# THE ASSOCIATION OF ADIPONECTIN POLYMORPHISMS WITH FOOD INTAKE

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Abstract — Obesity has become one of the most common diseases in the world and represents a serious public-health problem. The aim of this cross-sectional study was to examine the influence of dietary factors on the association between two adiponectin SNPs and some biochemical parameters. Ninety-six, healthy non-smoking adults aged 25-49 participated in this cross sectional study. Two single nucleotide polymorphisms (SNPs) at adiponectin (ADIPOQ) gene, +276G>T and +45T>G were genotyped in all participants. Additionally, the participants underwent standard anthropomorphological measurements of body composition, blood pressure measurements, dietary intake assessment and fasting serological measurements of glucose, insulin, triacylglycerol's, total cholesterol, low density lipoprotein cholesterol, high density lipoprotein cholesterol, and C-reactive protein. Based on measured biometrical parameters a statistical analysis was performed for assessing dietary intake. The SNP276G<T and SNP45T<G of the ADIPOQ gene are associated with different responses of total cholesterol, HDL cholesterol and C-reactive protein (CRP) to low or high intake of polyunsaturated fatty acid, saturated fatty acid and omega-3 fatty acid.

Index Terms — TRANS2CARE, obesity, adiponectin polymorphism, food intake

## 1    BACKGROUND

Overweight and obesity are associated with low-grade inflammation and can lead to development of insulin resistance (IR), metabolic syndrome (MetS), and increase risk of developing type 2 diabetes mellitus (T2DM), cancer and cardiovascular diseases (CVD) (1). Adiponectin, the most abundant adipocyte-secreted hormone in the blood have been reported to be reduced in obesity (2). Moreover, adiponectin exhibits anti-inflammatory, anti-diabetic, and anti-atherosclerotic properties (3).

Adiponectin is encoded by the ADIPOQ gene located on chromosome 3q27, where many of SNPs have been shown to be related to IR, T2DM and CVD. Nutrition and genetics both play an important role in human health as well as the development of the above mentioned diseases. Variability between individuals in response to dietary food intake is a well-known phenomenon in nutrition research and practice (4). For example, the effect of dietary changes on phenotypes such as blood cholesterol, body weight and blood pressure can differ significantly between individuals (5). Therefore, the primary goal of our study was to examine the influence of dietary factors on the association between two adiponectin SNPs and total cholesterol, HDL cholesterol and C-reactive protein (CRP).

Dietary factors play an important role in the development of the diseases. The expression of gene could be modified by environmental factors including diet, and the genetic variations may have effects on metabolic response to diet (5). Personalized nutrition is therefore gaining interest because of its usefulness in both the prevention and treatment of chronic diseases by tailoring dietary advice to an individual's unique genetic profile. Current research could lead to the development of personalized nutrition guidelines for individuals and specific sub-populations, which could decrease the risk of chronic diseases. .

## 2    OBJECTIVES

The objective of our study was to examine the potential modification of dietary factors on the association between two adiponectin SNPs and some biochemical parameters.

## 3    APPROACH & METHODS

### General approach
1. Dietary intake evaluation; 2. Blood collection; 3. DNA isolation 4.; Genotyping of different polymorphisms; 5. Statistical analysis of all data collected

### Methods
This cross-sectional study involved 96 healthy adults aged 25-49. Information of dietary intake were assesses by 3-Day Food Record. All participants underwent standard anthropometrical measurements of body composition, and fasting serological measurements of fasting glucose, insulin, total cholesterol, LDL cholesterol, HDL cholesterol, triacylglycerol's, and C-reactive protein. Genomic DNA was extracted from venous blood samples and two SNPs at ADIPOQ (rs1501299 (276G>T) and rs2241766 (45T>G)) were genotyped. Statistical analysis was performed based on 112 measured biometrical parameters and dietary intake composition.

## 4    RESULTS

We found that the effect of dietary changes on total cholesterol, HDL cholesterol and CRP can differ significantly between individuals. For each dietary intake a median value was used to divide participants into two groups according to low or high intake. The largest effect was observed for the polyunsaturated fatty acid (PUFA), saturated fatty acid (SFA), and omega-3 fatty acid. Participants carrying the G allele at position +276 were not responsive either to the low or high polyunsaturated fatty acid (PUFA) intake or low and high saturated fatty acid (SFA) intake in terms of total cholesterol and CRP (Figure 1B and 1C). On the other hand, participants carrying T allele showed the responsiveness to the low/high PUFA and SFA intake in terms of total cholesterol and CRP. The percentage of participants

