The Oral Health Status, Salivary Flow Rate and pH in Diabetic Patients

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Abstract. Diabetes Mellitus (DM) is a metabolic disorder disease which should be giving an antidiabetic therapy. Antidiabetic therapy causes several side effects, one of which is in oral health status such as a decrease in salivary flow rate which affects the acid-base balance (pH) in the oral cavity. Acidic saliva changes in oral health conditions. The study aimed to find out the oral health status, salivary flow rate and salivary pH in DM patients who routinely consume antidiabetic medicines. Quantitative descriptive research with a cross sectional approach was used in this study. Thirty patients with Type 2 DM who took antidiabetic medicines participated in this study selected by purposive sampling. Measurement of oral health status, salivary flow rate and salivary pH used the Oral Health Assessment Tool (OHAT); draining method with syringe and timer; and pH test strips. Most of the respondents' oral health status was unhealthy with a mean ± SD 10.13 ± 1.19, low salivary flow rate with a mean ± SD 0.17 ± 0.04 ml/minute and acidic salivary pH with a mean ± SD 6.25 ± 1.89. Most of the respondents had unhealthy oral health status, low salivary flow rate and acidic salivary pH. It is very important for diabetic patient to maintain the oral health status.

Keywords: Diabetes Mellitus · Antidiabetic medicines · Oral Health Status · Saliva flow rate · Salivary pH

1 Introduction

Diabetes Mellitus (DM) has become a worldwide public health problem in the 21st century [1]. Diabetes Mellitus is a metabolic disorder disease characterized by an increase in blood glucose levels (hyperglycemia) [2]. The underlying characteristic of all forms of DM is the inability of pancreatic beta cells to produce/excrete sufficient amounts of insulin to regulate glucose levels. In type 2 diabetes, hyperglycemia is the result of inadequate insulin secretion combined with impaired response to insulin (insulin resistance) in liver tissue [3]. Hyperglycemia in DM patients is treated by using oral antidiabetic medicines including the biguanides (metformin) and sulfonylureas (glimepiride and glibenclamide) [4], in which these medicines can contribute to a decrease in salivary secretion if taken for a long time [5] and dry mouth [6].

The decrease in salivary secretion in DM patients makes the salivary flow rate low so that it can affect the acid-base balance or commonly called the Potential of Hydrogen

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(pH) in the oral cavity [7]. Saliva has a contribution to pH maintenance by removing carbohydrates that can be metabolized by bacteria and eliminating acids produced by bacteria [8] thus if the salivary flow rate is low, it can result in a decrease in salivary pH to become acidic [9], 2015). The pH in saliva plays an important role in the life and growth of oral bacteria. Acidic salivary pH can support the growth of aciduric bacteria which then allows acidogenous bacteria to multiply creating an inhospitable environment for oral protective bacteria [10]. This is will interfere with oral health status in DM patients along with worsening conditions due to dry mouth caused by a decrease in salivary flow rate, the oral cavity will become a target for inflammation, fungal infections, rapid caries development, inflammation of the salivary glands, and bad breath [11].

Early identification and management of oral manifestations of DM can be an effort to prevent chronic complications related to DM and can play a role in improving the quality of life of DM patients. Nurses as professional medical personnel can play a role in early identification of the oral health status of DM patients. In identifying oral health status, there are several categories that need to be studied by nurses including lips, tongue, gums and surrounding tissues, saliva, natural teeth, dentures, oral hygiene and pain in teeth [12]. In addition, evaluation of the saliva profile may be an alternative for monitoring oral prognoses in DM patients as oral health monitoring that aims to improve the quality of life of DM patients [13]. The results of a preliminary study conducted by the researcher at the Puskesmas Kasihan Bantul Yogyakarta found that the average number of visits by DM patients in 2019 was 57 people every month. From a preliminary study conducted on 5 DM patients, it was found that DM patients who regularly consume antidiabetic medicines have complaints on their oral condition, like DM patients often feel the sensation of dry mouth and lots of cavities. Based on the aforementioned reasons, this study aims to determine the description of oral health status in DM patients who routinely consume antidiabetic medicines.

2 Method

2.1 Design

The design of this study used a descriptive quantitative method with a cross sectional approach.

