ATHEROGENIC INDEX OF PLASMA ASSESSMENT AS AN EFFORT TO DETECT THE RISK OF CORONARY HEART DISEASE IN PRODUCTIVE AGE INDIVIDUALS WITH OBESITY IN THE WORKING AREA OF THE SIMPANG SUNGAI DUREN HEALTH CENTER

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ABSTRACT

Prospective studies indicate that the Atherogenic Index of Plasma (AIP) is a superior marker compared to isolated assessments of triglycerides (TG) and High-Density Lipoprotein (HDL) in predicting Coronary Heart Disease (CHD). Simpang Sungai Duren Community Health Center serves a large population with a high proportion of productive-age and obese individuals. Routine metabolic screening for CHD risk stratification in obese residents has been hindered by limited facilities and healthcare financing systems. This community service initiative aimed to assess AIP for CHD risk stratification in obese individuals. Participants included residents aged 19–64 years with a body mass index (BMI) ≥25 kg/m², no recent lipid-lowering medication use (within 3 months), and an 8–10 hour fasting period. AIP scores (logarithm of TG/HDL ratio) were used to stratify CHD risk. Results were communicated to participants alongside health promotion leaflets. Among 61 participants, AIP-based screening identified 14.8% as high-risk, 26.2% as moderate-risk, and 59% as low-risk for CHD. Modifiable cardiometabolic risk factors in the high-risk group revealed 100% with central obesity and hypertriglyceridemia, and 50% with hypertension and/or low HDL levels. The high-risk cohort exhibited multiple cardiometabolic risks requiring comprehensive management.

Keywords: Atherogenic Index of Plasma, Obesity, Triglycerides, High Density Lipoprotein, Coronary heart diseases

ABSTRAK

Studi prospektif menunjukkan AIP) merupakan marker yang lebih baik dibandingkan asesemen trigliserida (TG) dan High Density Lipoprotein (HDL) secara terpisah sebagai predictor Penyakit Jantung Koroner (PJK). Puskesmas Simpang Sungai Duren memiliki wilayah kerja cukup luas, proporsi penduduk usia produktif dan obesitas yang tinggi. Skrining metabolit yang menjadi dasar stratifikasi risiko PJK pada penduduk obesitas belum dilakukan secara rutin karena kendala fasilitas, sistem jaminan pembiayaan. Tujuan dari kegiatan Pengabdian pada Masyarakat ini adalah melakukan asesmen AIP sebagai stratifikasi faktor risiko PJK pada penderita obesitas. Kegiatan diikuti oleh penduduk berusia 19-64 tahun, indeks massa tubuh ≥ 25 kg/m2, tidak mengkonsumsi obat anti-hiperlipidemia dalam 3 bulan terakhir. Peserta diwajibkan berpuasa 8-10 jam. Skoring AIP (logaritma kadar TG/HDL) digunakan sebagai stratifikasi risiko PJK. Hasil pemeriksaan dikirimkan kepada peserta pengabdian beserta media promosi kesehatan berupa leaflet. Sebanyak 61 orang mengikuti kegiatan ini. Skrining risiko PJK berdasarkan skor AIP didapatkan 14.8% berisiko tinggi, 26.2% berisiko sedang dan 59% berisiko rendah. Identifikasi faktor risiko kardiometabolik yang dapat dimodifikasi menunjukkan, 100% subjek pada kelompok risiko tinggi menderita obesitas sentral dan hypertrigliseridemia, 50% subjek menderita hipertensi dan atau kadar HDL yang rendah. Pada kelompok risiko tinggi PJK terdapat beragam risiko kardiometabolik yang harus ditatalaksana.

Kata kunci: Atherogenic Index of Plasma*, Obesitas, Trigliserida,* High Density Lipoprotein*, Penyakit Jantung Koroner*

INTRODUCTION

Previous epidemiological studies in Indonesia report an increase in the morbidity and morbidity rates of coronary heart disease (CHD) in the productive age group. Coronary heart disease is a major contributor to the numbers Daily Adjusted Life Years (DALYs) in Indonesia. This is link with the high premature mortality and disability as well as a decrease in the productivity and quality of life of individuals with CHD[1]. The Ministry of Health of the Republic of Indonesia launched the Healthy Living Community Movement (GERMAS) through routine health checks, as an attempt to detect the risk of CHD early[2].

