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Frequency of B and C Hepatitis Viruses, and Metabolic Profile in Type 2 Diabetics: A Case of the Yaoundé Central Hospital, Cameroon

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Abstract

Poorly controlled type 2 diabetes alters the immune system, increasing the risk of susceptibility to viral infections such as hepatitis B and C infections. This study aimed to determine the frequency of hepatitis B and C and metabolic profiles in type 2 diabetics. This was a cross-sectional study conducted over six months. It was conducted at the National Obesity Center (NOC) of the Yaoundé Central Hospital (YCH), Cameroon. 100 diabetic patients, with a mean age of 58.41 ± 10.74 years were enrolled in the study. The socio-demographic characteristics of the study population and the risk factors for virus transmission were recorded using a pre-established questionnaire. HBsAg and anti-HCV antibodies were revealed by a rapid diagnostic test. Liver function markers' activities were determined. Commercial kits were used to evaluate the patient's serum lipid profile, serum fasting glucose level, urea, creatinine, and albumin. With a sex ratio of 3:1, women outnumbered men. Risk factors for HCV and HBV infections evocated by the population were dental care (50%), followed by alcohol consumption (41%). HBsAg and anti-HCV antibodies frequency was 3% and 8% respectively. No cases of coinfection were found. In general, hypertriglyceridemia with a mean of 1.61 ± 0.46 g/L and hyperglycemia of 1.35 ± 0.45 g/L were noted. A significant difference ($p = 0.028$) was found in HDL-cholesterol values between non-co-affected diabetics and HCV+ diabetics. The effect of the duration of diabetes on biochemical parameters revealed that albumin was the only significant decrease over time ($p = 0.013$). Based on these results, the metabolic profile of patients was altered. It is important to take note of the prevalence of hepatitis seen in type 2 diabetes mellitus since it demonstrates the potential link between both illnesses. Thus, early detection could prevent complications related to B and C

hepatitis infections in type 2 diabetics.

Keywords

Type 2 Diabetes, Hepatitis B, Hepatitis C, Metabolic Profile, Frequency, Cameroon

1. Introduction

Hepatisis B virus (HBV) and hepatisis C virus (HCV) are infections that, according to some studies, are associated with diabetes mellitus (DM) [1] [2] [3]. This association can be considered a major public health problem, due to the numerous complications and metabolic or pathological disorders that these diseases can cause individually or in synergy. Despite the fact that a diabetic is undergoing therapy, these many dysfunctions might still exist.

In a cohort study in China, the relative risk of hepatitis B virus (HBV) infection was 43% higher in type 2 diabetics than in non-diabetic patients [4]. In Brazil, one study reported a prevalence of 15.83% of HBV infection and 1.7% of viral hepatitis C among type 2 diabetics [5]. In Africa, studies on the association between hepatitis B and C, and diabetes have often been cross-sectional [6]. In Morocco, a prevalence of 4.5% of Viral Hepatitis C has been found in patients with type 2 diabetes [7]. In sub-Saharan Africa, 11% - 27% of type 2 diabetics with viral hepatitis C and 5% - 10% with viral hepatitis B were reported [6]. Type 2 diabetics are more prone to developing infections, as diabetes is a cause of immunosuppression [8] [9] [10]. This immunosuppression induced by T2DM makes the body vulnerable to many pathologies, especially viral diseases such as hepatitis B and C [6] [11]. Type 2 diabetes, most often associated with dyslipidemia, is responsible for the accumulation of fat. Viral hepatitis infection weakens the liver and degrades its functioning and integrity. Thus, the coexistence of diabetes and hepatitis could potentiate the risk of developing steatosis and liver fibrosis [12]. This degradation of the functional and anatomical capacities of the liver has multiple metabolic repercussions.

Hepatitis B and C have been the subject of several investigations in Cameroon [13] [14] [15]. These trials were conducted on individuals who also had other illnesses, and as far as we are aware, none of them specifically addressed the hepatitis B or C viruses and type 2 diabetes. We did a study on the relationship between type 2 diabetes and hepatitis B and C to investigate the associations between problems of glucose metabolism, some other biochemical parameters, and hepatotropic viral infection in Cameroon. The comprehension of this association will contribute to the improvement of the management of diabetes mellitus and limit complications due to viral hepatitis B and C in diabetics. In particular, this study sought to ascertain the metabolic profile and prevalence of hepatitis B and C in type 2 diabetics visiting the Central Hospital of Yaoundé, Cameroon.

