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Effect of the Mediterranean diet on plasma adipokine concentrations in men with metabolic syndrome

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ABSTRACT

Objective. While a Mediterranean dietary pattern (MedDiet) has been associated with favorable changes in several features of metabolic syndrome (MetS), its impact on plasma adipokine concentrations remains largely unknown. The objective of this study was to determine the impact of the MedDiet consumed under controlled feeding conditions, without (–WL) and with weight loss (+WL), on plasma adipokine concentrations in adult men with MetS (NCEP-ATP III).

Materials/Methods. The diet of 26 men with MetS (age 24 to 62 yrs) was first standardized to a North American control diet for 5 weeks. Participants then consumed a pre-determined MedDiet for 5 weeks. Both diets were consumed under weight-maintaining isoenergetic feeding conditions. Participants then underwent a 20-week free-living caloric restriction period, after which they consumed the MedDiet again in weight stabilizing, isoenergetic feeding conditions.

Results. Body weight was reduced by $10.2\% \pm 2.9\%$ and waist circumference by 8.6 ± 3.3 cm after the weight loss period and stabilization on MedDiet ($P < 0.001$). MedDiet – WL had no impact on plasma concentrations of leptin, plasminogen activator inhibitor-1, resistin, visfatin, acylation stimulating protein and adiponectin. MedDiet + WL reduced plasma leptin concentrations ($P < 0.01$) and increased plasma adiponectin concentrations ($P < 0.05$) compared with the control diet and MedDiet – WL.

Conclusion. Data from this nutritionally controlled study suggest that short-term consumption of MedDiet has little effect on the concentrations of many adipokines in the absence of weight loss.

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1. Introduction

Adipose tissue is recognized as an active endocrine organ secreting several adipokines implicated in lipid metabolism, energy balance regulation, insulin sensitivity and pro- and

anti-inflammatory processes [1]. Leptin is produced by adipose tissue proportionally to adipocyte volume and total fat mass and plays an important role in the regulation of appetite [2]. Plasma levels of plasminogen activator inhibitor type-1 (PAI-1) have been positively associated with visceral

Abbreviations: ASP, acylation stimulating protein; C, cholesterol; CRP, C-reactive protein; CVD, cardiovascular disease; HDL-C, High Density Lipoprotein-cholesterol; HMW, high molecular weight; IL, interleukin; LDL-C, Low Density Lipoprotein-cholesterol; MedDiet, Mediterranean diet; MetS, metabolic syndrome; MUFA, monounsaturated fatty acids; PUFA, polyunsaturated fatty acids; SFA, saturated fatty acids; TFA, trans fatty acids; TNF- α , tumor necrosis factor- α ; TG, triglyceride.

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adiposity and have been shown to be a strong risk factor for thrombotic diseases in metabolic syndrome (MetS) [3]. Resistin and visfatin are considered important pro-inflammatory mediators and both may also play a role in the regulation of insulin sensitivity [3,4]. Acylation stimulating protein (ASP) is involved in glucose and fatty acid uptake as well as in triglyceride (TG) storage and synthesis in adipose tissue [5]. Plasma ASP concentrations are increased in obesity, dyslipidemia and cardiovascular diseases (CVD) and reduced with weight loss [5]. Adiponectin, which is abundantly expressed in adipose tissue, has been shown to have anti-atherogenic, anti-inflammatory and insulin-sensitizing properties [6]. Low plasma concentrations of adiponectin are associated with obesity, MetS and increased CVD risk [7]. Long-term weight loss and caloric restriction have been shown to reduce plasma leptin concentrations [8,9] and to increase plasma adiponectin concentrations in humans [10,11].

While it is well accepted that adhering to principles of the MedDiet reduces the incidence of major cardiovascular events [12], the underlying mechanisms for this beneficial effect are not fully understood. More specifically, the extent to which changes in plasma adipokine concentrations with MedDiet may explain part of its cardiovascular benefits remains largely unknown. It should also be stressed that previous studies that have investigated adherence to the MedDiet have also been confounded, in many instances, by significant concurrent weight loss [13].

