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BLOOD GLUCOSE TARGET ACHIEVEMENT AND ANTIDIABETES REGIMEN IN TYPE-2 DIABETIC GERIATRIC PATIENTS

Budi Suprapti

Abstract

Diabetes mellitus (DM) is a leading caused morbidity in geriatric patients. The prevalence of type-2 DM is more than 90% of DM population and increase with age, and half of those patients were geriatric. Blood glucose (BG) control is important for prevention diabetes complications, but attention must be given in geriatric patients due to the increasing susceptibility to risk of hypoglycemia. The aimed of this study was to identify BG achievement in diabetic geriatric patients and its therapeutic management. This study was done in Outpatient Geriatric Clinic, Dr. Soetomo General Hospital Surabaya Indonesia in the period of March to June, 2012. The inclusion criteria were type-2 diabetic geriatric patients with/without diabetic complication that received antidiabetic therapy and had BG data. The results from 165 patients showed that BG target achieved by 53% patients, 41% patients not achieved the target, while 6% patients in risk ofhypoglycemia. Management therapy for patients with achieved BG target was done by (1) continued therapy as before, (2) increasing dosage regimen for patients with BG already in the target but still within the upper limit target or decrease dosage regimen for patients with BG in lower limit target to avoid hypoglycemia, (3) change type of medication for patients who experienced side effects. Meanwhile, from all patients that failed to achieve BG target there were some patients received additional medications and regimen changes, but the rest of those didn't receive any additional medication or regimen changes, which were many of them eventually became one of the drug-related problems in this patient group. In conclusion, there were still quite large number patients that did not achieve BG target, therapy management changes were made based on BG profile and there were drug related problems related to dosage regimen that needs pharmaceutical care intervention

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Research Article

BLOOD GLUCOSE TARGET ACHIEVEMENT AND ANTIDIABETES REGIMEN IN TYPE-2 DIABETIC GERIATRIC PATIENTS

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ABSTRACT

Diabetes mellitus (DM) is a leading caused morbidity in geriatric patients. The prevalence of type-2 DM is more than 90% of DM population and increase with age, and half of those patients were geriatric age. Blood glucose (BG) control is important for prevention diabetes complications, but attention must be given in geriatric patients due to the increasing susceptibility to risk of hypoglycemia. The aimed of this study is to identify BG achievement in diabetic geriatric patients and its therapeutic management. This study was done in Outpatient Geriatric Clinic, Dr. Soetomo General Hospital Surabaya Indonesia in the period of March to June, 2012. The inclusion criteria were type-2 diabetic geriatric patients with/without diabetic complication that received antidiabetic therapy and had BG data. The results from 165 patients showed that BG target achieved by 53% patients, 41% patients not achieved the target, while 6% patients in risk of hypoglycemia. Management therapy for patients with achieved BG target was done by (1) continued therapy as before, (2) increasing dosage regimen for patients with BG already in the target but still within the upper limit target or decrease dosage regimen for patients with BG in lower limit target to avoid hypoglycemia, (3) change type of medication for patients who experienced side effects. Meanwhile, from all patients that failed to achieve BG target there were some patients received additional medications and regimen changes, but the rest of those didn't receive any additional medication or regimen changes, which were many of them eventually became one of the drug-related problems in this patient group. In conclusion, there were still quite large number patients that did not achieve BG target, therapy management changes were made based on BG profile and there were drug related problems related to dosage regimen that needs pharmaceutical care intervention

Key words: antidiabetes, regimen, blood glucose achievement, geriatric

INTRODUCTION

Elderly patients usually present with one or more degenerative diseases and about 60% of the population had a history of at least one chronic disease including diabetes (Naughton and Feely, 2006). Diabetes is a common chronic disease with the prevalence increases with age (Fauci *et al.*, 2008) and one of major cause of disability in the elderly (Triplitt, Reasner, Isley, 2008). The prevalence of type 2 diabetes in the elderly is likely to increase, generally 90% of adult patients with diabetes, diagnosed as type 2 diabetes and 50% of that were older than 60 years (Gustaviani, 2006). Because of carbohydrate metabolism disorder, elderly is more prone to suffer from diabetes (Chun, 2003).