2. Materials and Methods

2.1. Study Population

From January 2022 to June 2022, a cross-sectional study was conducted on diabetics attending the National Obesity Center of YCH. The sample size was determined based on the prevalence of diabetics in Cameroon, using the Lorentz formula and 100 patients were enrolled in the study. All participants in the study were type 2 diabetics attending the routine health screening exams with YCH.

2.2. Measurements

A standardized self-administered questionnaire was used to collect data from each study's participants on their socio-demographic characteristics, medical history, history of diabetes, usage of medication, and level of education. The age range was categorized as <40, 40 - 60, and >60. BMI was classified as <25, 25 - 30, and >30. Consumption of Alcohol, tobacco, blood transfusion, tattoo, intravenous drug abuse, surgical intervention, and dental care were recorded in patients as the risk of developing hepatitis. Education level was categorized as non-scolarized, primary, secondary, and university level of education. Hospital staff members took anthropometric measurements. Body Mass Index (BMI) was determined (kg/m^2). Anthropometric parameters were measured by hospital staff members. Body Mass Index (BMI) was calculated as weight in kilograms divided by height in meters squared (kg/m^2).

Blood was drawn from the antecubital vein after subjects had been fasting for at least eight hours. Blood specimens were sampled from the antecubital vein after at least 8 hours of fasting. Afterward, ten milliliters (10 mL) of venous blood were aseptically collected using plain and glucose tubes (5 mL in each tube) for the determination of various analyses. The blood specimen in those tubes was centrifuged at 3000 RPM for 15 minutes. The remaining serum and plasma were kept in the deep refrigerator at −20˚C. Liver enzymes, including aspartate aminotransferase (AST), alanine aminotransferase (ALT), and kidney markers such as urea and creatinine, albumin, lipid profile (Total Cholesterol, Triglycerides, HDL-Cholesterol, and LDL-Cholesterol) were evaluated using Commercial BIO LABO dosing kits. Subjects' fasting blood glucose (FBG) was measured by using a Glucose Oxidase/Peroxidase Kit assay (GLUCOSE liquicolor, Human GmbH, Germany). Diabetes was defined as the presence of a self-reported doctor diagnosis, self-reported usage of insulin or another hypoglycemic medication, or fasting blood glucose levels below 126 mg/dL. HBsAg hepatitis status was determined using a one-step HBsAg test strip (DiaSpot HBsAg; DiaSpot Diagnostics) and anti-HCV of subjects was detected by a rapid diagnostic test (DiaSpot HCV One Step Hepatitis C Virus Test Strip).

2.3. Statistical Analysis

The gathered information was imported into Excel and analyzed by the SPSS statistics version 20.0. At baseline visits, HBsAg and HCV Ab status were com-

pared to demographic traits, liver function profiles, serum fasting glucose level, and fatty liver disease. Numbers (proportions) were used to characterize categorical data, while the mean (with standard deviation) was used to describe continuous variables. Demographic characteristics, liver function profiles, serum fasting glucose level, and fatty liver disease at baseline visits were compared by HBsAg and HCV Ab status. Numbers (proportions) were used to characterize categorical data, while the mean (with standard deviation) or median was used to describe continuous variables. Comparisons were made using Analysis of Ordered Variables (One Way ANOVA), followed by a Chi-square test, and a Student's t-test, as needed, at the statistical significance level of 0.05.

3. Results

HCV and HBV infection frequency observed in diabetics was 8% and 3% respectively.

3.1. Socio-Demographic and Anthropometric Characteristics of the Studied Population

In the present study, the majority of participants (44%) were in the 40 - 60 age group. Female participants (60%) were the most represented with a sex ratio of 3:2. Almost all participants (86%) were married while 10% were widowed and 4% were single. In addition, the majority of participants had a primary level of education (38%) and were employed in the informal sector (35%). The age of participants ranged from 32 to 82 years, with an average of 58.41 ± 10.74 years. Participants' BMI (Body Mass Index) ranged from 17.10 to 56.64 kg/m^2, with an average BMI of 28.70 ± 6.01 kg/m^2 (Table 1).