2.2 Sample and Setting

The population in this study was the average number of DM patient visits each month in 2019 at Puskesmas Kasihan 1, Bantul Yogyakarta, which was 57 people. The sample was taken using purposive sampling method with inclusion criteria of patients who regularly visited the puskesmas (public health center) in the last 3 months; did not have a history of taking antihypertensive medicines, psychotherapy and antihistamines; took antidiabetic medicines like biguanide or sulfonylurea or a combination of both. Exclusion criteria were patients aged more than 60 years, active smoking and fasting when data collection. Based on the Slovin formula, the number of samples was 36, but those that matched the inclusion and exclusion criteria were 30 respondents. The location of research was in the working area of Puskesmas Kasihan I, Bantul, Yogyakarta.

2.3 Variable

Variables in this research include the oral health status, salivary flow rate and salivary pH in diabetic patients.

2.4 Instruments

The instruments used in this study to measure oral health status, salivary flow rate and salivary pH were the Oral Health Assessment Tool (OHAT) [14], pH indicator, measuring cup and stopwatch. The results of measuring oral health status using OHAT include several points that were evaluated including lips, tongue, gums, natural teeth, dentures, dental hygiene and tooth pain. The range of scores based on OHAT is as follows: healthy 0–3, no change 4–8, unhealthy 9–19 [14].

Salivary flow rate is the amount of saliva in one minute (mL/minute) using a tool in the form of a 30cc slime cup which was used to collect saliva with the draining method, namely letting saliva drips through the lower lip, a stopwatch to count the time required to collect saliva for 5 min. Then, the results of the amount of saliva were compared with the time in 5 min and categorized as normal 0.3–0.4 mL/minute, low 0.1–0.29 mL/minute, very low <0.1 mL/minute [15].

The pH test strip was used to measure the acidity (pH) of saliva. The measurement of the acidity level was done by soaking the pH test strip for 15 s into the saliva that had been collected in the slime cup, and then the interpretation of pH was normal if pH 6.75, acid if 6–6.5, very acid if <6.

2.5 Data Collection

The researcher with the help of one research assistant conducted oral assessment with OHAT instruments, collecting saliva using the draining method, and measuring salivary pH. During the saliva collection process, the respondents were asked to stand upright on a chair with their heads slightly bowed, bowed but facing forward and their right hands holding the slime cup, and then the saliva was collected using the draining method. The saliva was let to drip through the lower lip into the slime cup for 5 min measured by using a stopwatch. During saliva collection, the respondents were not allowed to speak, move their tongue and swallow. Respondents were instructed to end saliva collection by the researcher when the time had expired.

2.6 Data Analysis

Data analysis in this research was using univariate analysis. This univariate analysis was to determine the value of the frequency distribution and the percentage of oral health status, salivary flow rate and salivary pH in DM patients who routinely consume antidiabetic medicines.

2.7 Ethical Consideration

After obtaining ethical approval number 41/EC-KEPK FKIK UMY/I/2020, the researcher collected data based on the predetermined sample. Then, the sample was given with information about the data collection process and given informed consent.

Table 1. The Characteristics of respondents (N = 30)

Category		n	(%)
Age (Years)	≤ 40 41–50 51–60	3 4 23	10 13.30 76.70
	Total	30	100
Gender	Male Female	7 23	23.30 76.70
	Total	30	100
Antidiabetic medicine	Metformin Glimepiride Metformin and glimepiride Metformin and glibenclamid	22 3 3 2	73.30 10 10 6.70
	Total	30	100
The duration of antidiabetic medicine consumption (Years)	≤ 5 6–10 > 10	19 5 6	63.30 16.70 20
	Total	30	100

3 Result

The result of the research is discussed with initially presenting the characteristics of respondents.

Table 1 shows that the most of respondents age between 51–60 years old (76,70%). However, metformin was the most antidiabetic medicine which consumed by the respondents' (73.30%) and 19 respondents' (63.30%) already consumed the antidiabetic medicine less than 5 years.

Table 2 showed that the most of respondents' have unhealthy oral health status with mean ± SD 10.13 ± 1.10 (50%), low salivary flow rate with mean ± SD 0.17 ± 0.04 (43.40%) and acid salivary pH with mean ± SD 6.25 ± 1.89 (50%).