Blood sugar control in diabetes mellitus is essential to prevent a variety of chronic complications, both microvascular, macrovascular and neuropathic. However, special precaution should be given because there are a lot of changes in pharmacokinetics and pharmacodynamics that can bring the patient to a greater risk of hypoglycemia (Triplitt, Reasner, Isley, 2008). Study Action to Control Cardiovascular Risk in Diabetes (ACCORD) conducted a study in a population with an average age of 62 years with diabetes since 10 years, comparing the strategy of

intensive glycemic (HbA1c <6.0%) with a standard (target HbA1c of 7.0%). Results showed the risk of death was higher in the intensive group and likely caused by hypoglycemia (257 vs. 203 events deceased) (Gerstein, *et al.*, 2008). This study was conducted to identify the blood glucose achievement in geriatric patients with diabetes mellitus and therapeutic management.

MATERIAL AND METHOD

This is an prospective cross-sectional study, conducted at outpatient clinic dr.Soetomo Hospital Surabaya Indonesia from March to June 2012, using secondary data. The inclusion criteria were all geriatric patients with type-2 diabetic, with/without diabetic complication, had received antidiabetic therapy and complete BG data. Sampling was done by simple random sampling technique to obtain 165 samples of research. The methodology of this study was approved by Ethic Committee Dr. Soetomo Teaching Hospital, Surabaya Indonesia

RESULT AND DISCUSSION

From 165 patients obtained, there were higher female patients than males (64% vs. 36%) (Table I). National Commission on the Elderly in 2010 reported that the population of older women in Indonesia, almost 60% was higher than men. The patients were grouped into middle age patient (60-65), old age (66-75), very old age (76-85) and oldest old age (> 85) (Shephard, 1998) (Table I).

Table I. Characteristic of type 2 dm patients in geriatric outpatients Dr. Soetomo Hospital

No	Characteristic	Number of Patients (%)
1.	Gender:	
	Female	106(64)
	Male	59(36)
	Total	165(100)
2.	Age (Year) :	
	60-65	32(19)
	66-75	87(53)
	76-85	44(27)
	>85	1(1)
	Total	165(100)

Elderly is susceptible to chronic complications of diabetes that can increase morbidity and mortality (Kurniawan, 2010). A patient may experience more than one complication or comorbid. Results showed most complications are cardiovascular disease by 42% of patients and 18% of stroke patients. Cardiovascular disease and stroke are the macrovascular complications caused by AGEs products (Funk, 2010). In addition, most comorbid experienced by patients was hypertensive as much as 86% of patients.

Treatment of type 2 DM is started with a non-pharmacological therapy (healthy lifestyle) or OAD monotherapy. If it fails to lower BG then a combination of 2 to 3 oral antidiabetics (OAD) are given. If the target is not achieved with the combination then the combination of basal insulin and OAD is recommended. When the latest combination fails to control glucose levels, then the OAD is discontinued and insulin combination therapy is started. Therapy is stated to fails when BG target cannot be achieved in 2-3 months at each level (PERKENI, 2011).

Result showed that from totally antidiabetes drug used, 86% were OADs and 14% were insulin. They used as single or in combination. The use of Insulin was lower than OAD because insulin therapy requires special considerations including the ability to use insulin injections, recognizing and managing the condition of hypoglycemia, as well as the visual function, cognitive, availability of caregiver and patient financial capability (Neumiller and Setter, 2009).

Table II demonstrates that most drugs used was the sulfonylureas as much as 80.00% of the patients. The sulfonylureas is effective in achieving blood glucose target in elderly patients (Abbatecola and Paolisso, 2009). But it is needed special caution because hypoglycemia risk increases in old age.

Glimepirid is a long-acting sulfonylurea with half life 9h, duration of action 24h and has an active metabolite (Wickersham, 2009, Sweetman, 2009). Glimepirid is eliminated by liver and kidney by 60% (Lee, 2009, Sweetman, 2009). Kidney function tends to decline in old age lead to decrease drug excretion

Table II Types of antidiabetic used in geriatric outpatients Dr. Soetomo Hospital

Class	Name	Number of Patients (%)	Total Patients (%)
Sulfonylurea	Glimepirid	70(42,42)	
	Gliklazid	46(27,88)	132(80,00)
	Glikuidon	16(9,70)	
Biguanid	Metformin	63(38,18)	63(38,18)
Tiazolidindion	Pioglitazon	1(0,61)	1(0,61)
Inhibitor α-glukosidase	Akarbose	70(42,42)	70(42,42)
Rapid acting insulin	Aspart	9(5,45)	11(6,67)
	Glulisine	2(1,21)	
Long acting insulin	Glargine	9(5,45)	19(11,52)
	Detemir	10(6,06)	
Premixed insulin	70% aspart protamin, 30% aspart	13(7,88)	13(7,88)

