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Aging Effects on Glycemic Control and Inflammation for Politicians in Taiwan

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Abstract

Insulin sensitivity is deteriorating with age leading to many metabolic complications, yet fasting glucose is the common metabolic predictor in preventive medicine. In this study we compared the differences in fasting glucose, glucose tolerance, and inflammatory markers between two generations in politically active families. Their physical activity levels and dietary intake amounts were also evaluated. Eight elected councilors and their first order descendents participated in this study. Oral glucose tolerance test (OGTT), insulin, triglyceride, cholesterol, and inflammatory markers including C-reactive protein (CRP) and interleukin-6 (IL-6) were determined. Fasting glucose concentration in politicians was smaller than 100 mg/dL (considered clinically normal), and only ~14% concentration difference was observed between two generations. However, all politicians were substantially insulin resistant, compared with their young descendents, evidenced by exaggerated glucose and insulin responses (>100% greater area under curves above baseline) under oral glucose challenged condition. Their waist circumference, diastolic blood pressure, and cholesterol levels were significantly greater than controls. Furthermore, CRP of the politicians was approximately 2.3 folds of the control value suggesting a low grade inflammation. The levels of physical activity and dietary intake were not different between groups. However, the weekly walking energy expenditure for the politician group was approximately 3 times greater than that of the control. Conclusion: To reflect the age-dependent metabolic deterioration for the purpose of prevention, OGTT and CRP are far more sensitive measures than fasting glucose value. Greater walking activity in politicians was not sufficient to counterbalance the age-dependent changes.

Key Words: political representative, insulin resistance, glucose tolerance, diabetes, interleukin-6, CRP, inflammation, DHEA-S

Introduction

In democratic society, politician is an occupation characterized by demanding social activities on voter development and electoral campaign. This occupational orientation, similar to many other

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professions, creates a socially active lifestyle that might have ramification on their metabolic condition. In addition, politicians are generally senior with well-established network, and age is another well-recognized risk factor for metabolic disorders. To our best knowledge, the life-style characteristic (such as physical activity and diet) and its link to metabolic and inflammation profiles for politicians have not yet been reported previously.

Obesity-associated insulin resistance is a widespread lifestyle-related metabolic condition (26), which has been recognized as an early sign for several metabolic disorders, including type 2 diabetes, hypertension, dyslipidemia, coronary heart disease, and cancer (5, 10, 24). Recently, this condition has been found to causally link with chronic low grade inflammation (17, 21, 27). Individuals with elevated CRP (a stable inflammation indicator) are at an increased risk for aforementioned metabolic disorders (8, 20, 31). Recent studies reported that job strain is also associated with the levels of inflammation (2, 4). In this study, we hypothesized that, under the combined influences of age and their socially active lifestyle, politicians would display different metabolic and inflammation profiles compared with young healthy adult. To minimize the genetic influence on our observation, their first degree descendents were paired examined. Here, we compared the magnitude of differences in fasting glucose, OGTT, and inflammation measures between the two generations in politically active families. Since all politicians have not yet progressed to clinical stage, the present study showed that glucose tolerance and inflammatory marker CRP would be better metabolic indicators than fasting glucose to reflect the status of age-dependent metabolic deteriorations.

Materials and Methods

Participants

Eight elected council politicians (N = 8, M/F = 6/2, accounts for one third members of the entire Chia-Yi City Council, Taiwan, ROC), and their first degree decedents (N = 8, M/F = 4/4, genetic control) voluntarily participated in this study. All subjects were apparently healthy without previous diagnoses of any type of diseases. Aims and methods were explained to all subjects, who then gave formal consent. This study was conducted in accordance with the recommendations outlined in the Declaration of Helsinki. Ethical approval for the study was obtained from the Human Subject Committee of Taipei Physical Education College.

Physical Activity and Dietary Intake

Long format of International Physical Activity Questionnaire (IPAQ) was used to estimate the amount of energy expenditure for physical activity (3). Dietary Fat Intake Questionnaire was used to recall the caloric intake (19).