Routine health check-ups are recommended to be performed at least annually, especially in at-risk populations such as obese participants. RISKESDAS reported an increase in the prevalence of obesity from 2007 which was only 10.7 percent to 21.8 percent in 2018[3]. The increase in the prevalence of obesity is positively correlated with an increase in the prevalence of CHD. Adipose tissue in obese excess capacity to store fat. It will be deposed to other tissues such as the endothelium of blood vessels which called ectopic fat. Ectopic fat in the endothelium of the coronary arteries of the heart triggers an inflammatory response that ultimately leads to the formation of atherosclerosis plaques. Atherosclerosis plaques are the cause of CHD,

this can occur long before the appearance of symptoms and clinical signs of CHD[4,5]. Stratification of the risk for formation of arteriosclerosis associated with the risk of CHD can be performed by AIP scoring[6].

The AIP score was obtained from the calculation of the log of serum triglyceride (TG) levels divided by high density lipoprotein (HDL). Measurement of serum TG and HDL levels is recommended to performed regularly as an early detection of lipid metabolism disorders associated with increased CHD. Interpretation of both is commonly done separately as hyper-TG and low HDL which increases the risk of CHD. Studies prove that the analysis of both of them with AIP scoring increases sensitivity in predicting the occurrence of CHD. The meta-analysis study recommended the calculation of AIP scoring for the stratification of CHD risk in the community[6,7,8]. Based on those previous studies the measurement of the AIP scoring is relatively affordable, increasing the risk sensitivity of CHD compared to being measurement of TG or HDL separately. In addition, it can be carried out in limited laboratories facilities.

This community service program is series program of this working group to utilized low-cost, commonly measure markers in detecting CHD. Based on previous data, in the work area of the Simpang Sungai Duren Health Center, the prevalence of obesity at productive age is quite high. The Sungai Duren Health Center is equipped with supporting laboratory facilities, but the measurement of blood fat metabolism levels that can be carried out is limited to total cholesterol measurement, while other blood fat levels such as TG and HDL cholesterol fractions are not yet available. Public awareness is high enough to check themselves at the health center, but it has not been supported by the availability of facilities at the health center. This procedure that has been carried out as referrals to district hospitals with a considerable distance from home or patients can be asked to conduct this procedure in private laboratory facilities with a closer distance, but cannot be financed by the health insurance system. Furthermore, the health insurance system, has not been able to finance TG and HDL examinations as routine screening without a prior diagnosis of cardiometabolic disease. This community service program aims to conduct CHD risk screening in obese participants in productive age based on AIP scoring regardless of prior cardiometabolic diseases.

METHODS

The justification for the service team choosing this service location is because the Simpang Sungai Duren Health Center serve large working with heterogeneous population. Previous data shows that the proportion of young and productive participants in the health center work area is more than the elderly population[9]. Previous community service programs conducted by the team reported high prevalence of obesity and cardiometabolic risk abnormalities in the productive age population in this region[10]. So that various health checks such as AIP scoring need to be carried out. As an effort to detect CHD early to realize optimal health conditions. Optimal health conditions in the productive age population have a wide impact on economic productivity. So that early detection of CHD followed by appropriate management is important to be carried out in productive age of this region.

This community service program is a continuation of the previous community service program which reported the prevalence of obesity both based on body mass index and abdominal circumference is quite high in this region. Obesity conditions increase the risk of CHD. The prevention of CHD can be performed with fat metabolite screening and risk stratification for more comprehensive management. The laboratory facilities provided by the Puskesmas are still limited, so the service team chose to performed this service in this work area.