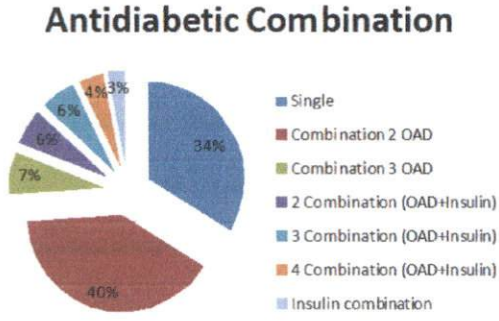

Figure 1. Percent of single and combination of antidiabetes drug in geriatric outpatients Dr. Soetomo Hospital

(Dipiro *et al.*, 2008). To avoid the risk of hypoglycemia, short-acting sulfonylurea is preferred because of less hypoglycemia risk than long-acting (Lee, 2009). However, glimepirid is still used because glimepirid can be given once a day that can improve patient compliance (Neumiller and Setter, 2009). Short acting sulfonylureas are gliclazide and gliquidon because they have short duration of action and without active metabolites. Glikuidon and gliclazide can be used in patients with renal disorder as they excreted more through the liver (Lee, 2009). The use of single and combination therapy can be seen in figure1.

The dose and regimen of oral anti antidiabetics can be seen in table III, whereas for insulin is listed in Table 4. Glimepirid dose was 0.5 to 4mg and used 1-2x per day (Table IV). Glimepirid maximum dose is 6mg (PERKENI, 2011). Gliclazide dose was 30-240 mg and the regimen were 1x1, 2x1, 2-1-0 while the maximum dose is 320 mg with frequency use 1-2x a day (PERKENI, 2011). Regimen 2-1-0 was appropriate if the total dose needed is more than 160mg/day (Sweetman, 2009). Glikuidon dose given to the patients was 15-60mg divided in 1-2x a day and 30mg with regimen 2-1-0, 1-½-0. Maximum dose of glikuidon is 120mg which divided in 2-3x daily (Sweetman, 2009). In order to achieve optimal control BG with minimal side effects, the dose was adjusted individually.

In this study acarbose dose used were 50 and 100mg with frequency of use was1-3x per day (Table III). While, maximum dose recommended is 300mg divided in 1-3x per day

Table III. Dose and regimen of oral antidiabetes in geriatric outpatients Dr. Soetomo Hospital

Drug	Dose	Regimen
Glimepirid	1 -4 mg	1x1 morning
		1x ½
		2x1
Gliklazid	30-80 mg	1x1
		2 x1 or 2-1-0
Glikuidon	30 mg	1x1or 1/2
		2x1 or 2-1-0 atau 1- ½ -0
Metformin	500 mg	1-3x1 evening
Pioglitazon	15 mg	1x1

Note : -1 patient can received more than 1 OAD.

Table IV. Dose and regimen of subcutan insulin in geriatric outpatients Dr. Soetomo Hospital

Drug	Dose	Regimen
Aspart	6-14 U	3x
Glulisine	12 U	3x
Glargine	10 -20U	1x morning or evening
Detemir	8 -20U	1x morning or evening
70 Aspart Protamin/ 30 Aspart	12 U-20U	12-0-12 U
	16-0-14 U	16-0-14U
	14-0-16 U	14-0-16U
	24-0-10 U	24-0-10U
	24-0-20 U	24-0-20U

(Sweetman, 2009). Acarbose is not recommended in patients with renal failure with creatinine clearance ≤ 24mL/min (Neumiller and Setter, 2009). Metformin dose used in this study was 500mg with a frequency of 1-3x per day. Metformin does not cause side effects hypoglycemia (Neumiller & Setter, 2009). Metformin can lose weight so that it can be used in patients who are obese (McEvoy, 2008).