with total cholesterol higher than 5.2 was higher at low PUFA intake and the percentage of participants with CRP higher than 1.2 was higher in the group of high SFA intake (Figure 1B and 1C). Furthermore, Figure 1A shows the different response of the polymorphism 276 on low and high SFA intake in terms of HDL cholesterol. The percentage of participants carrying G allele with HDL cholesterol > 1.4 is lower at low SFA intake than at high SFA intake. The percentage of participants carrying T allele with HDL cholesterol > 1.4 is higher at low SFA intake than at high SFA intake.
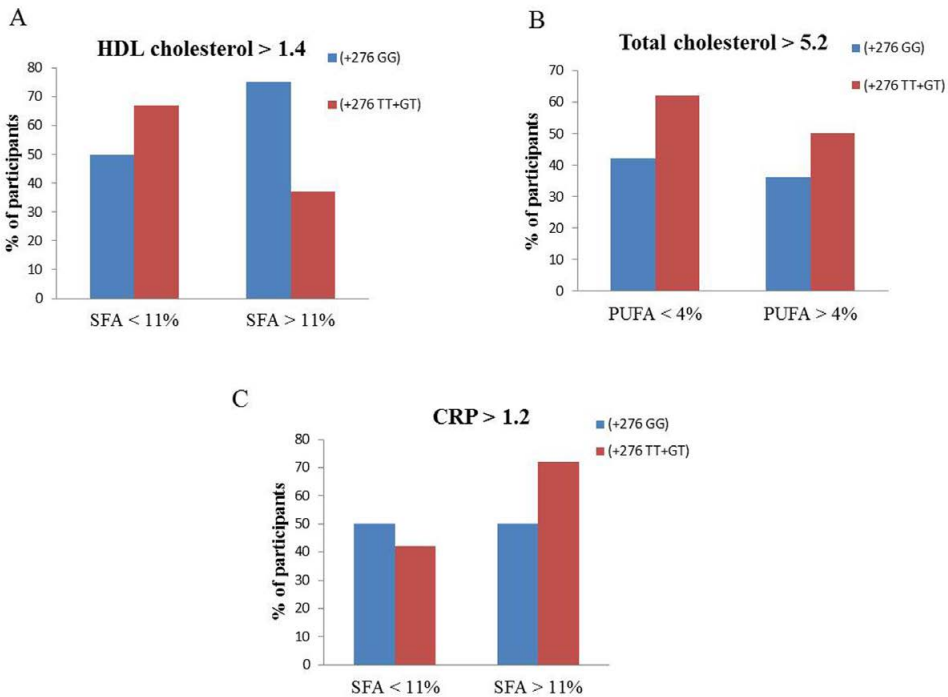


Figure 1: The percentage of participants with A) HDL cholesterol > 1.4, B) total cholesterol > 5.2, and C) C-reactive protein > 1.2 according to adiponectin rs1501299 genotype in each subgroup of low and high intake of PUFA (B) and SFA (A and C).

In the case of the adiponectin rs224176 genotype, participants carrying the T allele at position +45 were not responsive either to the low or high SFA in terms of HDL cholesterol. On the other hand the percentage of participants carrying G allele with HDL cholesterol > 5.2 is higher at low intake of SFA (Figure 2A). Figure 2B shows the different response of the polymorphism +45 on low and high omega-3 intake in terms of total cholesterol. The percentage of participants carrying T allele with total cholesterol > 5.2 is higher at low omega-3 intake than at high omega-3 intake. The percentage of participants carrying T allele with total cholesterol > 5.2 is lower at low omega-3 intake than at high omega-3 intake (Figure 2B).
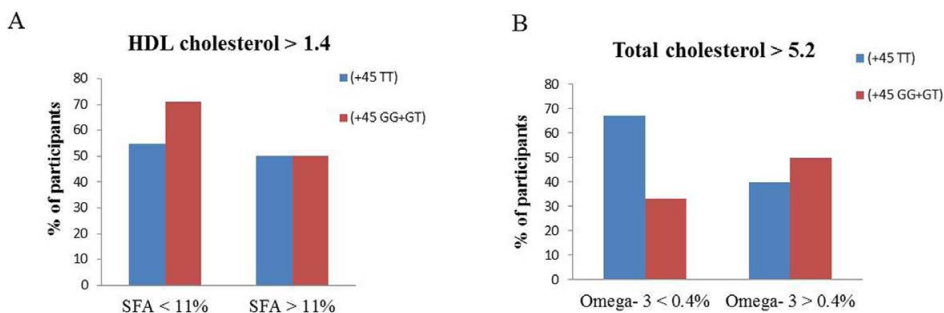
Figure 2: A) HDL cholesterol and B) total cholesterol according to adiponectin rs2241766 genotype in each subgroup of low and high intake of omega-3 fatty acid (A) and SFA (B).

# 5 POTENTIAL NEW PRODUCTS & SERVICES

Product: Current research could lead to the development of personalized nutrition guidelines for individuals and specific sub-populations, which could decrease the risk of chronic diseases.

Service: Personalized nutrition can be useful in both the prevention and treatment of chronic diseases by tailoring dietary advice to an individual's unique genetic profile and can be utilized as service for customers such as medical institutions, scientific institutions, SMEs, as well as to general public.

# 6 CURRENT COLLABORATIONS

## 6.1 With other researchers

The University of Primorska, Faculty of Health Sciences (PP12, Trans2Care), National Institute of Chemistry, (PP1, Trans2Care) form a research consortium on the association of ADIPOQ polymorphisms with food intake.

# 7 CONTACT OR COLLABORATIONS NEEDED

More contacts & higher number of subject's is needed.

# 8 COMMUNICATION TOOLS

This study has been presented to the biomedical community at the following conferences:
- 12th Slovenian Chemical Days on 12-14 September 2012 (Portorož, Slovenia)
- 13th Slovenian Chemical Days on 10-12 September 2013 (Maribor, Slovenia)

## 9 FUNDS NEEDED

### 9.1 For basic research (investigation of biological mechanisms): 25.000 €

### 9.2 For applied research (solutions for real-world problems): 50.000 €

### 9.2 For pilot & demonstrator activities (to develop a prototype): 90.000 €

## 10 CONCLUSION

Dietary factors play an important role in the development of the diseases. Personalized nutrition is therefore gaining interest because of its usefulness in both the prevention and treatment of chronic diseases by tailoring dietary advice to an individual's unique genetic profile.

## ACKNOWLEDGEMENT

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