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Brief Reports

Lipids seasonal variability in type 2 diabetes

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ARTICLE INFO

Article history:
Received 13 February 2012
Accepted 9 May 2012

Keywords:
Type 2 diabetes
Lipids
Seasons

ABSTRACT

Objective. The objective was to evaluate the seasonal lipid variations in type 2 diabetic (DM2) outpatients.

Materials/Methods. 302 (183 women and 119 men) DM2 subjects with or without statins therapy were screened. Body weight, HbA1c, total cholesterol (TC), high density lipoprotein (HDL-C), triglycerides (Trg) and low density lipoprotein cholesterol (LDL-C) were measured and patients' data of diet and physical activity were recorded during fall/winter (F/W) and spring/summer (S/S) seasons.

Results. HbA1c levels showed seasonal variability without statistical significance. During the colder seasons we observed an increase ($P<.05$) of weight associated with higher calorie intake and reduced physical activity. We showed a peak of TC, LDL-C and Trg levels during F/W while HDL-C levels were reduced. Median TC levels in F/W with respect to S/S were 197 vs 185 mg/dL ($P<.001$) without statins therapy and 172 vs 161 mg/dL ($P<.001$) in patients under statins therapy. Median LDL-C levels, without or with statin therapy, were 122 vs 114 mg/dL ($P<.001$) and 97.5 vs 88.5 mg/dL ($P<.001$), respectively. This seasonal lipids changes from F/W to S/S, modulated the percent of patients at LDL-C target < 100 mg/dL, both without or under statins treatment: from 22% to 29.5% ($P<.05$) with odds ratio 0.73 (95% CI 0.62–0.87) and from 47% to 55% ($P<.001$) with odds ratio 0.68 (95% CI 0.58–0.76), respectively.

Conclusions. DM2 patients showed a peak of TC and LDL-C during colder months associated with changes of diet and lifestyle habits. This seasonal lipid trend modified the percentage of patients at LDL-C therapeutical target.

1. Introduction

Plasma Low Density Lipoprotein-Cholesterol (LDL-C) is strongly associated to cardiovascular disease (CVD) risk in type 2 diabetes (DM2) and statins have proved to be the most effective lipid drugs to reduce LDL-C levels [1,2]. Interesting is the presence of a seasonal rhythm of lipid levels and how this variability is synchronous to CVD events during the colder months [3]. In fact, some studies in dyslipidemic subjects showed a characteristic peak of total cholesterol (TC) and LDL-C in fall/winter and a nadir during spring/summer [4]. This fact interferes in the attainment of therapeutical lipids target. To our knowledge, no data have been reported on the seasonal lipid trend in diabetes, thus we explored whether a variation in lipid levels exists in DM2 patients.

Abbreviations: LDL-C, Low Density Lipoprotein-Cholesterol; CVD, Cardiovascular Disease; DM2, Type 2 Diabetes; TC, Total Cholesterol; OHA, Oral Hypoglycaemic Agents; F/W, Fall/Winter; S/S, Spring/Summer; BMI, Body Mass Index; HDL-C, High Density Lipoprotein; Trg, Triglycerides; ADA, American Diabetes Association.

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0026-0495/$ – see front matter © 2012 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.metabol.2012.05.009

2. Patients and methods

We consecutively investigated 302 (183 women and 119 men) DM2 clinical outpatients without CVD, from October 2005 through December 2006. All patients were treated with unmodified oral hypoglycaemic agents (OHA), with or without statins, in two years of observation. The insulin doses were unchanged by >10% throughout the study. Patients affected by liver, thyroid or chronic kidney diseases were excluded. Seasonal visits were grouped in fall/winter (F/W) and spring/summer (S/S). We recorded body mass index (BMI), HbA1c, fasting glucose and lipid profile: TC, high density lipoprotein (HDL-C), and triglycerides (Trg). HbA1c was measured with high-pressure liquid chromatography (Menarini Diagnostics, Italy; upper limit of normal range 5.6%). Plasma glucose and lipids were automatically measured (Beckman Instruments, Brea, USA). LDL-C was calculated by the Friedewald formula [5]. All patients received by a nutritionist an appropriate diet according to the American Diabetes Association recommendations [6] and instructed to record quality and quantity of foods eaten supported by a reference book that contained nutrition advices and how to determine the calorie and fat gram content of their foods. All subjects were encouraged to participate in at least 150 min of moderate physical activity weekly. These advices were reinforced in each visit and monitored in a self recorded diary.

The therapeutical LDL-C target <100 mg/dL was considered [7]. All patients gave informed consent to the study which was approved by the University of Florence Medical Ethical Committee.

The data distribution was checked by Kolmogorov–Smirnov test. Categorical variables were compared by Chi square test. Seasonal differences of continuous lipid values were reported as medians and analyzed by Wilcoxon test. Odds ratio estimates (95% confidence intervals, CIs) by logistic regression (age, sex, BMI adjusted) quantified the seasonal attainment of LDL-C target. Significance was considered for $P<.05$. All analyses were performed using SPSS 17.0 (SPSS, Chicago, IL).