3.2. Viral Hepatitis Risk Factors in the Study Population

The main risk factors for viral hepatitis reported by participants were dental care, alcohol consumption, and surgical procedures (Table 2).

3.3. Duration of Diabetes and Type of Treatment

The majority of participants had a duration of diabetes less than 5 years (45%) with a mean of 6.86 ± 6.72. Most participants were taking oral antidiabetic drugs (70%). 15% were on insulin and 15% were on oral antidiabetic drugs and insulin.

3.4. Markers of the Hepatic and Kidney Function Level, Fasting Blood Glucose, and Metabolic Profile of the Study Population

These different markers reveal that the liver and kidney of the study population functioned normally, with hypertriglyceridemia and hyperglycemia (Table 3).

3.5. Seroprevalence of HCV in Diabetics Patients According to the Demographic and Clinical Characteristics

Comparisons between HCV+ diabetics patients and HCV– diabetics patients

showed that the difference between age, age range, BMI categories, sex, and risk factors was not significant ($p > 0.05$) (Table 4).

Table 1. Distribution of participants by socio-demographic characteristics.

Characteristics	Frequency	Proportion (%)
Age range		
<40	6	6.0
40 - 60	50	50.0
>60	44	44.0
Sex		
Male	40	40.0
Female	60	60.0
Marital status		
Single	4	4.0
Married	86	86.0
Widower	10	10.0
Education level		
Out of school	4	4.0
Primary	38	38.0
Secondary	34	34.0
University	24	24.0
Profession		
Formal sector	13	13.0
Informal sector	35	35.0
Unemployed	19	19.0
Retired	33	33.0

Table 2. Participants' distribution according to risk factors.

Risk factors	Effective (N = 100)	Proportion (%)
Alcohol	41	41
Tobacco	12	12
Blood transfusion	9	9
Tattoo	2	2
Intravenous drug abuse	1	1
Surgical intervention	23	23
Dental care	50	50
Total	100	100

The data in Table 2 represents the number of participants who mentioned the risk factor.

Table 3. Markers of the hepatic and kidney function level, Fasting Blood Glucose, and metabolic profile of the study population.

Variables	Mean ± SD	Minimum	Maximum
AST (UI/L)	38.79 ± 22.89	18.5	208.4
ALT (UI/L)	25.53 ± 17.27	11.0	147.4
Urea (g/L)	0.48 ± 0.08	0.25	0.75
Creatinine (g/L)	11.77 ± 3.98	4.4	21.8
Albumin (g/L)	43.56 ± 4.74	33.5	64.6
FBG (g/L)	1.35 ± 0.45	0.67	2.80
TC (g/L)	1.66 ± 0.42	1.06	3.17
TG (g/L)	1.61 ± 0.46	1.01	3.10
HDL-C (g/L)	0.45 ± 0.09	0.21	0.66
LDL-C (g/L)	0.89 ± 0.39	0.24	2.18

Legend: FBG: fasting blood glucose; TC: total cholesterol; TG: triglyceride; HDL-C: High-density lipoprotein cholesterol; LDL-C: Low-density lipoprotein.

Table 4. Seroprevalence of HCV in diabetics patients according to the demographic and clinical characteristics.

Variables	Total (N = 100)	HCV+ (N = 8)	HCV− (N = 92)	P-value
Age	58.41 ± 10.74	65.63 ± 8.4	57.78 ± 10.73	0.42
BMI	28.70 ± 6.01	28.44 ± 7.20	28.73 ± 5.94	0.71
Sex				
Male	40 (40)	1 (2.5)	39 (97.5)	0.09
Female	60 (60)	7 (11.7)	53 (88.3)	
Age range				
<40	6 (6)	0	6 (100)	0.17
40 - 60	50 (50)	2 (4)	48 (96)	
>60	44 (44)	6 (13.6)	38 (8.4)	
BMI categories				
<25	22 (22)	3 (13.6)	19 (86.4)	0.53
25 - 30	43 (43)	3 (7.0)	40 (93.0)	
>25	35 (35)	2 (5.7)	33 (94.3)	
Alcohol	41 (41)	2 (4.9)	39 (95.1)	0.34
Tabacco	12 (12)	0	12 (100)	0.28
Blood transfusion	9 (9)	1 (11.1)	8 (88.9)	0.72
Surgical Intervention	23 (23)	2 (8.7)	21 (91.3)	0.89
Dental care	50 (50)	5 (10.0)	45 (90.0)	0.46

Values representing ages and BMI are presented as mean ± standard deviation; Values in brackets are expressed in percentages; N represents the number of diabetics concerned.