4 Discussion

Most of the respondents' age group is 51–60 years (Table 1). Age is a non-modifiable risk factor in DM patients. Age can affect degenerative factors where there will be a decrease in organ function as a person age [16]. This condition causes a decrease in function, especially in endocrine and the ability of pancreatic β cells to produce insulin [17, 18]. This is in line with the [19] which states that at the age of 41–64 years a person will have a risk of suffering from DM 3.3 times more easily than those aged 25–40 because of a decrease in endocrine function to produce insulin, as well as in [20] stating that most DM patients were in the 56–65 years of age group.

Table 2. The Oral Health Status, Salivary Flow Rate and Salivary pH in respondents' (n = 30)

Category		n	Mean ± SD	%
The Oral Health Status	Healthy Change Unhealthy	1 14 15	3.30 ± 0 6.57 ± 1.28 10.13 ± 1.10	3.30 46.70 50
	Total	30		100
Salivary Flow Rate	Normal Low Very Low	5 13 12	0.48 ± 0.22 0.17 ± 0.04 0.04 ± 0.03	16.70 43.40 40
	Total	30		100
Salivary pH	Normal Acid Very Acid	1 15 14	6.75 ± 0.00 6.25 ± 1.89 5.25 ± 0.53	3.30 50 46.70
	Total	30		100

Female gender has a large percentage in this study. Women have a greater chance due to an increase in Body Mass Index (BMI). It occurs because premenstrual syndrome and postmenopausal syndrome experienced by women can make the distribution of body fat easily accumulate as a result of these hormonal processes, causing them more at risk of suffering from DM [18]. An increase in BMI is closely related to the occurrence of insulin resistance so that it can block the absorption of glucose into muscle and fat cells which causes an increase in blood glucose levels [21]. This is in accordance with the research conducted by [22] which state that the majority of DM patients are women [23]. However, on the other hand, this study contradicts [24] which states that there are more male DM patients (65.5%) than female DM patients (34.5%). This difference could be caused by the differences in the number and condition of respondents in each of these studies.

Most of the respondents in this study consumed the monotherapy medicine, metformin. Metformin is the only first-line medicine in the biguanide class for DM patients, with the effect of stimulating glucose uptake, reducing excess hepatic glucose production, reducing intestinal glucose absorption and increasing insulin sensitivity [25]. In some case, metformin induced xerostomia/dry mouth [6]. This biguanide class has a high level of glucose lowering efficacy and also has the advantage of better long-term safety in its use, moreover, this biguanide class of medicine also has a low cost [26]. Thus, this medicine is widely prescribed in patients with DM. In which these medicines can contribute to a decrease in salivary secretion if taken for a long time [5].

In some cases of DM, this biguanide medicine is combined with a sulfonylurea class. As in a study conducted by [20], it was found that the majority of DM patients consumed an antidiabetic medicine combination of metformin (biguanide) and glimepiride (sulfonylurea). The use of the combined medicine is intended to get maximum treatment results when one medicine is not enough to lower blood sugar levels in the body. These two medicines have complementary mechanisms of action, namely metformin by

reducing hepatic glucose production and sulfonylureas by stimulating β cells to release insulin.

The results of this study indicate that most of the respondents took antidiabetic medicine for ≤ 5 years (Table 1). The length of suffering from diabetes mellitus often does not describe the actual disease process. This is because many DM patients are diagnosed when they have experienced complications, whereas the course of the disease has been going on for years but has not been diagnosed. This causes most patients to take antidiabetic medicine when complications begin to appear. These results are in line with the research conducted by [22] stating that most patients have suffered from DM in the span of 1–5 years. This patient group is a group of patients who are still in the process of adjusting their habits and circumstances, from those who do not initially need to take medication to those who need to take medication every day, and from those who initially feel healthy (even though they already have DM) to those who feel sick.

The results of the study on the oral health conditions of respondents that experienced many disorders are in the categories of natural teeth, dentures, tongue, saliva, and oral hygiene. In the natural teeth category, it was found that the majority of DM patients had >4 cavities or damaged teeth. The denture category showed poor results in DM patients because the majority of DM patients did not use their dentures. In the tongue category, a lot of white coating was found. In the saliva category, many DM patients complained of feeling dry mouth and sticky mucosa. Then, in the category of oral hygiene, most DM patients were found to have tartar or plaque in most areas of their mouth and smell bad breath.

