

SHORT THESIS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY (PhD)

**ANALYZES ABOUT THE HEALTH-ECONOMIC RELATIONSHIPS OF  
OBESITY AND THE SAMPLE DIETS COSTS**

by

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## 1. INTRODUCTION

Obesity is an important public health, economic and societal issue both worldwide and domestically. The ever-increasing number of people affected is becoming increasingly important not only in terms of the tasks of domestic health care system, but also regarding the financing.

The continued and global spread of overweight and obesity also affects Hungary.

Obesity management and prevention also have an economic impact. Costs cannot be determined exactly at population level and can only be estimated on an individual basis. Obesity causes complications, which can also be associated with costs.

According to the World Health Organization, 80% of total deaths in the European Union are caused by non-communicable diseases. There is a strong correlation between higher BMI and total mortality; 5 kg/m<sup>2</sup> BMI increase 30% overall mortality increase, 40% increase in cardiovascular disease risk, 60-120% diabetes, kidney and liver disease risk increase and higher mortality.

Disorders associated with nutrition and lifestyle (cardiovascular, tumour diseases, hypertension, diabetes, obesity) are among the leading diseases among the Hungarian population.

Research has shown that diet plays an important role in preventing chronic diseases and obesity. With appropriate nutrient-rich diets and lifestyle patterns improvement could be achieved in the health of the population.

The economic costs of obesity consist of direct, indirect, and intangible elements. Direct costs can be divided into medical and non-medical costs.

## LITERATURE REVIEW

The economic and financial crisis that began in 2008 has reorganized the economies, societies and health systems of developed countries. Newly emerging internal and external economic impacts have had a major impact on the health care system, short-, medium- and long-term priorities have shifted. In 2010, health spending fell in 10 of the 29 OECD member states, with spending less than 2% in 9 countries and more than 2% in 10 countries.

In 2015, health expenditure in Hungary amounted to 7.2% of GDP. The EU average reached 8% in the same year. Approximately 3/4 of health spending is paid out of pocket in OECD countries.

In recent decades, cardiovascular disease remains the first death in most OECD countries. Regarding the mortality rate of ischemic heart disease in Hungary, 288 deaths per hundred thousand inhabitants. Hungary is also the leader in mortality due to cerebral vascular diseases. The mortality caused by malignant tumors was over 200 in 2015 in the OECD countries per 100.000 inhabitants. This rate was highest in Hungary, Slovakia and Slovenia.

The health burden of the population is partly covered by health insurance. Health insurance does not cover all medical examinations, the extent of coverage has a significant impact on the level of individual contributions.

Traditionally, Hungarian public health indicators are poor. The average life expectancy at birth is 5 years lower than the EU average, and 9 years shorter for the lower educated, compared to those with tertiary education. Just over half of the Hungarians consider themselves healthy, while this is much higher in the surrounding countries. The out of pocket payments of the population represent nearly a third of all health expenditure.

The Health Survey in 2014 confirmed that the lifestyle that can be considered unhealthy for Hungarians plays a significant role in the development of chronic diseases. Losing life years as a result of deaths and fewer years of life in health is a greater burden for the individual, the family, and society.

According to 2014 statistics, about 7.3% of the population, or about 727.000 people, suffered from type 2 diabetes this year with female dominance. Increasing social involvement has also been reflected in a steady increase in the number of patients referred to the hospital and in the number of days spent in the hospital. The increased number of patients led to an increase in the cost of treating the disease group.

With the increase in obesity, the chronic diseases associated with obesity also increase and their proportion increases with age. In studies trying to estimate the physical inactivity cost, they generally use the so-called Population Attributable Risk (PAR) estimate.

The composition and proportions of the cost of treating obesity are often analysed by the so-called Cost of Illness (COI) test method, based on expenditure on each disease.