Oral Glucose Tolerance Test (OGTT)

An oral glucose tolerance test (OGTT) was performed under overnight fasted condition. The test procedure was performed according to the method as previously described (30). Briefly, a 75-gram of glucose was orally delivered with 500 ml of pure water. Blood samples were collected from the fingertips at 0 (fasting value), 30, 60, 90, and 120 min. Blood glucose and insulin curves were plotted and total areas under the curve (AUCs) were calculated geometrically. The trapezoidal rule was used for calculation of areas under the curve (AUC) of glucose and insulin responses. All AUC are incremental (*i.e.* change from baseline values).

Insulin, Cortisol, CRP, Interleukin-6, and dehydroepiandrosterone sulfate (DHEA-S)

Plasma samples were collected from venous blood. The insulin, cortisol, CRP, and DHEA-S were determined on an ELISA analyzer (Tecan Genios, Salzburg, Austria) with the use of commercially available ELISA kits (Diagnostic Systems Laboratories, Inc. Webster, TX, USA), by a manner in accordance with the manufacture's instruction. Interleukin-6 (IL-6) was used ELISA kit from Bender Medsystems (Vienna, Austria). The catalog numbers for the assay kits are: insulin (DSL-10-1600), cortisol (DSL-10-2000), CRP (DSL-10-42100), DHEA-S (DSL-10-3500), and IL-6 (BMS213INST).

Creatine Kinase (CK) and Cholesterol

Total plasma cholesterol was measured on a Beckman spectrophotometer analyzer with Sigma Trinder's reaction (Sigma, St. Louis, MO, USA), according to the manufacturer's procedure. CK was directly determined on a Reflotron Plus Analyzer (Roche Diagnostic, Basel, Switzerland) according to its standard procedure provided by the manufacture.

Statistical Analysis

Paired *t*-test was used to compare the mean differences between the politician and the control values for all subjects. An analysis of variance (ANOVA) was performed for OGTT and insulin responses. Fisher's protected least significance test was used to distinguish significant differences be-

Table 1. Subject characteristics and body composition measures

	Politician	Control	*P*
Age (year)	50.9 ± 2.2	25.5 ± 3.5	< 0.001
DHEA-S	0.81 ± 0.16	1.33 ± 0.12	0.027
Height (cm)	168.1 ± 3.5	163.1 ± 4.2	0.526
Weight (kg)	77.1 ± 4.8	62.4 ± 3.8	0.042
BMI	27.3 ± 1.4	23.3 ± 0.6	0.026
Waist circumference (cm)	93.7 ± 3.9	80.1 ± 3.5	0.026
Hip circumference (cm)	101.7 ± 3.1	97.7 ± 1.4	0.350
WHR	0.92 ± 0.02	0.82 ± 0.03	0.018

Table 2. Energy expenditure of physical activity

Kcal/Week	Politician	Control	*P*
Work	909 ± 288	465 ± 30	0.162
Transportation	1,682 ± 511	1,578 ± 455	0.460
Housekeeping	15 ± 10	52 ± 13	0.075
Outdoor recreation	2,488 ± 415	3,984 ± 1,009	0.188
Sitting	292 ± 47	343 ± 32	0.139

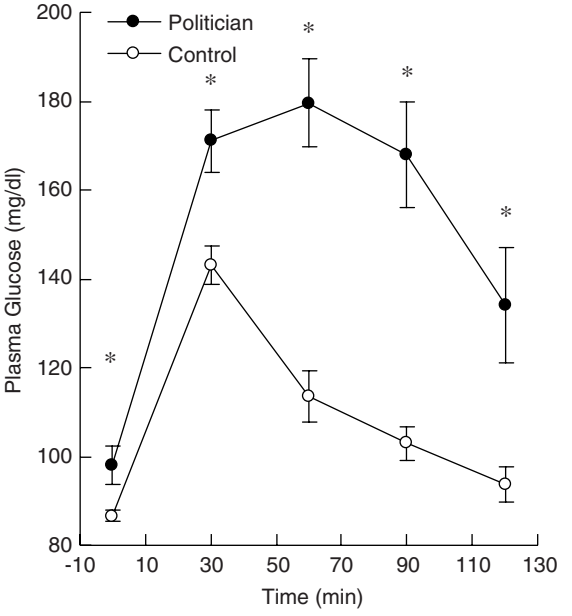

Fig. 1. Oral glucose tolerance test (OGTT). *Denotes significant difference against the Control group, $P < 0.05$.

