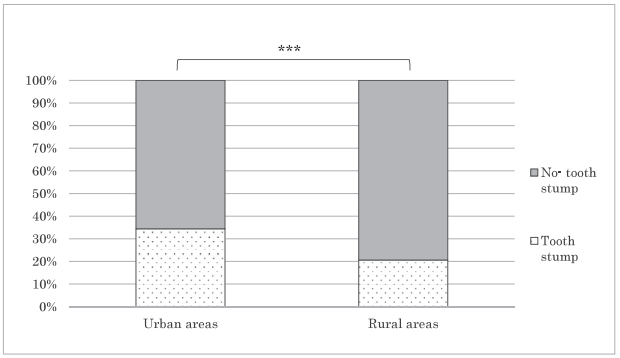

Fig 5. Comparison of the prevalence of tooth stumps in pregnant women between urban and rural areas in the Republic of Kiribati.
*** $p<0.001$.

DISCUSSION

This is a first cross-sectional study that clarified the oral health status of pregnant women in the Republic of Kiribati. Additionally, we compared our results from the Republic of Kiribati with similar data from Japan, and also investigated regional disparities within the Republic of Kiribati.

This study expressed two main findings, and the first was that the average number of DMF teeth was 3.8. Pregnant Kiribati women had more decayed teeth, more missing teeth, fewer filled teeth, and worse periodontal status than pregnant Japanese women. We consider that the reason for these results is that the Republic of Kiribati is a more difficult environment in which to receive dental treatment than Japan. The budget for the Ministry of Health and Medical Services in Kiribati is supported by overseas contributions (8) and medical treatment including dentistry is free. However, there are only five dentists in the Republic of Kiribati servicing a total population of around 110,000. In contrast, Aomori Prefecture has the lowest proportion of dentists in Japan, with 56.8 dentists and a total population of about 100,000, which is 12 times that of the Republic of Kiribati.

Because there are only three dental clinics and a full-time dentist in the clinic in the Republic of Kiribati, even though all treatment fee is free, there are insufficient dental services to meet the demand. Therefore, it is difficult for pregnant women to take dental treatment of decayed teeth. For these reason Kiribati pregnant women had more decayed teeth, but fewer filled teeth than Japanese. The number of missing teeth was significantly higher in Kiribati pregnant women than in the Japan†1 cohort ; this is because they are unable to take dental treatment even if their teeth have deep decay. Furthermore, we speculate that orthodontic treatment is also not available in the Republic of Kiribati, meaning that no teeth are extracted for orthodontic reasons. Additionally, pregnant women in the Republic of Kiribati had higher rates of calculus deposition and gingival swelling than Japanese pregnant women. One of the reasons for their poor periodontal condition was considered to be inadequate dental health guidance, as a result of insufficient dental staff such as dentists and dental hygienists. Periodontal disease can induce premature births and low birth weight through hypercytokinemia (9-12), but there is no public health guidance about this issue in the Republic of Kiribati, and oral health guidance is provided only by foreign countries through agencies such as JICA. Additionally, toothbrushes are too expensive to use daily, so the Kiribati population does not develop good oral hygiene habits. However, we were unable to provide an objective basis for the causes of the poor oral health status of pregnant women because few data were available on the economy and lifestyle of

the Republic of Kiribati.

The second finding in this study was the regional disparities in oral health status among pregnant women within the Republic of Kiribati. We presumed that the reason for these disparities was related to regional economic differences or lifestyle factors in rural areas. For example, certain foods and drinks are more widely available in city areas than in rural areas because of lifestyle changes caused by globalization in recent decades. Rapid globalization in South Pacific countries has increased the risk of lifestyle related diseases (13-18). We considered that lifestyle-related diseases including non-communicable diseases would worsen as economic growth and globalization progressed throughout the Republic of Kiribati. However, since no official information on maternal and child health systems and dental health systems in the Republic of Kiribati has been published, and there is no data on regional economic disparities or domestic living factors, it was not possible to decide whether the oral health status of whole population was poor due to an inadequate national dental care system, or whether the oral health status of pregnant women was poor due to an inadequate maternal and child dental health system. We inferred that both reasons. Additional research will need to clarify this in the future.