3.6. Seroprevalence of HBV in Diabetics Patients According to the Demographic and Clinical Characteristics

Comparisons between these two groups, HBV+ diabetics patients and HBV− diabetics patients showed that the difference between age, age range, BMI, BMI categories, sex, and risk factors was not significant ($p > 0.05$) (Table 5).

3.7. Seroprevalence of HBV and HCV of the Study Population According to the Biological Characteristics

Table 6 shows comparisons between these three groups; Diabetes patients only, HBV+ diabetics patients, and HCV+ diabetics patients. This table revealed that there was a significant difference in High-density lipoprotein cholesterol between Diabetes patients only and HCV+ diabetics patients ($p < 0.05$). Moreover, the difference in High-Density Lipoprotein Cholesterol between diabetes patients only and HBV+ diabetics patients was not significant ($p > 0.05$) (Table 6).

Table 5. Seroprevalence of HBV in diabetics patients according to the demographic and clinical characteristics.

Variables	Total N = 100	HBV+ N = 3	HBV− N = 97	P-value
Age	58.41 ± 10.74	50.67 ± 5.86	58.65 ± 10.79	0.21
BMI	28.70 ± 6.01	27.26 ± 5.71	28.75 ± 6.04	0.13
Sex				
Male	40 (40)	1 (2.5)	39 (97.5)	0.81
Female	60 (60)	2 (3.3)	58 (96.7)	
Age range				
<40	6 (6)	0	6 (100)	0.17
40 - 60	50 (50)	2 (4)	48 (96.7)	
>60	44 (44)	1 (13.6)	38 (86.4)	
BMI categories				
<25	22 (22)	3 (13.6)	19 (86,4)	0.53
25 - 30	43 (43)	3 (7.0)	40 (93.0)	
>25	35 (35)	2 (5.7)	33 (94.3)	
Alcohol	41 (41)	3 (7.3)	38 (92.7)	0.4
Tobacco	12 (12)	1 (8.3)	11 (91.7)	0.25
Blood transfusion	9 (9)	0	9 (100)	0.580
Surgical Intervention	23 (23)	1 (4,3)	22 (95.7)	0.67
Dental care	50 (50)	3 (6.0)	47 (94.0)	0.08

Values representing ages and BMI are presented in mean ± standard deviation; Values in brackets are expressed in percentages; N represents the number of diabetics concerned.

3.8. Effect of the Duration of Diabetes on Biochemical Parameters

Table 7 demonstrates that the amount of albumin drops by 0.013 every year of diabetes duration.

Table 6. Seroprevalence of HBV and HCV of the study population according to the biochemical parameters.

Parameters	Diabetes N = 89	Diabetes + Hepatitis B N = 3	Diabetes + Hepatitis C N = 8	ANOVA P-value
ALT (UI/L)	24.48 ± 17.01	39.10 ± 23.89	32.11 ± 16.52	0.181
AST (UI/L)	37.33 ± 22.36	52.10 ± 21.24	50.06 ± 27.34	0.192
Urea (g/L)	0.49 ± 0.08	0.39 ± 0.12	0.46 ± 0.04	0.056
Creatinine (g/L)	11.82 ± 3.84	10.30 ± 3.93	11.75 ± 5.75	0.812
FBG (g/L)	1.36 ± 0.45	1.44 ± 0.68	1.28 ± 0.35	0.863
TC (g/L)	1.68 ± 0.43	1.60 ± 0.13	1.43 ± 0.20	0.252
HDL-C (g/L)	0.46 ± 0.08[b]	0.48 ± 0.10[a,b]	0.37 ± 0.11[a]	0.0282
LDL-C (g/L)	0.91 ± 0.40	0.78 ± 0.11	0.72 ± 0.25	0.372
TG (g/L)	1.61 ± 0.45	1.71 ± 0.17	1.67 ± 0.55	0.879
Albumin (g/L)	43.90 ± 4.73	39.73 ± 2.54	41.42 ± 4.70	0.134

Legend: [a,b]Represents the statistically significant differences of post hoc test of Tukey after one way Anova; Values are represented as mean ± Standard Deviation; N represents the number of diabetics; FBG: fasting blood glucose; TC: total cholesterol; TG: triglyceride; HDL-C: High-density lipoprotein cholesterol; LDL-C: Low-density lipoprotein.