The results of this study are in agreement with the research of (9) which showed that there was an increase in the incidence of dental caries in DM patients compared to non-DM patients, and it was associated with a decrease in acidic salivary pH (Table 2). However, the research conducted by [27] gave different results, that there was no significant difference in dental caries examination between DM and non-DM patients. It could be due to the modifications in the diet of DM patients by reducing the amount of processed carbohydrate intake, so that it reduced the formation of an acidogenic environment that could cause dental caries.

The study found various oral changes caused by DM, including periodontitis, hyposalivation, and candidiasis. Periodontitis is an infection on the gums characterized by bacteria that accumulate as plaque at the base of the teeth, so that it can damage the tissue around the teeth [28]. They observed an increased incidence of this periodontal disease among the majority of DM patients and found that the predominant periodontal disease was seen in patients ranging from 60 years of age and over, followed by patients with an age range of 51–60 years, indicating that the increased incidence periodontal disease increases with age [29]. Hyposalivation or reduced amount of saliva that can cause a dry mouth sensation occurred in 12.05% of DM patients in the study, with the majority of patients having periodontal disease, thus revealing a strong correlation between decreased salivary flow rate that creates a favorable environment for organism growth and periodontal disease initiation. Around 6.14% of DM patients in the study also showed candidiasis which is an infection by the fungus Candida albicans which accumulates in the mouth and can cause white lesions on the surface of the tongue [30].

The description of the unstimulated salivary flow rate in DM patients at Puskesmas Kasihan 1 Bantul can be seen in Table 2. Several studies have evaluated changes in saliva in diabetic patients. This study investigates the salivary flow rate in patients with type 2 diabetes. The findings showed that patients with type 2 diabetes had low salivary flow rates. These results were mostly found in DM patients aged 51–60 years and had been taking antidiabetic medicine for more than 10 years whose diagnosed type 2 DM. This can occur due to physiological decline because of increasing age [16]. In addition, it is known that the course of type 2 DM affects the sympathetic and parasympathetic nervous systems of the salivary glands which can result in decreased salivary secretion, microangiopathy, dehydration, and hormonal changes, which can contribute to a decrease in the salivary flow rate [27]. Likewise, in the research conducted by [5], it was found that patients on oral antidiabetic medicine therapy experienced a 30–40% lower rate of unstimulated salivary flow. The results of the decrease in the salivary flow rate in this study can be proven by some respondents around 13 participants with low salivary flow rate which complaining that their mouths often feel dry and thirsty.

Meanwhile, several studies have confirmed the same findings that the participant feels dry mouth because of low salivary flow rate [31]. Previous studies have also compared the unstimulated salivary flow rate in DM and non-DM patients, and the results showed that there was a significant difference that DM patients had a lower unstimulated salivary flow rate than non-DM patients [7, 27, 32]. However, there are several studies that state that there is no clear difference in the salivary flow rate between DM and non-DM patients [13]. Such contradictions can be attributed to differences in the method of collection of saliva (draining or spitting), timing of collection, condition and position of patients at the time of collection, and difference in age and sex.

The research on the description of salivary pH in DM patients at Puskesmas Kasihan 1 Bantul can be seen in Table 2. The results showed that the majority of DM patients at Puskesmas Kasihan 1 Bantul had an acidic salivary pH. This may be due to metabolic changes in DM patients that result in an acidic pH. In DM, there is a reduction in bicarbonate levels in all body fluids which leads to metabolic acidosis of all body fluids. This explains the acidic nature of saliva in patients with DM. In this study, acidic salivary pH was often found in DM patients who had low salivary flow rates. Saliva has a function to maintain pH close to neutrality in the oral cavity (6.7–7.3). This is done by two main mechanisms, namely the cleansing of carbohydrates that can be metabolized by bacteria by salivary flow, so the acid produced by bacteria can be removed, and secondly saliva neutralizes the acidity formed from food and drink as well as from microbial activity by its buffering action [10]. When the salivary flow rate decreases, there will also be a decrease in the buffer capacity. This buffer capacity is highly dependent on the concentration of bicarbonate, which is often called bicarbonate buffer, which is the most important buffer in maintaining the salivary pH [33].

Acidic pH was also observed in DM subjects by [10]. In their studies, this decrease in salivary pH was associated with the incidence of dental caries and changes in oral health conditions. The study conducted by [31] also found significant results from the comparison of salivary pH between DM patients and non-DM patients, that salivary pH in DM patients is more acidic. On the other hand, research by [13] reported that

no difference was found in salivary pH between DM and non-DM patients; both had salivary pH in the normal range.