The description of the phase and methods of implementing this community service activity:

1. Analysis of the situation based on the conditions that occur in the community service partner and identification of problems experienced by the community service partner. This process is carried out by the community service team together with community service partners.
2. Prioritizing problems and alternative solutions that are appropriate to the situation of the community service partner.
3. The community service team search the partner laboratory that is willing to performed the laboratory measurement as the implementation of this community service activity.
4. The team create health promotion media related to AIP and CHD.
5. The implementation of community services includes:
    a. Preparation for places, tools and materials for the implementation of activities
    b. Coordinate with service partners to consent for the time of implementation of community service
    c. Disseminate information about the service activities that will be carried out. This is carried out by filling out a form via G-form for collected participant data.
    d. The implementation of screening activities consist of: taking fasting venous blood for a minimum of 8 hours for TG and HDL measurement. The methods are CHOD-PAP method for HDL and GPO-PAP for triglycerides.
    e. Distribution of health promotion media.
    f. AIP assessment based on TG and HDL results

g. Recapitulation results of individual examinations and personal counseling about the results of the examination and follow-up steps that can be taken by individuals to achieve an optimal degree of health.

The main service implementation team is doctors with primary service competency certification with specialties in the fields of biomedical science, clinical biochemistry, nutrition, and medical education with appropriate job roles. In the implementation of the activity, the team was assisted by other health workers such as nurses, laboratory analysts and medical students who had received briefings on the details procedure of this community services. The partner of this activity is the UNJA Smart Clinic as one of the health facilities in the working area of the Sungai Duren Simpang Health Center. Participants are residents who living in area which the Simpang Sungai Duren Health Center service, aged 19-64 years old, have a body mass index of ≥ 25 kg/m^2, have not consumed anti-hyperlipidemia drugs in the last 3 months and have never been diagnosed with CHD before.

RESULTS AND DISCUSSION

A total of 61 participants who met the criteria participated in this community service activity. A total of 28 participants (45.9%) are male and 33 participants (54.1%) are female. Based on the age category, 49 participants (80.3%) are adults, 5 participants (8.2%) are middle-aged and 7 participants (11.5%) are elderly. The results of the AIP assessment were 8 participants (13.1%) at high risk of CHD, 17 participants (27.9%) at moderate risk of CHD and 36 participants (59%) at low risk of CHD (**Figure 1**)