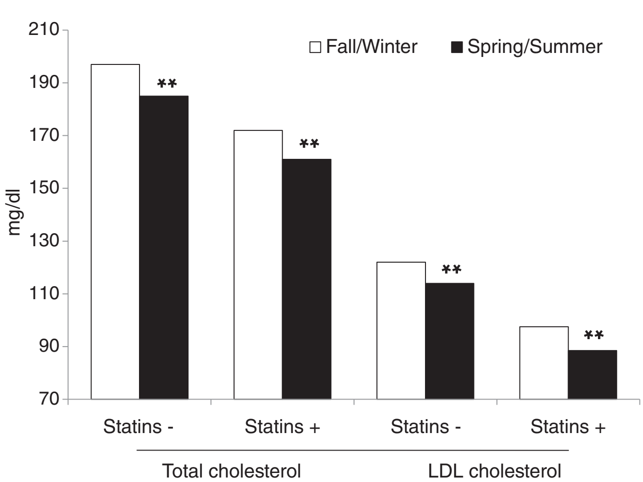

Fig. 1 – Seasonal variations of total and LDL cholesterol (mg/dL) median levels from Fall/Winter to Spring/Summer; *: $P<.001$ vs Fall/Winter.

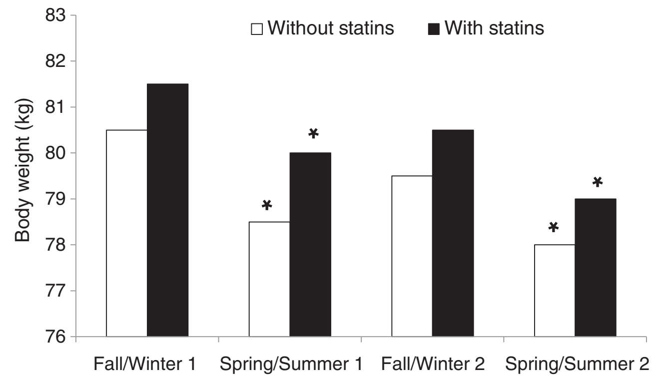

Fig. 2 – Seasonal variations of body weight (kg) median levels; *: $P<.05$ vs Fall/Winter.

3. Results

The cohort showed a mean age of 64.5±9.0 years, BMI of 28.6 ±2.7 kg/m^2, HbA1c 7.0%±0.8% with 6.6±5.5 years duration of diabetes. OHA were used by 87.2% patients. In particular, 51.5% assumed metformin (Metf) alone, 32.7% Metf plus other OHA (25% thiazolidinediones (TZDs), 70% secretagogues, 5% acarbose), 3.0% OHA without Metf and 12.8% insulin plus Metf. Statins were used by 51.0% of patients and 1.0% other hypolipidemic drugs (fibrates, ezetimibe, niacin, fish oils, red rice yeast). 8.0% were currently smokers.

Statistically significant higher TC, LDL-C and Trg concentrations were observed during F/W while HDL-C levels were reduced. Median TC levels in F/W with respect to S/S were 197 vs 185 mg/dL ($P<.001$) without statins therapy and 172 vs 161 mg/dL ($P<.001$) in patients under statins therapy. Median LDL-C levels, without or with statin therapy, showed a statistical seasonal difference (122 vs 114 mg/dL, $P<.001$; 97.5 vs 88.5 mg/dL, $P<.001$, respectively; Fig. 1). An opposite trend was observed between the HDL-C and Trg, with lower levels in F/W and higher values in S/S for the former, independent of the use of statins. Median HDL-C concentrations without statins were 43 vs 46 mg/dL and 46 vs 49 mg/dL in statins group ($P<.05$, for all). Median Trg levels without statins were 135 vs 129 mg/dL and in statins treated 127 vs 119 mg/dL ($P<.05$, for all).

This seasonal lipids variability modulated the percent of patients at goal of LDL-C <100 mg/dL in both subjects without or with statins treatment: from 22% to 29.5% ($P<.05$) with odds ratio 0.73 (95% CI 0.62–0.87) and from 47% to 55% ($P<.001$) with odds ratio 0.68 (95% CI 0.58–0.76), respectively. When we looked at the effect of OHA on lipids seasonal variability, Metf alone showed a major LDL-C seasonal reduction from a median of 118.5 mg/dL in F/W to 114 mg/dL in S/S ($P<.05$). HbA1c levels were not associated to a significant seasonal variability. Data analysis obtained by self recorded diaries, showed a 40% increase of time spent for weekly physical activity during the warmer months and associated a 15% reduction of carbohydrates (bread and pasta) and lipids intake. These data were concordant to the sinusoidal-like trend of body weight, with a statistical significant peak in F/W and a nadir S/S, with or without lipid drugs (Fig. 2).