5 Limitation of the Study

The limitation of this study was difficult to prevent DM patient not to eat, drink or brush their teeth one hour before saliva collection. Those situation would affect the results of salivary flow rate and salivary pH.

6 Conclusions and Suggestions

Antidiabetic medicines consumed by DM patients who regularly consume antidiabetic medicine have contribute effect on oral health status, decrease the salivary flow rate and lower salivary pH. However, physiological changes also contribute to this such as age for decrease the organ function.

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References

1. López-pintor RM, Casañas E, González-serrano J, Serrano J, Ramírez L, Arriba L De, et al. Flow in Diabetes Patients. Hindawi Publ Corp J Diabetes Res Vol 2016 http//dx.doi.org/101155/2016/4372852 Rev. 2016;2016:1–16.
2. Bowser Riley F, House CR. The actions of some putative neurotransmitters on the cockroach salivary gland [Internet]. Vol. 64, Journal of Experimental Biology. 1976. 665–676 p. Available from: https://www.idf.org/aboutdiabetes/type-2-diabetes.html
3. Ormazabal V, Nair S, Elfeky O, Aguayo C, Salomon C, Zuñiga FA. Association between insulin resistance and the development of cardiovascular disease. Cardiovasc Diabetol [Internet]. 2018;17(1):1–14. Available from: https://doi.org/10.1186/s12933-018-0762-4.
4. Al- Mashhadane F. Effects of Oral Hypoglycemic Drugs on Flow Rate and Protein Composition of Saliva in Patients with Diabetes Mellitus. Al-Rafidain Dent J. 2011;11(2):297–302.
5. Smidt D, Torpet LA, Nauntofte B, Heegaard KM, Pedersen AML. Associations between oral and ocular dryness, labial and whole salivary flow rates, systemic diseases and medications in a sample of older people. Community Dent Oral Epidemiol. 2011;39(3):276–88.
6. Kurniawan AA, Wedhawati MW, Triani M, Iman DNA, Laksitasari A. Laporan Kasus: Xerostomia pada Penderita Diabetes Mellitus Tipe 2. Stomatognatic (JKG Unej). 2020;17(1):33–6.