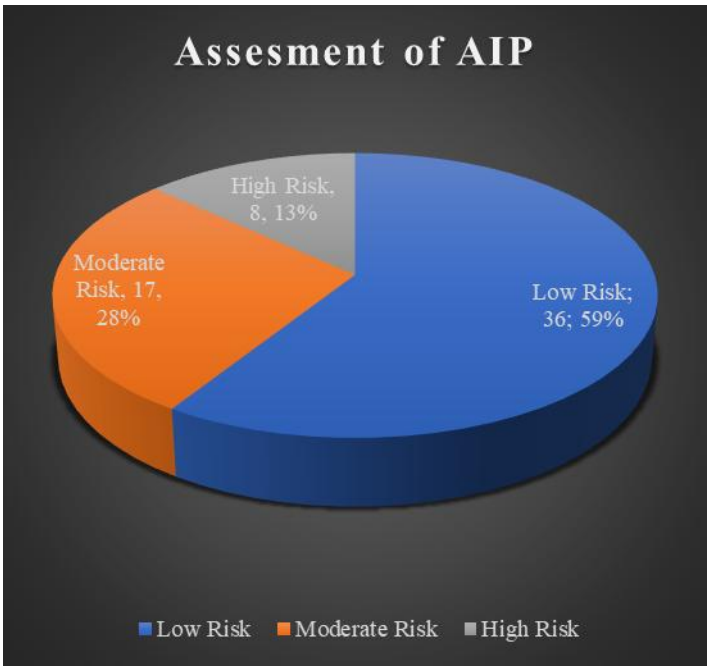

Figure 1. AIP assessment results diagram

In this activity, CHD risk factor screening was carried out based on HDL and TG lipid profile measurement, blood pressure measurement and abdominal circumference assessment to determine central obesity. HDL levels were measure, the results were 45 participants (73.8%) had low HDL, increased risk of CHD and 26 participants (26.2%) had HDL levels in the normal range, but none of the subjects had optimal HDL levels (>60mg/dL). Measurement of TG levels found that 13 participants (21.3%) had high TG levels, increased risk of CHD and 48 participants (78.7%) had normal TG levels. A total of 25 participants (41%) had hypertension and 36 participants (59%) did not have hypertension. A total of 53 participants (86.9%) had central obesity and 8 participants (13.1%) were not centrally obese. In participants with a high risk of CHD, they have at least suffering hypertension or central obesity. In the group at high risk of CHD, all participants suffered from hypertriglyceridemia and central obesity. Half of the subjects had hypertension and/or low HDL levels (**Figure 2**).

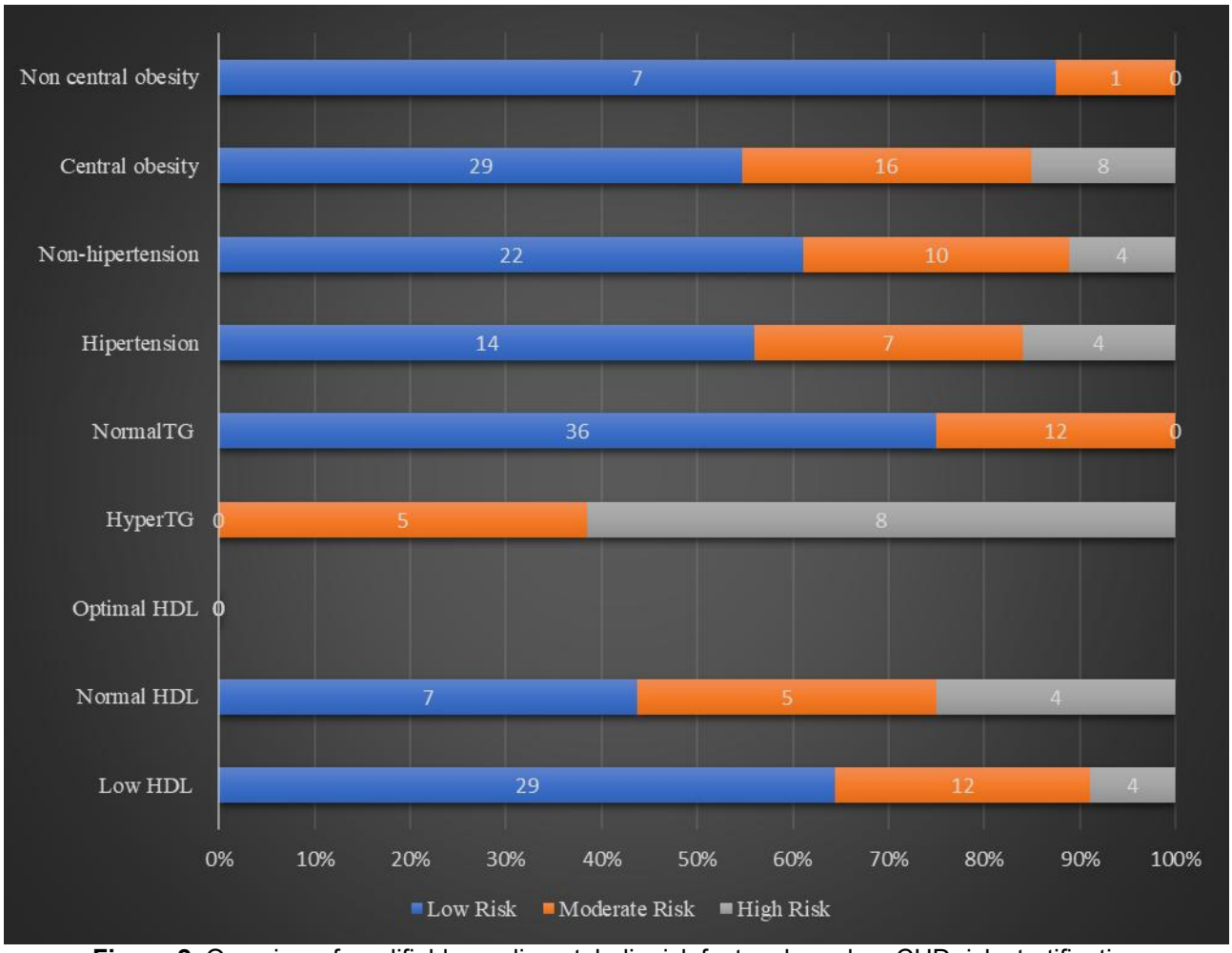

Figure 2. Overview of modifiable cardiometabolic risk factors based on CHD risk stratification