The total economic consequences of obesity are compounded by three costs: direct, indirect, and intangible costs. Direct costs can be further divided into medical and non-medical costs. Direct costs include the diagnostic and therapeutic costs of prevention, basic, outpatient and inpatient care. This category includes the cost of medicines and medical aids, the costs of rehabilitation, the costs of disease prevention. Indirect costs include those costs or income losses that result from a reduction in sickness capacity, reduced productivity, sick pay, invalidity pension, or death. We call intangible or personal costs that occur as a result of the disease, but their quantification is almost impossible.

In healthcare, cost sharing is shared between 3 participants: the state, the insurer (s) and the individual. The burden on individual is usually much more extensive. In the case of obesity, in addition to medicines or medical aids, the costs of any surgical treatment (gastric narrowing), the individual wardrobe, special means of transport, and care costs should not be forgotten.

Research has clearly shown that diet plays an important role in preventing chronic diseases and obesity. Appropriate diets and lifestyle patterns could significantly improve the health of the population.

Nutrition and lifestyle related disorders (cardiovascular, tumour diseases, diabetes, obesity) are among the leading illnesses among the Hungarian population.

## 2. OBJECTIVES

1. Conducting a representative epidemiological study by professionals in the framework of primary care, anthropometric survey, height, body weight, waist circumference, education, registration of metabolic diseases, BMI calculation.
2. In our study, we wanted to examine the cost elements related to obesity within the Hungarian healthcare system based on the data of the year of 2012 at the level of the national economy and public expenditures, as well as estimating the individual expenditures, and then summarizing their magnitude at national level.
3. For a broader morbidity cycle regarding the year of 2013, the same data were analysed by other methods, comparing, and explaining differences.
4. A comparative analysis was performed about the costs of 4 specific diets related to nutritional habits, compared to
  - the "traditional Hungarian" diet
  - a weight-loss sample diet,
  - a sample diet for diabetics, as well as
  - the cost of buying a bio-food diet, taking into account the energy content of each diet and other expenditures on lifestyle.

In our study, we were looking for answers to the question of the proportion of obesity prevalent in Hungary, its prevalence, its relationship with other illnesses, whether it is influenced by residence or education.

We asked how much can the treatment of obesity and close co-morbidity be?

Can the right diet and lifestyle change be a solution to prevent obesity?

### 3. METHODS

#### 3.1. Population anthropometric parameter survey

Between September 2012 and April 2013, volunteers over 18 years of age were enrolled in GPs' offices, occupational health examinations nationwide. It was an exclusion condition, a disease that affected the nutritional status. Inquiries were carried out by GPs and 224 practices were volunteered. We asked for the first 200 people to appear on the orders. The examined population can be considered nationally representative by the level of education, distribution of place of residence and age distribution.

We asked for ethical permission for the test and (ETT-TUKEB 20928-I). The attending GPs received the detailed methodological description and the following data were measured and registered in an electronically sent table:

- Body height [cm]-Patients on barefoot, measured with approved stadiometer,
- Body weight [kg]-Measured using a regularly calibrated weighing machine,
- Waist circumference [cm]-Using a professional tape
- The presence or absence of metabolic disease (diabetes and/or hypertension) was also registered.
- The participants' highest achieved level of education:
  - not completed the 8-year elementary school (under),
  - completed only elementary school (primary),
  - graduated in secondary school and/or skilled worker qualification (secondary),
  - having university or college degree (higher).

The WHO-established BMI categories were used in our survey.

Regarding waist circumference, the upper limit of normal range was 94 cm for men and 80cm for women, the "risky" range was between 94-102 and 88-94 cm respectively, and abdominal obesity was diagnosed above these values.

Statistical analyses were performed in Stata 9.2.programme.

### **3.2. In 2012, financial costs associated with obesity in public funded**

We analyzed data for 2012 on the financing of the healthcare system, documented by the National Health Insurance Fund, based on diagnoses of obesity and co-morbidity (hypertension, diabetes).