7. Hoseini A, Mirzapour A, Bijani A, Shirzad A. Salivary Flow Rate and Xerostomia in Patients wWth Type I and II Diabetes Mellitus. Electron Physician. 2017;9(9):5244–9.
8. Baliga S, Muglikar S, Kale R. Salivary pH: A Diagnostic Biomarker. J Indian Soc Periodontol. 2013;17(4):461–5.
9. Singh M, Yadav P, Ingle N, Ingle E, Kaur N. Effect of Long-Term Smoking on Salivary Flow Rate and Salivary pH. J Indian Assoc Public Heal Dent. 2015;13(1):11.
10. Seethalakshmi C, Jagat Reddy RC, Asifa N, Prabhu S. Correlation of Salivary pH, Incidence of Dental Caries and Periodontal Status in Diabetes Mellitus Patients: A Cross-Sectional Study. J Clin Diagnostic Res. 2016;10(3):ZC12–4.
11. Petrušić N, Posavac M, Sabol I, Mravak-Stipetić M. The Effect of Tobacco Smoking on Salivation. Acta Stomatol Croat. 2015;49(4):309–15.
12. Chalmers JM, King PL, Spencer AJ, Wright FAC, Carter KD. The Oral Health Assessment Tool - Validity and Reliability. Aust Dent J. 2005;50(3):191–9.
13. Archana PS, Gopal KS, Vardhan BGH, Kumar PM. Saliva as a Non-invasive Tool in Evaluation of Type 2 Diabetes Mellitus. Int J Sci Study. 2016;4(1):178–82.
14. Maille G, Saliba-Serre B, Ferrandez AM, Ruquet M. Objective and Perceived Oral Health Status of Elderly Nursing Home Residents: A Local Survey in Southern France. Clin Interv Aging. 2019;14:1141–51.
15. De Almeida PDV, Grégio AMT, Machado MÂN, De Lima AAS, Azevedo LR. Saliva composition and functions: A comprehensive review. J Contemp Dent Pract. 2008;9(3):072–80.
16. Boss GR, Seegmiller JE. Age-related physiological changes and their clinical significance. West J Med. 1981;135(6):434–40.
17. Mildawati, Diani N, Wahid A. Hubungan Usia, Jenis Kelamin dan Lama Menderita Diabetes dengan Kejadian Neuropati Perifer Diabateik. Caring Nurs J. 2019;3(2):31–7.
18. Kasmawati H, Sabarudin S, Ihsan S. The Characteristic of Patients with Diabetes Mellitus Type 2 in All Community Health Centre, City of Kendari, Southeast Sulawesi in 2016. Int J Green Pharm. 2017;11(4):S694–6.
19. Standards of medical care in diabetes--2015: summary of revisions. Diabetes Care. 2015;38(January):S4.
20. Anggraini TD, Puspasari N. Tingkat Kepatuhan Penggunaan Obat Antidiabetik Pada Pasien Diabetes Melitus Tipe 2 Di Apotek Sehat Kabupaten Boyolali | Anggraini | IJMS - Indonesian Journal on Medical Science. Indones J Med Sci [Internet]. 2019;6(2):1–8. Available from: http://ejournal.ijmsbm.org/index.php/ijms/article/view/179/177.
21. Yosmar R, Almasdy D, Rahma F. Survei Risiko Penyakit Diabetes Melitus terhadap Masyarakat Kota Padang. J Sains Farm Klin. 2018;5(Agustus 2018):134–41.
22. Wijaya IN, Faturrohmah A, Agustin WW, Soesanto TG, Kartika D, Prasasti H. Profil Kepatuhan Pasien Diabetes Melitus Puskesmas Wilayah Surabaya Timur dalam Menggunakan Obat dengan Metode Pill Count. J Farm Komunitas. 2015;2(1):18–22.
23. Mohsin S, Fawwad A, Mustafa N, Shoaib A, Basit A. Impact of Type 2 Diabetes Mellitus on Oral Health Related Quality of Life among Adults in Karachi, Pakistan - A Cross-Sectional Study. Br J Med Med Res. 2017;20(1):1–7.
24. Dehghan P, Mohammadi F, Javaheri MR, Nekoeian S. Identification of Candida species in the oral cavity of diabetic patients. Curr Med Mycol. 2016;2(2):0–0.
25. Dumitrescu R, Mehedintu C, Briceag I, Purcărea VL, Hudita D. Metformin-clinical pharmacology in PCOs. J Med Life. 2015;8(2):187–92.
26. Sheehan MT. Current Therapeutic Options in Type 2 Diabetes Mellitus: A Practical Approach. Clin Med Res. 2003;1(3):189–200.
27. Puttaswamy KA, Puttabudhi JH, Raju S. Correlation between Salivary Glucose and Blood Glucose and The Implications of Salivary Factors on The Oral Health Status in Type 2 Diabetes Mellitus Patients. J Int Soc Prev Community Dent. 2017;7(1):28–33.

28. Kinane DF, Stathopoulou PG, Papapanou PN. Periodontal diseases. Nat Rev Dis Prim [Internet]. 2017;3(June):1–14. Available from: https://doi.org/10.1038/nrdp.2017.38.
29. Bathla S. Aging and Periodontium. Textb Periodontics. 2017;43–43.
30. Rodrigues CF, Rodrigues ME, Henriques M. Candida sp. Infections in patients with diabetes mellitus. J Clin Med. 2019;8(1).
31. Stetiu AA, Dancila A, Mitariu M, Serb B, Mitariu MC, Ormenisan A, et al. The Influence of The Chemical Composition of The Saliva, Buffer Capacity and The Salivary pH on Children with Diabetes Compared to Non-diabetics. Rev Chim. 2016;67(10):1966–9.
32. Basir L, Aminzade M, Javid AZ, Khanehmasiedi M, Rezaeifar K. Oral Health and Characteristics of Saliva in Diabetic and Healthy Children. Australas Med J. 2017;10(10):884–9.
33. Hapsari AP, Riyanto R, Kadarullah O, Susiyadi S. Hubungan Kadar Gula Darah Puasa Terhadap Kadar Ph Dan Laju Aliran Saliva Pada Penderita Diabetes Mellitus Tipe 2 Di Puskesmas 1 Kembaran. Saintika Med. 2018;14(2):104–8.