Thiazolidinediones used in this study was pioglitazon (1 patient) (Table III). The use of thiazolidinediones should be aware by patients who have congestive heart failure stage III and IV because it can cause edema (Neumiller and Setter, 2009). Pioglitazone has a lower risk of myocardial infarction compared to rosiglitazone (Neumiller and Setter, 2009). In addition, pioglitazone may improve endothelial function, increase levels of HDL (Triplitt, Reasner, Isley, 2008). Dose used in this study was 15mg once daily while the maximum dose is 45mg/day (Wickersham, 2009).

Geriatric patients require insulin in hyperglycemic conditions which are difficult to control and condition which are contraindicated with OAD (Tanwani, 2011). In this study, rapid-acting insulin used by 6.67% patients, while long-acting insulin used by 11.52% patients and premixed insulin (70% aspart protamine, 30% aspart) by 7.88% patients (Table II). Elderly patients with irregular eating schedule can benefit from the use of rapid-acting insulin (Tanwani, 2011). Long-acting insulin has a long duration of action and used once a day so it increase compliant. In addition, insulin glargine reduced the incidence of nocturnal hypoglycaemia so it is appropriate for the elderly that who are at greater risk of hypoglycemia (Neumiller and Setter, 2009). The advantage of premixed

Table V. Blood glucose achievement of tipe 2 DM patients in geriatric putpatients Dr. Soetomo Hospital Surabaya

No.	Blood Glucose Achievement	Management Therapy	Number of patient (%)	Reason
1.	Achieved Target (FPG 100-125 mg/dl, 2hPP 145-180mg/dl, CPG ≤ 180mg/dl)	No Change	65 (39.4)	Target has been achieved
		Reduce Regimen /Reduce the number of drug	7(4.2)	Blood Glucose Level was close to the lower limit
		Increase Regimen/ Add other drugs	11 (6.7)	Blood Glucose Level was close to the upper limit
		Change Drug	5 (3.0)	Patients suffered from adverse drug reactions
		Total	**88(53.3)**	
2.	Not achieved (FPG >125 mg/dl, CPG&2hPP > 180mg/dl)	No Change	35 (21.2)	- 20,6% were close to target - 2,4% needed additional drug because blood glucose levels were far from the target
		Increase Regimen/Add other drugs	18 (10.9)	In order to achieve blood glucose target
		Reduce Regimen /Reduce the number of drug at	7(4.2)	Patients suffered from adverse drug reactions
		Change Drug	7(4.2)	The previous regimen failed to achieve target, so the drug was changed
		Total	**67 (40.6)**	
3.	Hypoglycemia Risk (≤ 110 mg/dl)	-	**10(6.1)**	1,8% patients had blood glucose levels very low. Therefore, the drug were switched to another drug that has lower potency.

insulin is more flexible because it lowers the frequency of intensive insulin injection (Tanwani, 2011).

Decision to give rapid-acting insulin is based on the 2h postprandial glucose levels whereas long-acting insulin levels is based on fasting plasma glucose/casual plasma glucose. In this study, insulin dosage given to patients varies (Table IV) and adjusted based on individual response, which was assessed from the glucose levels. Regimen instructed to patients was appropriate include rapid acting 3x daily, long acting insulin 1x daily at night or in the morning while the premixed insulin used 1-2x a day in the morning and evening (Table IV).

The patients were routinely checked the BG levels (CPG, FPG and 2hPP) every month. For patients older than 60 years, the target achievement can be higher than adults with

Type 2 DM. Target achievement of FPG is 100-125mg/dL, 2hPP is 145-180mg/dL (Perkeni, 2011) and CPG is less than 180mg/dL (ADA, 2012). The risk of hypoglycemia may increase in patients with very tight control of glucose levels that is ≤ 110mg/dL (Wiener *et al.,* 2008).

In this study as much as 53.3% patients achieved blood glucose levels, 40,6% failed to achieve and 6,1% suffered from hypoglicemia. Management for the patients is depend on BG level and directed individually. From total patients who achieved target, 39,4% patients had no change of therapy, 4,2% patients was reduced regimen or reduced drug because glucose levels were close to lower limit and 9,7% patients were increased regimen or given additional drug or changed to another drug that more potent because glucose levels were close to upper limit (Table V).