The request for data covered the whole of inpatient and outpatient care. The data collection was based on the BNO codes of the diagnosed diseases, which in the case of obesity was E65-68, in case of diabetes E10-11, and in case of high blood pressure I10-15 BNO code. We also asked for the same amount of sickness benefit payments with 2012 BNO codes.

The data collection covered drugs and medical aids caused by the diseases mentioned above. We analyzed the related National Health Insurance Fund grants and patient reimbursement fees.

The cause of obesity was determined in 80% of diabetics, 60% in the case of high blood pressure.

### **3.3. In 2013, financial costs associated with obesity in the public funded**

In 2013, further comorbidities were selected related to obesity, including diabetes (E10-11), hypertension (I 10-11), stroke (I 63-64), heart failure and ischemic heart disease (I 21-25), gonarthrosis (knee osteoarthritis) (M 17), breast cancer (C 50), ovarian cancer (C 56), colon cancer (C 18) and gall stone (K 56). The cost of drug therapy used to reduce cholesterol levels was also included in the analysis. The filtering was for drugs prescribed by the E78 BNO coding character.

Based on the above, inpatients and outpatients have been opted out from the National Health Insurance Fund database and based on our BNO codes and diagnoses, for whom these disorders were the leading diagnosis in nursing account. In the case of medicines and medical aids, the analysis was based on the BNO code indicated on the prescription.

Sickness benefit payments were also considered, although the amounts could not be broken down into defined and encoded diseases.

Among the leading diagnosis, the cost of obesity was 100% for the calculation of direct medical costs, while the estimated costs of the other diseases were calculated using the risk factor-based ratio (PAR) of the average risk in the population by  $PAR\% = [P (RR - 1)] / [1 + P (RR-1)]$ , where P is the population



density ratio of obesity and RR is the relative risk of developing a certain disease among obese individuals.

As regards macroeconomic data, the public figures of the Hungarian State Budget were provided as well as the official government pages containing the data of the Hungarian State Treasury.

For both studies, the requested data was provided free of charge by the National Health Insurance Fund Strategic Analysis Department's public reclamation request.

### **3.4. Comparison of cost of sample trends using nutrient composition and analysis software**

In our lifestyle and nutrition survey, we have compiled four different 3-day sample diets. We took into account the physical activity need, medication, and other expenditures of the disease groups. The costs were determined by the prices of the Hungarian Central Statistical Office database, which is roughly the same as Hungary's retail and wholesale prices. Sample diets were calculated using (Nutricomp®) nutritional and analytical software, which included the energy content and the ratio of ingredients as well.

In low energy diets, the recommended energy input is 1.500-2.000 calories per day among people with an average body mass and with physical activity. "Traditional Hungarian" meals have an average daily energy content of about 3.000 calories. This includes foods that are not recommended by professionals for their high caloric content and unhealthy composition. In case of bio-food consumption, the recommended energy input is 2.000 calories. Diabetic people with average anthropometric parameters consume 1.600-1.800 calories a day.

## **4. RESULTS**

### **4.1. Survey of population anthropometric parameters**

Altogether, the data of 40.127 (16.449 men and 23.678 women) were analyzed. The average age of subjects in the study was 52.15 years ( $\pm$  SD: 21.92). Coming from all parts of Hungary, the number of participating GPs was 244, representing 3.5% of all primary care practices. The location and number of practices were as follows: Budapest, the capital of Hungary: 38, cities and towns: 99, and villages: 107.

