Paradoxical relationships between anthropometric variables and phenotypic expression of the metabolic syndrome in non-diabetic Polynesians of New-Caledonia

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ABSTRACT

Objective: Obesity and diabetes are highly prevalent in Polynesians of New Caledonia. We explored whether this ethnic group would present the cluster of cardiometabolic disorders named “metabolic syndrome”, an established risk factor for type 2 diabetes and cardiovascular diseases in populations of European descent. Methods: A total of 419 non-diabetic participants were selected from the CALDIA Study, a population-based survey of diabetes prevalence in New Caledonia. Anthropometric variables, glucose, insulin, lipids and blood pressure were compared between the three main ethnic groups of the archipelago (Melanesians, Europeans, Polynesians). The associations between anthropometric and cardiometabolic variables were also studied. Results: Despite their much higher mean body mass index and waist circumference, Polynesians had lower plasma insulin levels and indices of moderate insulin resistance compared to Melanesians and Europeans. They also had a much higher rate of glycemic abnormalities. On the other hand, their mean triglycerides and blood pressure were lower compared to Melanesians, and total cholesterol was lower compared to Europeans. Moreover, in this ethnic group, triglycerides were not associated, and total cholesterol was inversely associated with abdominal obesity. Conclusions: Despite their high body mass, marked abdominal fat distribution and high blood glucose levels, non-diabetic Polynesians did not exhibit the cluster of abnormalities usually observed in the metabolic syndrome. This illustrates the diversity of phenotypic expressions of the metabolic syndrome across populations, and may have implications for the assessment of disease risk and for the design of preventive measures in Polynesians.

Keywords

Epidemiology; Polynesians; Insulin resistance; Insulin secretion; Type 2 diabetes; Metabolic syndrome.

1. INTRODUCTION

It is well known that the burden of non-communicable chronic diseases is rapidly growing in emerging and developing countries [1]. One of the key factors for the situation is what can be called “Westernization”, i.e., worldwide adoption of a lifestyle that promotes, among other evils (from smoking to pollution), bad eating habits and sedentarity, and hence, an increase in the prevalence of obesity [2]. In turn, obesity promotes an array of illnesses which include cardiovascular diseases and type 2 diabetes.

In the last two decades, the metabolic syndrome has emerged as a probable explanation linking obesity to these last two disorders [3,4]. The syndrome is usually described as a cluster of both atherogenic (dyslipidemia, elevated blood pressure) and diabetogenic (insulin resistance, dysglycemia) anomalies, associated with excess abdominal fat [5]. However, several studies have shown that this cluster can present wide variations in expression as well as in associated risks in different populations [6,7]. Why this is the case is still an open research question, and also the base for current debate about the utility of the concept [8]. Yet, up to now, insulin resistance has hardly ever been disputed as a core component of the cluster, and a pre-requisite in the natural history of type 2 diabetes.

We performed two analyses of a large population-based study in the multietnic population of New Caledonia (the CALDIA study) that may challenge this belief[9,10].

2. RESULTS

2.1 Diabetes in Polynesians

Pacific Islanders are known to be at high risk for diabetes mellitus, and Polynesians are no exception [11]. In French Polynesia, a 1995 survey on a representative sample of the population over 16 years of age [unpublished report, Ministry of Health] gave an age-and-sex-adjusted prevalence estimate of 17.7%, meaning that close to one-fifth of the inhabitants of the archipelago would be diabetic, and this was more than ten years ago! In the CALDIA study, conducted around the same time, the prevalence of type 2 diabetes was much higher (15.3%) in Polynesians than in Melanesians, the main ethnic group of New Caledonia, or Europeans (8.4%) [12]. To try and explain this higher risk of diabetes, we analyzed metabolic parameters in non-diabetic subjects selected from the CALDIA database, thus including 298 Melanesians, 58 Europeans and 63 Polynesians aged 30-59 years.

2.2 Results of the CALDIA Study

We first discovered that despite their high body mass index (mean: 30.3 kg/m\textsuperscript{2}; 95% CI: 28.5-32.2) and waist circumference (mean: 99.3 cm; 95% CI: 95.0-103.6), non-diabetic Polynesians had low fasting plasma insulin levels (61.7 pmol/l) and low degree of HOMA-estimated insulin resistance (2.75 mU:mmol/l\textsuperscript{2}).
HOMA estimate of β-cell secretory capacity was also significantly lower compared to Europeans and Melanesians (83.1 mU/mmol vs 119.3 and 124.8 respectively; P<0.02), suggesting a defect in insulin secretion capacity, which could be the major cause for the higher risk of diabetes observed in this ethnic group [9]. Further examination of the parameters entering the definition of the metabolic syndrome confirmed that Polynesians did not exhibit the usually described cluster of abnormalities [10]. They had the lowest triglyceride level of the three ethnic groups (1.20 mmol/l, 95% CI: 1.05-1.38), together with relatively low mean value for systolic blood pressure (133.3 mmHg, 95% CI: 127.6-139.0). The mean level of HDL-cholesterol was similar in all three ethnic groups. These findings are displayed in Figure 1. Another peculiarity was that triglyceride levels were found to be positively associated with waist circumference in Europeans and Melanesians, as expected, but not in Polynesians, where triglyceride and fasting plasma glucose levels were independent of abdominal obesity indices.

3. CONCLUSION
We found that despite their large body mass, non-diabetic Polynesians in New Caledonia do not seem to display the expected profile of disorders described under conventional definitions of the metabolic syndrome. The reasons for this variation in phenotypic expression are not yet elucidated. It may be that anthropometric indices related to overall or central obesity have limitations in assessing total and visceral body fat. For instance, several studies indicated that for a given BMI, Polynesians have higher percentage of lean mass and higher bone mineral density compared to other populations [13].

The particular metabolic profile we observed in Polynesians may also be related to their low degree of insulin resistance. This result in itself challenges the classical view that insulin resistance is a main feature of the metabolic syndrome and a leading factor predisposing to type 2 diabetes. When several intervention trials have shown the benefits of reducing insulin resistance for the prevention of diabetes [14], our findings indicate that the resulting common advice given to populations ("eat less, exercise more") may be insufficient to protect certain ethnic groups, where defective insulin secretion apparently overrules insulin resistance in the delicate imbalance that leads to overt diabetes.
4. REFERENCES


