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# Lifestyle Changes in Diabetes Prevention: Really Simple but Very Powerful: A Case Report

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**Abstract**

Lifestyle characterized through over nutrition and physical inactivity is said to be the main reason for the growing of risk factors for type 2 diabetes mellitus and other chronic diseases. Our case represents simple but powerful lifestyle changes in a person being at risk for diabetes mellitus. Dietary recommendations and improved physical activity significantly reduced visceral fat and liver fat and substantially improved glucose tolerance. This case proves the effectiveness of a simple lifestyle change to prevent chronic diseases. Future strategies of lifestyle intervention should directly targeting different fat compartments with a focus on hepatic fat content reduction.

**Keywords:** Lifestyle, Diabetes; Liver fat; Adipokine; Prevention; Simple; Powerful

## Abbreviations

ALAT: Alanin Amino Transferase; BMI: Body Mass Index; CVD: Cardiovascular Disease; HDL: High Density Lipoproteins; FG: Fasting Glucose; GT, Glucose Tolerance; IFG: Impaired Fasting Glucose; IGT: Impaired Glucose Tolerance; LDL: Low Density Lipoproteins; LI: Lifestyle Intervention; T2DM: Diabetes Mellitus Type 2; TG: Triglycerides; Ogtt: Oral Glucose Tolerance Test

## Introduction

Today we observe a growing prevalence and incidence of type 2 diabetes, obesity and other related chronic diseases. Especially the rising prevalence of type 2 diabetes but also the increasing number of persons with prediabetes is often described [1-7]. Societal lifestyle promotes the development of chronic disease risk and the new normality is a common behavior with rich food consumption and physical inactivity. Eating behavior moves from self-preparation of food to marketing driven consumer behavior in a toxic food environment [8]. This behavior and societal changes promote the development of unhealthy lifestyle, building the basis of growing risk factors for chronic diseases, but also the progression of incidence and prevalence of chronic diseases like obesity and diabetes mellitus Besides of the interaction of diabetes and obesity the linking between diabetes, liver fat and visceral fat content is partially understood [9-16]. The presented case mirrors a characteristic stereotype of persons living in the above described environment and underlines the linking between body weight reduction and changes on glucose metabolism and liver fat content. The case report also presents one method to prevent the development of chronic diseases.

## Methodology Section

### Case presentation

Our case is a 46 years old German who was unsatisfied with his body shape and weight who was concerned about his individual health when we met for the first time. Since 2004 he had taken angiotensin II receptor blocker 32mg and calcium antagonists 20mg because of hypertension. The patient described a positive family history of Type 2 Diabetes Mellitus (T2DM). His lifestyle is characterized through irregularly eating behavior (a lot of red meat, no fresh food, often fast food) and step counts less than 5000 steps per day. He smokes up to 10 cigarettes per day and reported moderate alcohol consumption.

The patient's weight was 101, 0 kg, BMI 30, 2 kg/m$^2$ with a waist of 106 cm. Blood pressure and physical examination did not show any abnormalities. The laboratory finding showed an Impaired Fasting Glucose (IFG) level (6, 18 mmol/l) and Impaired Glucose Tolerance (IGT) with a 7 hour glucose of 8, 13 mmol/l after oGTT with an corresponding HbA1c of 5, 7%. The Matsuda Index 1,401 and IGI 241, 81 indicated a higher level of insulin resistance, confirming the high risk to develop T2DM within the next years (Table 1) [17-19]. The patient also presented with dyslipidemia as Triglycerids (TG) 1, 59 mmol/l, Cholesterol 5, 67 mmol/l (LDL 3, 07 mmol/l, HDL 1, 04 mmol/l). Liver enzyme ALAT was elevated (0,99 µmol/

**Table 1:** Effects of the intervention and changes in %.

| | Before | After | % changes |
|---|---|---|---|
| Body characteristics | | | |
| body weight kg | 101,8 | 84,9 | 16,6 |
| BMI kg/m² | 31,1 | 25,9 | 16,72 |
| waist cm | 106 | 94 | 11,32 |
| Liver fat % | 31,58 | 8,23 | 73,94 |
| Visceral fat l | 7,06 | 3,78 | 46,49 |
| Metabolistic characteristics | | | |
| HbA1c % | 5,7 | 5,2 | 8,78 |
| fasting PG mmol/l | 6,18 | 5,17 | 16,34 |
| PG 120 min after oGTT mmol/l | 8,13 | 5,35 | 34,2 |
| TG mmol/l | 1,59 | 0,5 | 68,55 |
| Chol mmol/ | 5,67 | 4,59 | 19,05 |
| HDL-Chol mmol/ | 1,04 | 1,61 | -54,81 |
| LDL-Chol mmol/ | 3,07 | 2,72 | 11,40 |