The objective of this study was to investigate the impact of the MedDiet consumed under carefully controlled feeding conditions without changes in body weight, on plasma adipokine concentrations, and to assess how weight loss further modifies these effects in men with MetS. Our hypothesis was that MedDiet improves the plasma adipokine profile only when accompanied by significant weight loss.

2. Methods and procedures

2.1. Population

The study design has been described in detail previously [14]. Briefly, non-smoking men (18 to 65 years) from the Québec City metropolitan area with MetS (NCEP-ATP III [15]) were

recruited for the study. Men with a previous history of CVD or type 2 diabetes, with monogenic dyslipidemia, with endocrine disorders, on lipid-lowering or hypertension medication were excluded. Participants had to have a stable weight for 6 months and to have no aversion for specific components of the MedDiet. Current users of vitamin supplements or natural health products were not eligible. Study procedures have been approved by the Research Ethics Committee of Laval University and written informed consent was obtained from all participants enrolled in the study.

2.2. Diets and study design

Fig. 1 shows the design of this fixed sequence study [14]. Participants' diet was first standardized to a North American control diet for 5 weeks under weight-maintaining condition and was devised to reflect current macronutrient average intake in North American men (Table 1) [16]. Participants were then fed with a MedDiet for 5 weeks that was formulated to be concordant with a Mediterranean-style diet [17] in quantities to maintain body weight constant [14]. This first phase of the study under isoenergetic controlled feeding conditions allowed us to investigate the impact of the MedDiet *per se* on plasma adipokine concentrations, in the absence of weight loss (MedDiet – WL). Participants then underwent a 20-week free-living period during which they were counselled to restrict energy intake in order to achieve a minimum of 5% reduction in body weight (see next section). Finally, subjects again consumed the MedDiet (5 weeks) in isoenergetic conditions to achieve a stable body weight after the weight loss phase. This allowed us to compare the combined impact of the MedDiet and weight loss (MedDiet + WL) on adipokines to the control diet and the MedDiet – WL. Comparing values before and after weight loss measured in both instances after the controlled feeding of the MedDiet (MedDiet – WL vs. MedDiet + WL) provides information on the effect of weight loss *per se* on adipokine concentrations since there is no difference between these two phases. A dietary score reflecting the degree to which the traditional MedDiet was achieved, was computed as published in Goulet et al. [18]. This score is based on 11 components of the Mediterranean diet pyramid, each contributing 0 to 4 points, thereby yielding a MedDiet score ranging from 0 to 44 points (Table 1).

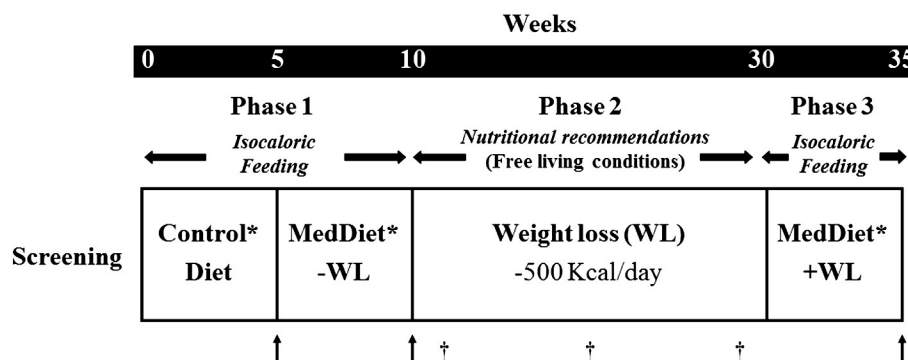


Fig. 1 – Study design as shown in [14]. *Daily weighing and adjustment of energy intake (controlled feeding phases of the study with all foods provided). † Food journals and physical activity records (3 days). ‡ Blood sampling and anthropometric measurements.

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