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# OLD PEOPLE AND DIABETES MELLITUS

(Orang Lanjut Usia dan Diabetes Mellitus)

Hardjoeno\*

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## ABSTRAK

Menjadi tua adalah proses mengembangkan hidup yang berkaitan dengan kumpulan perubahan yang di orang lanjut usia (lansia) dapat meningkatkan resiko kematian. Sindroma metabolik merupakan salah satu perubahan tersebut yang dikenal secara klinis dan hasil laboratorik yaitu obesitas, hipertensi, intoleransi glukosa, dislipidemia, proinflammatory dan prothrombotic state. Hal ini dapat meningkatkan prevalensi diabetes mellitus tipe 2 (T2DM) dan komplikasinya. Karena banyak kasus DM tidak terdiagnosis, penyaringan (skrining) yang diikuti pencegahan dan penatalaksanaan sangat diperlukan. Menyaring (skrining) orang lanjut usia dengan satu atau lebih komponen sindroma metabolik yang belum terdiagnosis DM dengan menilai glukosa darah puasa dan dua jam sesudah beban untuk diagnosis DM dan resiko kematiannya. Penyaringan (skrining) dilakukan di 1080 lansia umur 50 tahun atau lebih di Makassar yang diduga DM dengan tes glukosa plasma puasa dan dua jam sesudah beban, kemudian dinilai menurut klasifikasi WHO 1998. Dari 1080 pasien yang terdiri atas 560 (51,85%) laki-laki dan 520 (48,15%) perempuan, ditemukan DM, 420 (38,89%) dengan glukosa plasma puasa  $\geq 126$  mg/dl, 425 (39,35%) dengan 2 jam sesudah beban glukosa  $\geq 200$  mg/dl dan 517 (47,87%) dengan glukosa plasma puasa  $\geq 126$  mg/dl serta 2 jam sesudah beban  $\geq 200$  mg/dl. Satu atau lebih komponen sindroma metabolik orang tua merupakan biomarker atau prediktor untuk T2DM dan PJV. Pemeriksaan kesehatan secara reguler atau sedikitnya tes gula darah puasa dan 2 jam sesudah beban glukosa di orang tua perlu dilakukan dan termasuk dalam sistem asuransi kesehatan. Diagnosis dini diabetes dan penatalaksanaannya berarti mengurangi komplikasi, cacat, kematian maupun pembiayaan.

**Kata Kunci:** orang lanjut usia, glukosa darah, sindroma metabolik dan diabetes mellitus

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## INTRODUCTION

Aging is a development process of life in relation to the accumulation of changes, particularly in old people, that increase the risk of disease, disability and death. Since antenatal, neonatal, childhood until adult, there are biological growth and development peaking at before age 30, with subsequent linear decline until death in the age of 80 or more. Aging reflects the accumulated results of reduced cellular functions, cell injury and cell death. Beside the biologic, anatomic and physiological factors such as genetic defects, environmental factors may produce aging changes.<sup>1,2,3</sup>

Environmental factors, like oxidative stress and quality of life also alter the process of aging. Old people are expected to live longer than ever before, but multiple factors and diseases further aggravate the advance age.<sup>1,4</sup> In relation to the factors and diseases in old people mentioned above, laboratory parameters also change. Biologic functions are declining with age namely renal blood flow, creatinine clearance, albumin, alkaline phosphatase, glucose level and glucose tolerance.<sup>3,5,6</sup> As glucose intolerance in diabetes mellitus and its complications increase

the risk of death, this paper is focused on fasting and two hour blood post-load glucose levels in old age, particularly in relation to metabolic syndrome and diabetes mellitus.

## Old People and Diabetes Mellitus

There are three ranges of biologic age groups. The young-old are individuals between 65 and before 75 years of age, who has the few loss of function and impairment. Individuals between 75 and before 85 years of age are the middle-old group, and the old-group is comprised of individuals of 85 years and older.<sup>1,3</sup> In Indonesia, since the retirement begins at the end of 55 years old and life expectancy is 65, the group between 55 and before 65 years old is classified as the pre young-old.