From total patients who failed to achieve target 21,2% patients had no change of therapy. From that patients, 20,6% were close to target and 2,4% patients % were still far from target, therefore it was drug related problem. As much as 10,9% patients who failed to achieve target got dose escalation or received additional drug. Reduced regimen or reduced number of drug were done in 4,2% patients whose sometimes experienced from hypoglycemia/adverse drug reaction. Meanwhile the rest 4,2% patients had changed the drugs therapy. Some patients (6,1%) who at risk of hypoglycemia (BG <110 mg/dL, for geriatric) were changed to another drug that has lower potency to decrease risk of hypoglycemia (Table V).

CONCLUSION

The number of diabetic geriatric patients who did not achieve the target BG is still quite large, therapy management changes made based on BG profile individually and there are drug related problems in dosage regimen that needs pharmaceutical care intervention.

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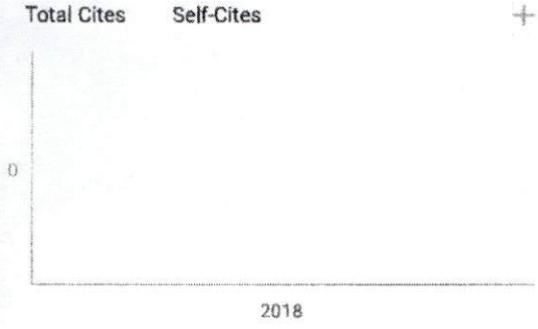

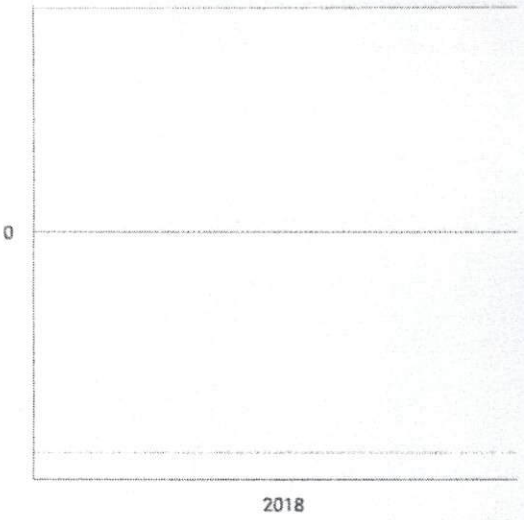

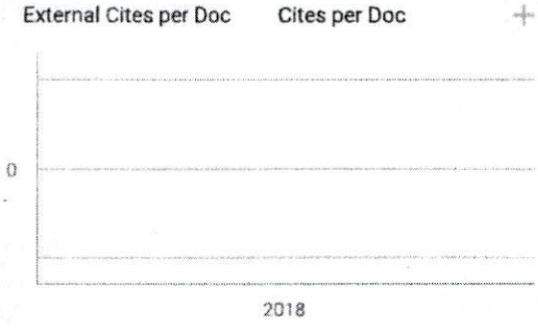

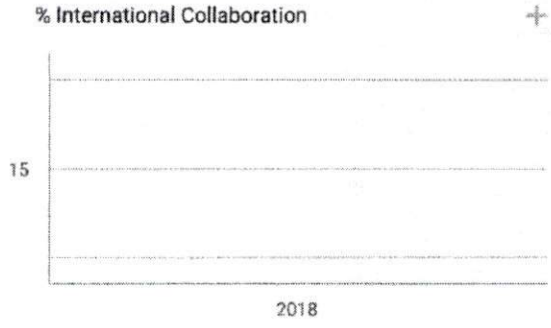

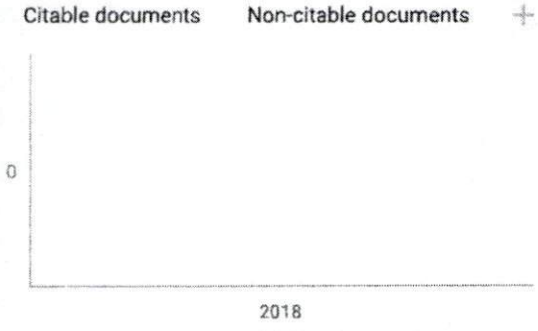

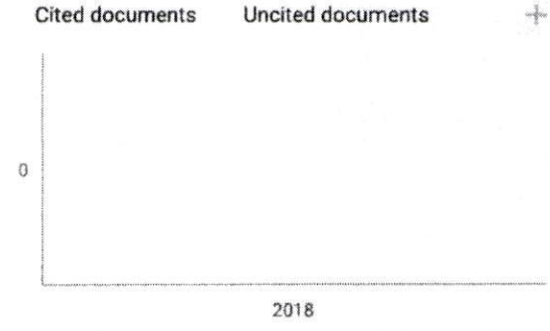

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Indonesian Journal of Pharmacy