Lifestyle-related diseases and periodontal diseases affect each other (19-21). Health promotion efforts should include oral health, but there is little understanding of the importance of maintaining oral health. Additionally, it is important to formulate a dental health guidance program that considers not only the improvement and maintenance of oral health, but also the prevention of lifestyle-related diseases. The Republic of Kiribati currently has quite a few dental hygienists, so it is necessary to increase the number of dental hygienists. However, since there is no dental hygienist training school in Kiribati, it will be difficult to do in short period. For that reason, it is important for whole people to improve oral literacy including oral hygiene by nurses acquired knowledge about oral hygiene.

Oral health education for pregnant women improves their knowledge about the importance of oral health, their motivation to maintain their own health and that of the developing fetus, and the general and oral health status of both mothers and their children (22-25).

The Republic of Kiribati is a developing island country with no official information on public health and health activities. We are worried about that non information itself is one of the most problems in implementing health activities in the developing country. There is often insufficient educational information on the importance of oral hygiene. Without the information, the residents of these countries do not learn the long-term effects until it is too late. Therefore, establishing sustainable oral hygiene systems in these countries is necessary so that better oral hygiene can be achieved in the long run. An opportunity can be full filled by dispatching volunteers from developed countries such as Japan to transfer technology and knowledge that is important. However, according to JICA data, a total of 1887 nurses were dispatched during the 55 years from 1965 to 2020, but only 47 dental hygienists were dispatched to developing countries (26). Dental hygienists are expected not only to play an active role in their own country, but also to voluntarily support their experience and skills in developing countries. Although it is difficult to apply fluoridation due to undeveloped water supply and sewerage systems. Instead, we recommended using the fluoride-added salt and the fluoride-containing toothpaste in Kiribati, as it is used in Central and South America (27). Like this, we would also like to propose sustainable public health measures that can be used developing countries including the Republic of Kiribati based on the objective result and quantitative data obtained from the surveys like this study.

In this study, we were able to roughly confirm the oral health status of pregnant women in the Republic of Kiribati, but we could not ascertain the detailed status because it was a retrospective study, and the content of the survey was limited. Further research should include investigation of other components related to the oral health status of pregnant women including their tooth brushing habits, eating habits, and smoking habits (28, 29). Developing countries such as the Republic of Kiribati have few opportunities for scientific research, and official information and objective numerical data on public health and health activities in general have not been published. In particular, there is no official data on dental health at all. In order to improve environmental hygiene and health guidance in the future, it is thought that many scientific research reports such as this research will be necessary. From this point of view, this research study is important and significant as a basis for health guidance. We convinced that it will eventually improve the oral health status of the entire nation by professional health guidance and education including dental hygienists.

CONCLUSION

The findings in this study with dental examination data of 512 pregnant women in the Republic of Kiribati showed that the average DMF score was 3.8 and Kiribati pregnant women had more decayed teeth, more missing teeth, fewer filled teeth, and worse periodontal condition than Japanese pregnant women. In addition, it was clarified that regional disparities in oral health status among pregnant women in Kiribati. We consider that oral health promotion including education and practical assistance is needed to improve the oral health of Kiribati pregnant women.

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The authors declare no conflicts of interest associated with this manuscript.

ACKNOWLEDGEMENTS

The role of the Japan Overseas Cooperation Volunteers program in this research was supported by the Japan International Cooperation Agency in 2012–2013. The authors would like to thank Dr. Sam Teeta in the Republic of Kiribati Dental Department, the Japan International Cooperation Agency, and Professor Daisuke Hinode. Additionally, we would like to thank all the pregnant women who participated in this study.

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