Table 7. Effect of the duration of diabetes on biochemical parameters.

Biochemical parameters	Coef	T	P-value
FBG (g/L)	0.003	1.00	0.322
AST (UI/L)	−0.003	−0.34	0.735
ALT (UI/L)	0.001	0.06	0.955
TC (g/L)	2.541	1.29	0.200
HDL-C (g/L)	−3.108	−1.40	0.164
LDL-C (g/L)	−2.786	−1.40	0.165
TG (g/L)	−0.365	−0.89	0.376
Urea (g/L)	0.998	0.87	0.389
Creatinine (g/L)	0.034	1.59	0.115
Albumin (g/L)	−0.044	−2.53	0.013

Legend: SE: Standard Error; Coef: Coefficient; T: T-test; FBG: fasting blood glucose; TC: total cholesterol; TG: triglyceride; HDL-C: High-density lipoprotein cholesterol; LDL-C: Low-density lipoprotein.

4. Discussion

We conducted a cross-sectional study whose objective was to determine the frequency of hepatitis B and C and the metabolic profile in patients with type 2 diabetes followed at the National Obesity Center (CNO) of the Central Hospital of Yaoundé (HCY). We included 100 type 2 diabetics in this study with an average age of 58.41 ± 10.74 years.

The included patients had a normal liver function. In addition, we found a prevalence of 11% of hepatitis B and C, 3% for hepatitis B, and 8% for hepatitis C in type 2 diabetics.

The different ages of patients ranged from 32 to 82 years. The majority were in the 40 - 60 age group, this is similar to the one published by Gebrekristos *et al.*, in Ethiopia and that of Ba-Essa *et al.*, in Saudi Arabia who reported the same age group of 46 - 60 years with a respective average age of 45.8 ± 11.8 years and 48.42 ± 13.70 years [16] [17]. This could be explained by the fact that type 2 diabetes affects the elderly much more. Women were the most represented (60%). These results are consistent with other data such as that obtained by Merza, in 2020 in an Iraqi Kurdistan population (Duhok province) and that of Villar *et al.* in 2019 in a Brazilian population, which had a greater representation of women (65.87% and 63.87% respectively) [5] [18]. This result could be justified not only by the high representation of women in society but also by their greater attendance at healthcare facilities. The majority of participants had a primary level of education (38%), this is in line with the study by Gebrekristos *et al.*, in Ethiopia, which reports a proportion of 36.5% of participants with a primary level of education [16]. This justifies the fact that most respondents had heard of hepatitis B and C, but did not know the mode of transmission.

The participants' average BMI was 28.70 ± 6.01 kg/m^2, indicating that they were overweight; more than 90% of type 2 diabetes patients have a BMI of 25 kg/m^2 or above [19]. Similar data were obtained in the Moroccan population [7]. Indeed, it has been shown that being overweight or obese is a risk factor for type 2 diabetes.

In general, patients had normal liver function (AST and ALT: 38.79 ± 22.89 and 25.53 ± 17.27 respectively). Similarly, renal function was normal in the included patients (creatinine: 11.77 ± 3.98; albumin 43.56 ± 4.74). This can be seen as a protective effect for these patients since all of them are under medication. Apart from triglyceride levels (1.61 ± 0.46), other lipid profile parameters were normal in our study population. Triglycerides are fatty acid esters of glycerol and represent the main lipid component of dietary fat and fat depots of animals. Elevated triglycerides level can be considered a lipid metabolism disorder, which can be linked to diabetes or treatment, in particular to insulin which is known to have an anti-lipolytic effect [20].