After the AIP assessment is carried out, the service team sends the results to each participant accompanied by the distribution of educational leaflets about CHD. The team also opens a consultation session if the subject wants to consult the results of the examination obtained.

The implementation of this community service received good attention from the participants and service partners. Factors that support the implementation of this activity are supporting from community service Partners (UNJA SMART Clinic) to promote this activities, enthusiasm of participants to check themselves and find out more about the risks of CHD. Further of concern is the compliance of service participants to undergo therapy, especially in participants with a high risk of CHD.

In productive-age individuals, lifestyle factors such as sedentary behavior and an unhealthy diet can aggravate dyslipidemia, thereby amplifying cardiovascular risk[11]. The use of AIP in clinical practice is supported by studies demonstrating its sensitivity in reflecting the balance between atherogenic and protective lipoproteins, particularly in individuals with obesity[12,13]. Research indicates that AIP correlates with other emerging risk markers, including pro-inflammatory cytokines and adipokines, often elevated in obesity, thereby adding an extra layer of risk stratification for CHD[14]. This interplay between lipid dysregulation, inflammation, and obesity underscores AIP's clinical utility as an early warning marker in demographics where early intervention is beneficial.

Furthermore, AIP can be obtained from standard lipid profiles, providing clinicians with a cost-effective, non-invasive tool for routine screening among individuals with obesity. Traditional indices such as total cholesterol and LDL-C levels sometimes fail to capture the full spectrum of risk associated with qualitative changes in lipoprotein particles; thus, AIP offers a measure that addresses these limitations[15,16]. The risk-predictive capacity of AIP has been noted in studies involving diverse populations, suggesting AIP could serve as a reliable adjunct in assessing CHD risk, especially in obesity-related metabolic contexts[13,14]. Hopefully with this community service activity that include community-based education and integrating AIP assessment into routine clinical evaluations could facilitate early diagnosis and intervention, ultimately reducing the burden of coronary artery disease in this vulnerable population[11,12,14,17,18,19].

CONCLUSION

This community service initiative underscores the clinical relevance of the Atherogenic Index of Plasma (AIP) as a cost-effective and sensitive tool for stratifying Coronary Heart Disease (CHD) risk in obese individuals. Among 61 productive-age participants with obesity, AIP-based screening identified 14.8% as high-risk, 26.2% as moderate-risk, and 59% as low-risk for CHD. High-risk individuals exhibited a clustering of modifiable cardiometabolic risk factors, including universal central obesity and hypertriglyceridemia, with 50% presenting hypertension and/or low HDL levels. These findings highlight the urgent need for targeted interventions in high-risk groups to mitigate CHD progression.

The integration of AIP into routine metabolic screenings offers a practical approach to early CHD detection, particularly in resource-limited settings like the Simpang Sungai Duren Health Center, where comprehensive lipid profiling remains inaccessible. Community-based education and collaboration with local health partners, such as the UNJA Smart Clinic, proved vital in raising awareness and facilitating risk communication. However, challenges persist, including limited healthcare financing for routine TG/HDL testing and the need for longitudinal follow-up to assess intervention efficacy.

Future efforts should prioritize policy advocacy to expand insurance coverage for lipid profile assessments, coupled with lifestyle modification programs addressing obesity, dyslipidemia, and hypertension. Larger-scale studies are warranted to validate AIP's predictive utility across diverse populations and to evaluate the long-term impact of early risk stratification on CHD outcomes. By bridging gaps in screening and management, such initiatives can significantly reduce the burden of CHD in high-risk, underserved communities.

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