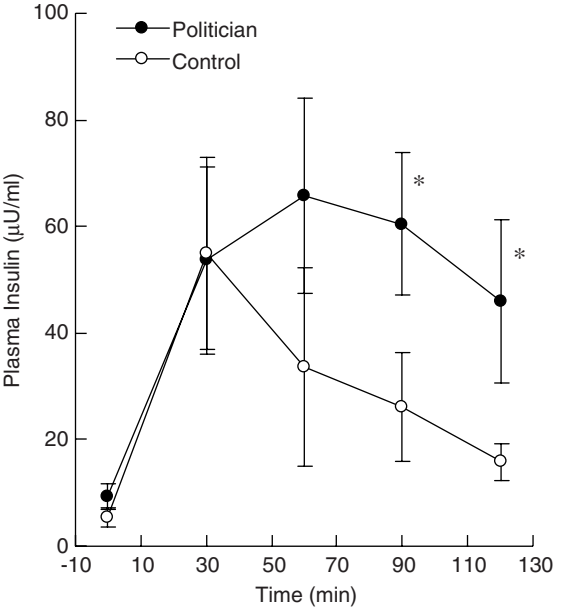

Fig. 2. Insulin Response to OGTT. *Denotes significant difference against the Control group, $P < 0.05$.

tween pairs of groups. A level of $P < 0.05$ was set as significant on all tests, and all values are expressed as means ± standard error.

Results

The participant characteristics are shown in Table 1. The politician group was significantly heavier and more obese than the control group. DHEA-S, the biomarker of human aging (25), was found lower in the politician group than that in the control group.

The energy expenditure in physical activity is shown in Table 2. Overall, no significant difference in energy expenditure of physical activity between the politician and the control groups was found. However, the weekly walking energy expenditure for the politician group was significantly greater than that for the control (688 ± 243 *vs.* 160 ± 113 Met ×

Table 3. Metabolic and inflammatory profiles

	Politician	Control	*P*
GAUC	7,935 ± 997	2,412 ± 291	< 0.001
IAUC	5,440 ± 1,430	2,977 ± 1,369	0.110
Systolic blood pressure	128.5 ± 6.1	116.9 ± 7.4	0.078
Diastolic blood pressure	87.0 ± 4.5	74.6 ± 4.1	0.032
Total cholesterol	193 ± 9	143 ± 6	< 0.001
Triacylglycerol	159 ± 29	150 ± 34	0.819
CRP	1.02 ± 0.20	0.43 ± 0.13	0.020
IL-6	1.08 ± 0.19	1.51 ± 0.12	0.010

Table 4. Uses of tobacco and alcohol

	Politician	Control	*P*
Cigarette (Pack/wk)	1.75 ± 1.14	0 ± 0	0.074
Light Alcohol (Bottle/wk)	10.3 ± 6.8	0.1 ± 0.1	0.082
Liquor (Bottle/wk)	1.5 ± 0.9	0 ± 0	0.050
Restaurant dinning (Times/wk)	4.4 ± 0.9	0.9 ± 0.2	0.002

min, $P = 0.034$).

Glucose and insulin levels, under glucose challenged conditions, were substantially greater in the politician group than those in the control group (Figures 1 and 2). The levels of inflammatory cytokines CRP and IL-6 are displayed in Table 3. Area under curve of glucose (glucose AUC), cholesterol, diastolic blood pressure, and C-reactive protein (CRP) were significantly greater in the politician group than those in the control group. However, IL-6 level was significantly lower in the politician group than that in the control group.

Tobacco habit, alcohol consumption, and dining habit are shown in Table 4. Politicians exhibit substantially greater alcohol drinking and restaurant dining, compared with control. However, total caloric intake between two generations was not significantly different.