The treatment frequency with oral antidiabetic drugs was 70%; 15% were on insulin treatment, while 15% were taking oral antidiabetics and insulin. These different treatments taken by most of the patients in this study could partly ex-

plain the results of their metabolic profile. Indeed, metformin (a first-line antidiabetic drug taken by some patients in the study population) has been shown to have a lipid-lowering effect [21] [22] [23].

Serological tests for hepatitis B and C were performed during this investigation to look for anti-HCV antibodies and HBsAg. Contrary to the prevalence values of hepatitis B (11.2%) [13], and hepatitis C (4.9%) [24] obtained in the general population of Cameroon, we obtained a prevalence of 3% of hepatitis B and 8% of hepatitis C in type 2 diabetics. Because hepatitis B is more frequently linked to sexually transmitted diseases (STDs), which in turn cause an increase in the national incidence of hepatitis B in Cameroon, the low prevalence of hepatitis B in our research population can be attributable to this [25]. In contrast, anti-HCV antibodies are more prevalent in our sample because the average age is of 58.41 ± 10.74 years (which is the third age), meaning that some diabetics would have had pathologies that are likely to have resulted in blood transfusions (the primary cause of hepatitis C contamination) and because there is no effective hepatitis C vaccine for the majority of the population [26]. Bassit, in 2014 recorded in his study in Marrakech a prevalence of 4.5% of hepatitis C and 2.5% of hepatitis B [7]. Villar *et al.* in 2019 in Brazil did a study showing a prevalence of 2.42% of hepatitis C and 0.55% of hepatitis B [5]. These results are consistent with ours, with a low prevalence of HBsAg compared to HCV-Ac. Our results contradict certain studies conducted in Africa [27] [28]. This variation in results can be explained by the type of study population. First, the study population consisted of children co-infected with human immunodeficiency virus type 1 (HIV-1) and viral hepatitis [27]; second, the sample was composed of southeast Nigerian HIV-positive patients co-infected with hepatitis B and C [28].

HCV+ participants had an average age of 65.6 ± 8.4 years and most (6/8) were in the age range > 60 years. This result is consistent with many epidemiological studies that have demonstrated that diabetes people between the ages of 40 and 65 have an increased risk of contracting hepatitis C [29] [30].

In contrast, HBV+ participants had an average age of 50.7 ± 5.9 years, and most (2/3) were in the 40 - 60 age group. This low prevalence of HBV infection and the high frequency in younger patients is thought to be related to the wide vaccination coverage against hepatitis B, lowering the circulation of the virus in the general population. The risk factors for HCV and HBV reported by the study population were dental care (50%), followed by alcohol consumption (41%), surgery (23%), and blood transfusion (9%). However, all these risk factors were comparable in diabetic patients without viral infection and those with HCV+ or HBV serology. Thus, HBV and HCV infection in diabetes patients included in our study would not be linked to these risk factors. Similar results were obtained respectively by Chen *et al.* in 2006 in a Chinese population, Jadoon *et al.* in 2010 in a Pakistani population, and Kombi *et al.* in 2018 in a Congolese population [29] [30] [31].

There was a non-significant increase in AST and ALT values in HCV+ diabetic patients and HBV+ diabetics than in diabetic patients only. These findings

are contrary to the study in an Indian population that reported a significant difference between those two parameters [32]. This could be explained by the type of study population.

Our results showed a significant decrease ($p = 0.028$) in HDL cholesterol levels in HCV+ diabetic patients compared to the other 2 groups (diabetic only and HBV+ diabetic patients). This contradicts the findings of research conducted in Iran, where individuals with hepatitis B had considerably high HDL cholesterol concentrations ($p = 0.04$) [33]. The decreasing level of albumin in the blood may be related to water retention over time related to the effectiveness of antidiabetic treatments.

5. Conclusion

It appears from this study that the included patients had normal liver and kidney functions. Moreover, the lipid profile of the patients was dominated by hypertriglyceridemia. In addition to this, the results revealed that the seroprevalence of hepatitis B and C was 3% and 8%, respectively in type 2 diabetics.

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Data Availability Statement

Data is available from the corresponding authors (N.N).

Authors' Contributions

L.A.F.S, N.N, N.L initiated the project, wrote and corrected the manuscript. L.A.F.S, conducted biological tests. J.L.M.N, F.M.M, conducted statistical analyzes. N.N, J.A, supervised the study. All the authors read and approved the final manuscript.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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