The increasing numbers of older people in both developed and developing countries is called as "population aging". It is predicted that in 2020 more than 1000 million people aged 60 years and older will be living in the world, more than 700 million of them in developing countries with largest elderly population will be China (230 million), India (142 million), Indonesia (29 million), Brazil (27 million) and Pakistan (18 million). By 2020, it is projected that three-quarters of all deaths in developing countries could be aging-related. The largest share of deaths will be caused by non-communicable disease such as disease of circulatory system, cancers and diabetes.<sup>7</sup> Diabetes mellitus alone,

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which is estimated to affect some 143 million people worldwide, claims on an average around 8–10% of total health budgets in industrialized countries. Budgets for this purpose in many developing countries are limited, although with "shared care".<sup>8</sup> This involved the participation of hospital, specialists and primary care physicians in the delivery of care for diabetic patients, but only a little budget is included in the health insurance system. There are challenges to improve the quality of life in old age, including screening the elderly for impaired glucose tolerance and diabetes mellitus. For further prevention not only for diabetes mellitus but also for cardiovascular disease, dyslipidemia, obesity, microalbuminuria and hypertension, which are all related with insulin resistance or metabolic syndrome.<sup>9,10</sup> According to Zimmer,<sup>11</sup> top nine countries with ranking for number of diabetics in millions in 1995 and prediction in → 2005 are as follows; India (1): 19.4 → (1): 57.2; China (2): 16.0 → (2); USA (3): 13.9 → (3): 21.9; Russian Fed (4): 8.9 → (6): 12.2; Japan (5): 6.3 → (10): 8.5; Brazil (6): 4.9 → (8): 11.6; Indonesia (7): 4.5 → (5): 12.4; Pakistan (8): 4.3 → (4): 14.5; Mexico (9): 3.8 → (7): 11.7.