Higher BMI groups can be observed in all categories. According to waist circumference, parameters of risk were identified among more men in rural than urban settings. In their fourth decade of life, the ratio of males at risk was much higher in the rural population and in the fifth one it was. A similar trend was observed among rural women in their forties and over 70 years of age. Fewer people with higher education were represented in the obese category. Men with a higher degree had the highest proportion among the overweight BMI group and also higher in the normal than in obese group, while females had the lowest record among the obese and the highest in the normal range. Similar results were found according to waist circumference. In the categories of obesity there were inverse relations between odds ratios and degrees of education. In both genders, these differences were mostly statistically significant when comparing primary and other educational levels. The prevalence data for obesity was the highest in the villages (35.4%), the lowest in Budapest (28.9%). They represented the 32.5% of other urban and 28.6% of rural population. The incidence of registered metabolic morbidities (hypertension and diabetes) was different regarding type of domiciles, showing an inverse correlation with the number of inhabitants. These morbidities were also significantly correlated with levels of education and categories of BMIs, with strong relation to the increasing age.

### **4.2. Financial expenditure on obesity in the public funded care in 2012**

From direct costs, we examined the amount of social security support for patients diagnosed with obesity, diabetes and hypertension, inpatient institute studies, medical aids, and prescriptions as well. The sum of the fees paid by the

patient, both for medical aids and medicines, was classified as personal expenses.

In 2012, there were 47.517 inpatient obese people and the cost of their treatment was HUF 10.023.903.000. Outpatient care was used by 112.579 obese people, which meant HUF 549.728.000 cost. The cost of 169.108 diabetics was HUF 55.712.657.000. The cost of outpatient 427.791 diabetics was HUF 2.850.866.000. In the case of hypertension, there were 52.878 inpatient people, with a cost of HUF 160.965.095.000, while outpatient care was used by 1.128.142 people, which meant HUF 7.019.320.000 in 2012. In the case of sickness benefit days related to obesity, there were 226 days among patients between 40 and 49 years, altogether 13 people used it with HUF 720.000 cost. In the age group of 50-59 years, 163 days were spent by 8 people on sick leave, which meant HUF 341.000. In the 40-49 years old age group, 514 diabetic patients spent 12.930 days of sick leave, the gross amount of which was HUF 30.295.000. In the age group of 50-59 years, 817 people used 27.087 days. The gross amount of sickness benefit was HUF 71.168.000. There were 46 hypertensive 40-49-year-olds patients, with a total amount of 1.488 sick leave and HUF 4.008.000 sickness benefit. There were 133 50-59-year-olds, and 3.396 sick leave meant HUF 9.401.000. The therapeutic aids included in the obesity indication affected 110 people, the Social Security support was HUF 2.887.000 and the fee of the patient was HUF 675.000. In the case of redeemed prescriptions, 3.901 people were supported by Social Security with an amount of HUF 16.532.000 and the fee paid by the patients was HUF 10.681.000. The medical aids for diabetics were HUF 5.587.221.000 with Social Security support and HUF 1.193.433.000 were paid for 165.003 people. The Social Security support of medicines can be accounted with HUF 28.859.362.000 and HUF 5.342.307.000 patients fee and 564.733 diabetics. In case of hypertension, 5.256 people received medical aids with a support of HUF 34.424.000 and HUF 7.371.000 patient fee. In the field of medicines, 2.831.205 people redeemed a prescription with a Social Security support of HUF 35.945.924.000, and HUF 27.590.559.000 patient fee. Nationally aggregated health insurance payments and patient fees for the examined disease groups as well as the prevalence data on obesity (80% for diabetes, 60% for hypertension) were calculated beside HUF 207.450 million social security support, which meant that the amount HUF 21.799 million was paid by patients in 2012.

This funding is 11.6% of total public health expenditure, 0.73% of gross domestic product (GDP). GDP was HUF 28.048.068 million in the year under review.