Country	Indonesia - SIR Ranking of Indonesia
Subject Area and Category	Health Professions Pharmacy Medicine Pharmacology (medical) Pharmacology, Toxicology and Pharmaceutics Pharmaceutical Science
Publisher	Universitas Gadjah Mada - Faculty of Pharmacy
Publication type	Journals
ISSN	23389486, 23389427
Coverage	2016-2019
Scope	The journal had been established in 1972, and online publication was begun in 2008. Since 2012, the journal has been published in English by Faculty of Pharmacy Universitas Gadjah Mada (UGM) Yogyakarta Indonesia in collaboration with IAI (Ikatan Apoteker Indonesia or Indonesian Pharmacist Association) and only receives manuscripts in English. Indonesian Journal of Pharmacy is Accredited by Directorate General of Higher Education. The journal includes various fields of pharmaceuticals sciences such as: -Pharmacology and Toxicology -Pharmacokinetics -Community and Clinical Pharmacy -Pharmaceutical Chemistry -Pharmaceutical Biology -Pharmaceutics -Pharmaceutical Technology -Biopharmaceutics -Pharmaceutical Microbiology and Biotechnology -Alternative medicines.

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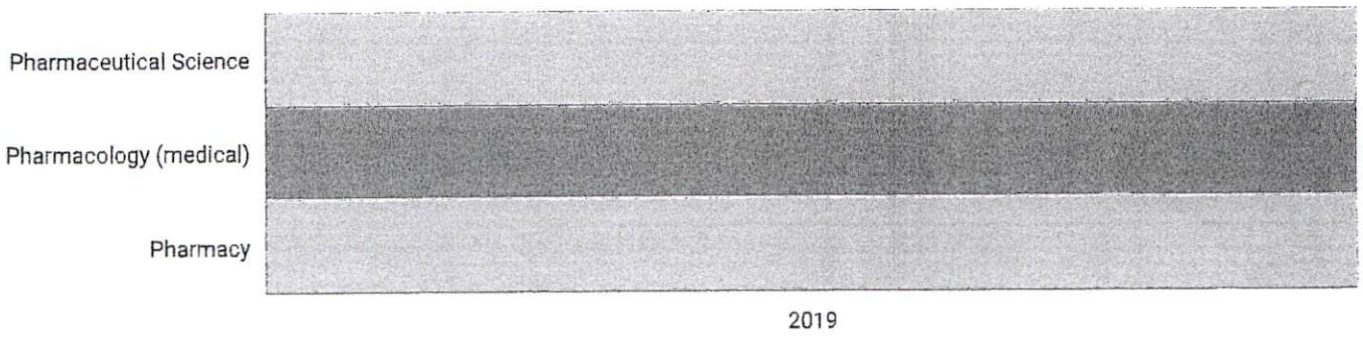

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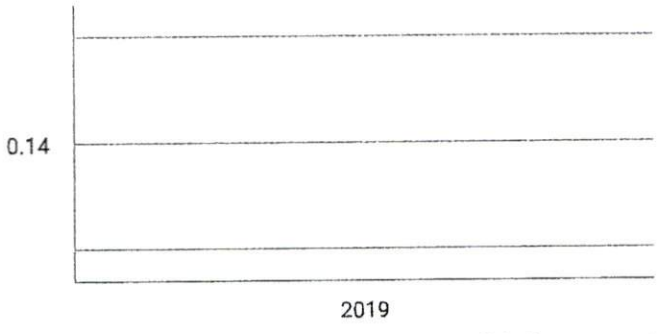