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s'l) A specific MR Screening and n axial T1-weighted fast spin-echo technique showed 31, 58% liver fat content and a visceral fat content 7,06 l (Table 1) [20-22]. Patient's medication included angiotensin II receptor blocker and calcium antagonist for treating hypertension.

### Lifestyle program

The patient was randomized in an intensive lifestyle intervention program including intensive regular lifestyle counseling by a nutritionist. The life style changes consist of a modified diet and higher physical activity level. The patient should have a 10% reduced calorie intake by less than 30% of fat and less than 10% of saturated and higher fiber intake with 15 g/1000 kcal. He also had to walk at least 10000 steps per day. The lifestyle program was accepted by the ethic committee.

### Statistics

Differences between before and after the lifestyle intervention program were evaluated with paired one-sided t test. Values of $p<0.05$ were considered significant.

## Results

The patient tried to adhere to the intervention program. After a short period we detected a conspicuous reduction in total fat and saturated fat intake and consequent changing to fiber rich food like whole grain bread and legumes. He also increased his daily step counts up to average 11416 steps.

At the 15 month clinical investigation we detected a significant improvement of all clinical values. Patient lost 14, 2 kg and presented a BMI of 26, 6 kg/m$^2$. The glucose tolerance and dyslipidemia was improved up to a normal level (FG as 5, 17 mmol/l, GT as 5, 35 mmol/l, HbA1c as 5, 2%) and (TG 0, 5 mmol/l, Cholesterol 4, 59 mmol/l (LDL Cholesterol 2, 72 mmol/l and HDL Cholesterol 1,61 mmol/l). After one year intensive lifestyle intervention we also measured a significant liver fat reduction to 8, 23% and decreased visceral fat content of 3, 78l (Table 1). In consequence with the enormous body weight reduction the patient discontinued all medication [23]. Finally our case does not meet the criteria for obesity, nor prediabetes or hyperlipidemia after simple but significant lifestyle change.

## Discussion

It is so simple, but powerful. A healthy lifestyle helps prevent the development of chronic diseases [24]. In this case, the patient had a significantly elevated risk for getting numerous chronic diseases, primarily diabetes and the metabolic syndrome. The patient was motivated and sought for assistance to reduce this risk. Coaching the patient to adhere to a healthier lifestyle, where a high level of daily physical activity was combined with dietary recommendations, enabled a significant reduction of disease risk determinants. The underlying factor is insulin resistance. The patient suffered from a high degree of insulin resistance, which had been his disease risk before the study. Throughout the intervention, insulin resistance could be improved enormously, leading to the improved health outcome. The underlying driver for insulin resistance is the visceral fat, in conjunction with a high amount of liver fat. It is known that adipokine secretion out of the visceral fat modulate insulin resistance and physical activity helps reduce visceral fat content and adequate secretion [25-30]. The hepatic fat content is more prominent today. We expect – and the present case report supports this theory – that the existence of a threshold amount of hepatic fat acts as a toxic substance to drive insulin resistance and disease risk elevation, probably by hepatokine secretion. The change in dietary behavior with a parallel increase of daily physical activity helps reduce the hepatic fat, parallel to the visceral fat [31-32]. This is relevant, because hepatic fat accumulation becomes increasingly common, driven by food consumption, containing a growing amount of industrialized ingredients, leading to toxic effects on liver pancreas fat and muscle tissue. We expect that a certain threshold of liver fat has to be exceeded to express its toxic function and that this threshold gets overthrown increasingly on population level. Although in our case a lifestyle intervention program lead to a conspicuous reduction in visceral and liver fat, larger studies are needed to prove statistical significance. Nevertheless future strategies for the prevention of diabetes and other chronic diseases, therefore, should focus on interventions which directly target different fat compartments including the visceral fat, but with a growing relevance also the hepatic fat content. The case presented here shows a simple, but very powerful strategy – by changing the daily lifestyle – in order to be able to prevent the development of chronic diseases.

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