Discussion

Prevention is better than treatment for age-onset metabolic disorders. In the family-paired segregation study, the lifestyle of politician in Taiwan is characterized by greater restaurant dining and alcohol consumption compared to their first-order descendent. This lifestyle, to some extent, is similar to many other socially active occupations. Here we found only a small difference in fasting glucose values (14%, < 100 mg/dl) between two generations. However, when oral glucose tolerance test (OGTT) and insulin measurements were performed, those politicians exhibited a substantial insulin resistance compared with their family counterparts. CRP levels in politicians were also far greater than those of their family counterparts (2.3 folds). Unfortunately, fasting glucose, but not OGTT and CRP, is the common medical examination routine for preventing age-dependent metabolic disorders. Thus the result of the study provides a crucial message for clinicians and those socially active middle-aged people that OGTT and CRP are far more sensitive indicators to reflect the status of age-dependent metabolic deterioration than fasting glucose value.

This adverse metabolic condition in politicians appears to be associated with greater abdominal obesity, secondary to the combined effect of aging (6, 12) and their socially active lifestyle (1, 5-7, 11, 15). Early studies had reported that insulin resistance in aging men is independently associated with central fatness (13, 22), which has been recognized as a major risk factor for virtually all age-onset metabolic disorders. Although genetic factor is undoubtedly important affecting the degree of obesity, the recent rapid growth of obese population in industrialized society is mostly explained by lifestyle factor (14). Therefore, the greater degree of central obesity in this particular group is most likely due to their socially active lifestyle and aging, which is not unique to this profession.

Abdominal obesity is known to increase baseline inflammation (29). In this study, one major differences associated with insulin resistance in the politician against control is the greater level of baseline inflammation, as shown by CRP value. Inflammation has recently been noted as a pathogenic cause for insulin

resistance (27, 29). Recently, inflammatory processes are implicated in the pathogenesis of the most common chronic metabolic diseases such as type 2 diabetes, coronary heart disease, and cancer (4, 8, 20, 27). CRP, a hallmark of the inflammation, is generally elevated in insulin resistance patients (29). Occupation has been suggested as one factor associated with baseline inflammatory level (2, 4). To determine the relative contribution of obesity and job strain on CRP levels, greater population would be required.

In contrast to the CRP result, the cytokines IL-6 level of the politician group was lower than that of the control group. Elevated plasma IL-6 level has been consistently observed in patients with type 2 diabetes mellitus, and as a consequence both have been related to insulin resistance and impaired glucose tolerance (16). It has been reported that the increment of CRP is caused by a rise in the plasma concentration of IL-6, which is produced in macrophages, endothelial cells and T-cells (9, 18). However, previous study has also shown that IL-6 can be produced in exercised skeletal muscle and elevated during the period of enhanced insulin sensitivity (28), and this report shows marginally (non-significant) greater physical activity level in the young control than politicians that might influence the IL-6 result to some extent. Recently, the anti-inflammatory role of IL-6 has been suggested (23). Whether IL-6 could not be considered as a stable inflammation marker in this setting remains uncertain.

The main limitation of the study is our difficulties of recruiting a large number of subjects in this occupation. Therefore, the current work is considered as a preliminary but original report aiming, to elicit more research interest for this socially active population. In future, greater population and other occupations with similar lifestyle are required to identify whether the deteriorated metabolic condition of politician is relatively faster against other occupations. Therefore, better controls which had similar characteristics in age, social income, education, working duration, and medication would be required to determine the independent influence of lifestyle on the metabolic phenotype in this occupation.

The current study reported a significant insulin resistance for the politicians against their first order descendents. In particular, all politicians displayed substantially greater glucose and insulin responses under an oral glucose challenge above control (> 100%), but only small difference (14%) in fasting glucose concentration was detected. This age-dependent metabolic deterioration was linked with considerably greater baseline inflammation level, which appears to be contributed by abdominal obesity and advancing aging, independent of genetic factor. The most important message of the study is that using OGTT and inflammatory marker CRP, in comparison with their genetic counterpart, would be a better way to monitor the status of age-dependent metabolic deterioration. Currently, fasting glucose concentration is the most commonly used examination item for prevention of metabolic disorders, which shows minimal sensitivity to reflect the age-dependent metabolic changes.

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