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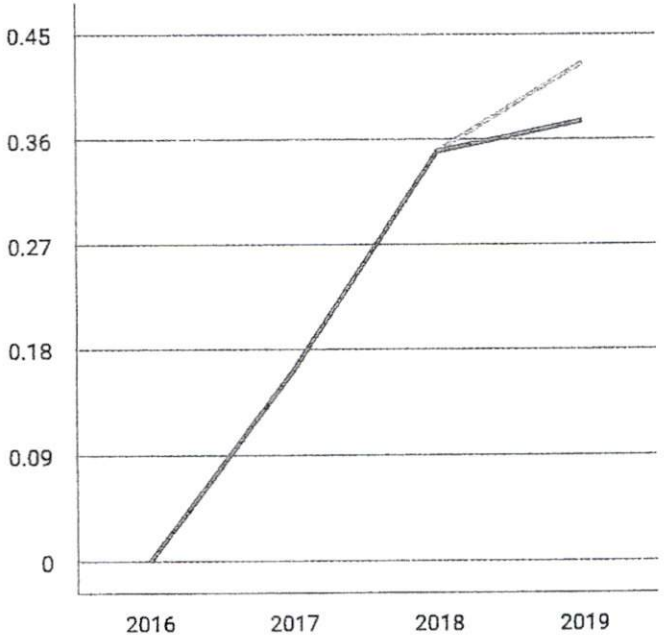

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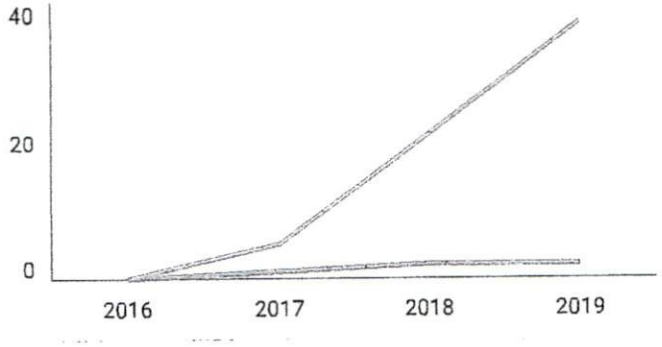

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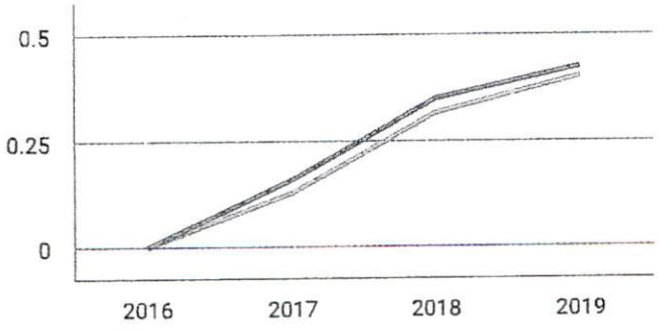

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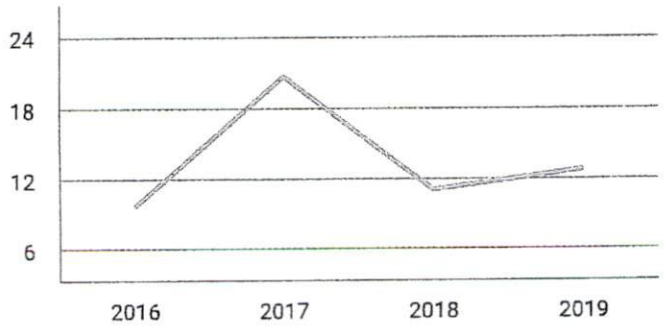

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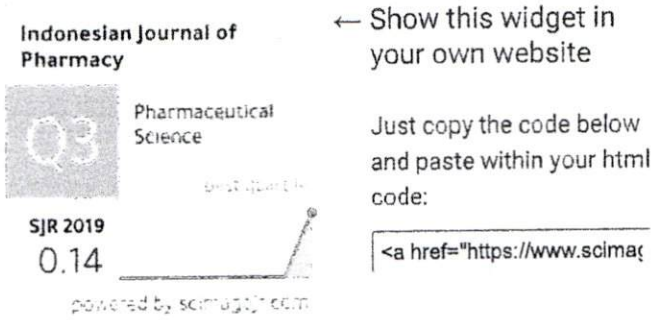

Niar 2 months ago

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SCImago Team

Melanie Ortiz 2 months ago

Dear Niar,
Thank you for contacting us. Our data come from Scopus, they annually send us an update of the data. This update is sent to us around April / May every year. Thus, the indicators for 2019 will be available in June 2020. Best Regards, SCImago Team

faridatulain 9 months ago

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reply

SCImago Team

Melanie Ortiz 9 months ago

Dear user, thanks for your participation! Best Regards, SCImago Team