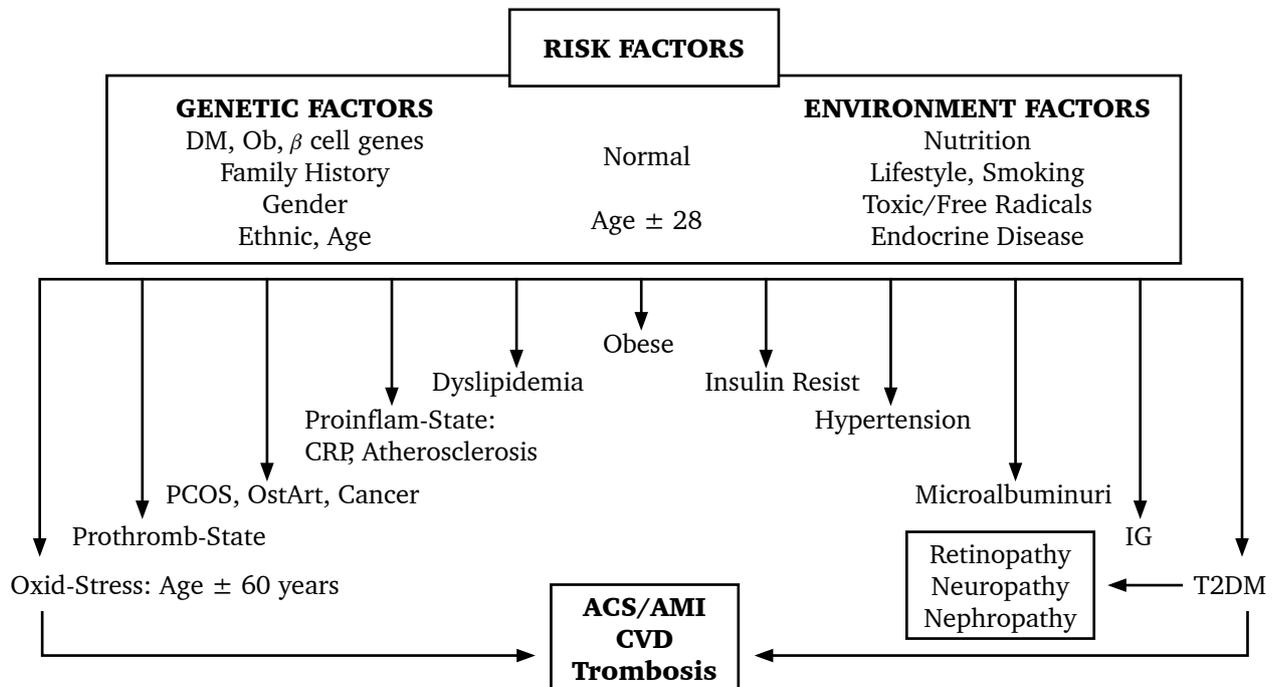
**Metabolic Syndrome**

Many studies have been conducted in clinical<sup>10</sup> and epidemiological evidence<sup>11</sup> linking defects in insulin receptor signalling diminished insulin action, insulin resistance and hyperinsulinemia, obesity

with the development of type 2 diabetes mellitus and promote the development of hypertension and dyslipidemia, which in turn increase the risk of cardiovascular disease and called as syndrome X or metabolic syndrome or insulin resistance syndrome (IRS) (Reaven 1988; Ferrary & Weidmann 1990; Niskanen, Uusitupa & Pios 1991; Alberti & Zimmer 1998, Beck Nielson 1999).<sup>9,12</sup>

A WHO expert committee in 1998 proposed that the metabolic syndrome should be diagnosed in patients who show evidence of glucose intolerance and or insulin resistance together with two other component of the syndrome e.g. central obesity, hypertension, hypertriglyceridemia or high density lipoprotein cholesterol (HDL- C). Fifty percent of the variability of insulin action may be attributed to difference in life style for example obesity, physical inactivity and cigarette smoking all increase the degree of insulin resistance. The other 50% of the variability is likely to be related to genetic factors.<sup>9</sup> According to Hew et al.,<sup>12</sup> the future of IRS are glucose intolerance, hypertension, central obesity, dyslipidemia (elevated triglyceride, low HDL-C), elevated fibrinogen level, elevated plasminogen activator inhibitor, hyperuricemia and albuminuria.<sup>12</sup> Example of the components of metabolic syndrome, type 2 diabetes mellitus (T2DM) hypothetically can be seen in figure 1.

According to the National Cholesterol Education Program (NCEP)-ATP III 2001 the component of the



**Figure 1.** Risk factors schema of diabetes mellitus

MetS are: fasting plasma glucose  $\geq$  110 mg/dl, blood pressure  $\geq$  130/85 mmHg, triglyceride  $\geq$  150 mg/dl, HDL Cholesterol  $\sigma$ :  $<$  40 mg/dl  $\rho$ :  $<$  50 mg/dl, waist circumference  $\sigma$ :  $>$  102 cm (Asia 90 cm)  $\rho$ :  $>$  88 cm (Asia 80 cm). Three or more components are needed for the diagnosis of MetS. Figure 1 shows that there is a relation between the components of MetS and DM or CVD.

### **Diabetes Mellitus as a Global Problem and Its Diagnosis**

Diabetes mellitus (DM) is a group of metabolic diseases characterized by hyperglycemias resulting from defects in insulin secretion, insulin action or both.<sup>14</sup> The prevalence of DM is about 6–7% of the adult population, rising to 18% of the population between 65 and 74 years of age, with approximately one-half of these individuals unaware of their conditions. High rising prevalence of DM will be in Asia. DM can lead to complications that seriously affect quality of life and life span particularly in persons who are 65 years or older.<sup>15</sup>

Studies have demonstrated that the ability to clear an oral glucose load decreases with age, resulting in a 10–20 mg/dl rise per decade in plasma glucose levels measured 1–2 hours after an oral glucose challenge. Fasting plasma glucose levels are only minimally changed by aging.

The diagnosis criteria of DM were made according to WHO 1999:<sup>9,10,16</sup> symptoms of DM plus casual plasma glucose concentration  $\geq$  200 mg/dl or FPG  $\geq$  126 mg/dl or two hour plasma glucose (2-hPG)  $\geq$  200 mg/dl after 75 g glucose ingestion.

### **Risk factors for diabetes mellitus in old people are as follows:**

(1) Obesity: body mass index  $>$  25 (weight in kg/height in  $m^2$ ) or percentage ideal weight  $\geq$  115% and age  $\geq$  45 years. (2) For Asian abdominal obesity: Waist Circumference (WC)  $>$  80 cm in women and  $>$  90 cm in men. (3) Positive family history of type 2 diabetes mellitus in direct relatives. (4) Ischemic heart disease. (5) Hypertension. (6) Cerebrovascular disease. (7) Peripheral vascular disease. (8) Dyslipidemia. (9) Positive history of glucose intolerance. (10) Morbid obstetrical history or a history of babies over 4 kg at birth. (11) Certain racial group e.g. Arab, Asian migrants, Hispanic American (King et al, 1963). (12) Use of diabetonic drugs e.g. corticosteroids, oestrogens, thiazides, beta blockers, and phenytoin. The risk of developing T2DM increases with age, obesity lack of physical activity and previously identified IFG or IGT.<sup>13,14,17</sup>

### **Clinical features of hyperglycemias that often unsuspected by the old people are:**

(1) Increased urination, nocturia, poor sleep, nocturnal falls, incontinence, dehydration, excessive thirst, polydipsia, weakness. (2) Poor vision, decreased mobility, falls, impaired ability to drive. (3) Intermittent claudication, thrombosis stroke, myocardial infarction. (4) Recurrent infections. (5) Poor wound healing. (6) Non-specific complaints (e.g. weight loss, fatigue). (7) Poor memory, poor compliance. (8) Increase painful symptoms. (9) Severe dehydrations, decreased consciousness, coma, visual disturbances, seizures, cerebral thrombosis and (10) depression.<sup>13</sup>

### **Complications of DM in Old People**

Complications of DM in old age are related with aging and usually with metabolic syndrome.<sup>17</sup> Micro vascular complications of DM are retinopathies as a leading cause of blindness, nephropathy until the end stage of renal disease with the problems of gangrene and foot amputation. They also have a greater of having dyslipidemia, hypertension and obesity.<sup>9,14,17</sup> Post prandial state and or post load hyperglycemias  $\geq$  200 mg/dl contribute the development of atherosclerosis, endothelial dysfunction, oxidative stress or other components of metabolic syndrome and risk factors for cardiovascular disease.<sup>9</sup> Macro vascular complications of DM can be coronary heart disease, myocardial infarct, stroke and or possibilities of thrombosis such as deep vein thrombosis, thromboartery disease or thrombi embolism that share to disability and death.<sup>18,19</sup>

Because of this chronic gradual onset and lack of suspicion by the physician and unawareness of the patients type 2 diabetes (T2DM) is often undiagnosed, therefore fasting and the oral glucose tolerance tests should be used more widely and early detection can help to prevent progression to end stage disease.

### **Fasting and Two Hour Blood Glucose Levels in Old People**

As old people usually had vague complaints or casual plasma glucose was  $<$  200 mg/dl and suspected that about one half of DM cases in old age were undiagnosed, the results of fasting and two hour post-load plasma glucose levels of people 55 years old and over were reviewed. The objectives were to find DM in old people who previously undiagnosed for treatment recommendation and to predict the risk of the complications.

## METHODS

Fasting and two hour post-load plasma glucose levels of 1080 people age  $\geq 55$  years and over with one or more components of MetS in Makassar were evaluated. Fasting glucose were determined after ten hour or more fasting and 75 gram glucose were taken orally before test of two hour plasma glucose. The glucose tests were done by hexokinase method using Cobas Mira automatic chemistry analyzer in an accredited clinical laboratory. Diabetes mellitus (DM) was diagnosed if fasting plasma glucose level was  $\geq 126$  mg/dl or  $\geq 200$  mg/dl after two hour post-load.

## RESULTS

The results from 1080 persons that were consisted of 560 men and 520 women with one or more components of MetS were evaluated and grouping according to their ages and criteria of diagnosis. In this case majority of persons between 55 until  $< 65$  years old (pre-young old) were DM with highest percentage either only fasting glucose (FG), two hour post-load glucose (2-hPG) or FG and 2-hPG. The total number of DM sufferers in the table below was more than 1080 as the different criteria of diagnosis so that one person can be calculated more than one.

## DISCUSSION

The majority of them were between 55 until  $< 65$  years old. These results were higher than the results of our previous study in the year of 2000 for persons 45 until  $< 55$  years old or old-adult e.g. DM 16.25%.<sup>20</sup> It seems that the prevalence of glucose intolerance is peaking in person aged 55 years and over. The high prevalence of DM in old people with one or more components of MetS meant that the components of MetS in old people can be used as biomarker or predictor of T2DM. High percentage between 55 until  $< 65$  years old were caused by

persons who will extend their jobs or requesting new job after retirement who need the results of their general medical check up.

The high prevalence of diabetes in the pre young-old group (55 until  $< 65$  years old) is caused by many factors such as: (1) Aging process and functionally decline of glucose intolerance. (2) Many IFG and IGT that begin several years before become DM. (3) Changes of genes e.g.: diabetic genes, insulin resistance genes and family history. (4) Old age, retirement and or job position accompanied by lack of physical exercise or sedentary life. (5) Adapting a transitional or westernized life style or over nutrition. (6) Overweight and obesity that influence the insulin resistance. (7) Socioeconomic status and place of residence. (8) Increased detection rates for diabetes. (9) Improved survival rates in the aging society. (10) Other factors mentioned in metabolic syndrome, clinical features, risk factors for diabetes mellitus in old age as mentioned above.

In the United Kingdom Prospective Diabetes Study (UKPDS) 50% of patients had at least one complication at the time of diagnosis, while the DPD study showed that 30% of IFG and IGT developed DM within the next three years.<sup>21</sup> One of the DECODE Study conclusions was post challenge glucose level is better predictor for CVD mortality particularly cancer and the post challenge glucose or post prandial hyperglycemias spike of DM was a risk in the pathogenesis of CVD.<sup>22,23</sup> It means that the components of MetS in old people can be used as biomarker or predictor of T2DM and CVD.

Results of the Indonesian Health Survey in 1997 showed that the top causes of death were coronary vascular disease, hypertension, dyslipidemia, DM, central obesity that mostly related with post load hyperglycemias all had risk for CVD and in elderly DM also had risk for other DM complications.<sup>24</sup> There fore one or more components of MetS in old people can be used as predictor of CVD and T2DM with its complications such as retinopathy, neuropathy and nephropathy. Early detection for glucose intolerance is highly important like regular medical check-up and

**Table 1.** Diagnosis of DM with different criteria in difference ages group

No	Age (years)	FG > 126 mg/dl	2-hPG $\geq$ mg/dl	FG > 126 mg/dl 2-hPG $\geq$ mg/dl
1.	55 – < 65	253	244	297
2.	65 – < 75	128	146	174
3.	75 – < 85	30	27	35
4.	$\geq 85$	9	8	11
Total		420 (38.89%)	425 (39.35%)	517 (47.87%)

it should be included in the health insurance system or at least evaluation of fasting and two hour glucose levels should be conducted for early diagnosis.

For better future healthcare to reduce the cost of management, prevention of disability and death that program using glucose tests that usually known by most people is beneficial.

## CONCLUSIONS

1. One or more components of MetS in old people can be used as biomarker or predictor of T2DM and CVD.
2. Regular medical check up or at least fasting and two hour plasma glucose level in old people should be conducted and included in the health insurance system.
3. Early diabetes mellitus diagnosis and treatment mean reduction of its complications, disability, death and reduction the cost of management.

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