### **4.3. Financial expenditure on obesity in the public funded care in 2013**

In the Hungarian hospitals in the year of 2013, 2.010.536 patients were diagnosed with obesity, diabetes, hypertension, heart failure and ischemic heart disease, stroke, gonarthrosis, colon cancer, breast cancer, ovarian cancer, and gall stone. HUF 60 million for obesity, HUF 3.253 million for diabetes, HUF 2.434 million for hypertension, HUF 20.032 million for heart failure, HUF 9.922 million for stroke, HUF 5.940 million for gonarthrosis, HUF 5.638 million for colon cancer, HUF 12.370 million for breast cancer, HUF 2.061 million for ovarian tumour, and HUF 4.724 million for gall stone were paid to inpatient care establishments. Outpatient care was used by 1.693.898 people. Obesity was HUF 70 million, diabetes was HUF 1.760 million, hypertension was HUF 3.576 million, heart failure was HUF 1.337 million, stroke was HUF 423 million, gonarthrosis was HUF 1.192 million, colon cancer was HUF 295 million, breast tumour was HUF 1.435 million, ovarian tumour was HUF 48 million, and gall stone was HUF 318 million cost.

Redeeming a prescription happened in case of 5.528.818 people, with a total amount of HUF 43.029 million. Medical aids were needed for 192.846 people in the amount of HUF 1.294 million.

The number of days left out of work due to sick leave was 8.890.851 days, which amounted to HUF 24.083 million for sickness benefit.

Funding by National Health Insurance Fund was HUF 58.986 million in case of overweight and obese patients, including the calculated prevalence of listed diseases, and a further HUF 25.209 million of financial contributions were made by patients.

In case of obesity, National Health Insurance Fund funded outpatient and inpatient care, redeemed medications and medical aids costed HUF 156 million. These costs for diabetes mean HUF 16.124 million, accounting for 40% prevalence of obesity. In case of hypertension with 45% prevalence it means HUF 16.376 million, heart failure with 23% means HUF 6.094 million, stroke with 11% means HUF 1.138 million, gonarthrosis with 19% means HUF 1.528 million, cholesterol lowering with 30% means HUF 4.940 million, sick leave

with 30% means HUF 7.225 million, colon cancer with 10% means HUF 694 million, breast cancer with 12% means HUF 2.391 million, ovarian tumours with 22% means HUF 534 million and gall stone with 35% means HUF 1.786 million. Patients' financial contribution to prescribed medications and therapeutic aids in case of obesity is HUF 12 million, for diabetes it is HUF 2.870 million, for hypertension it is HUF 12.555 million, for heart failure it is HUF 520 million, for cholesterol lowering it is HUF 1.912 million, for gonarthrosis it is HUF 115 million and it is HUF 7.225 million for sick leave.

Concerning the management of diabetes in 2013, HUF 40.311 million was paid from the state and HUF 7.173 million from patients. This amounted to HUF 47.484 million, representing 5.2% of total healthcare expenditure and 16% of the total medication refund budget. The total cost of diabetes is 0.16% of GDP.

These amounts represent 9.3% (908.011 million HUF) of healthcare expenditures of the total state budget and 30% (296.024 million HUF) of the total medication reimbursement budget.

The gross domestic product (GDP) at purchase price was HUF 29.846.300 million in 2013. Adding the amount of health insurance and patient fees, this amount represents 0.28% of the current year's GDP.

#### **4.4. Cost of sample schedules compiled using nutrient composition and analysis software**

In case of weight reducing 3-day sample diet, the average daily cost of the meals is HUF 1.870. The cost of the consumed fluid is HUF 200/2 l, with the vitamin taken and the monthly cost of the gym, this diet is HUF 2.471 per day.

Someone with a "traditional Hungarian" lifestyle has a daily intake of energy of 3.000 Kcal and the average cost of meals is HUF 2.211 per day. With the cost of consumed sweetened soft drinks, this diet can be calculated with a daily cost of HUF 2.800.

In case of the consumption of bio-foods, the daily average cost of a meal with 2.200 Kcal is HUF 3.259. When purchasing bio medicinal waters, vitamins and gym season ticket, HUF 4.490 is the total daily cost.

For diabetics, 1.600-1.800 Kcal is the recommended energy intake, which means HUF 2.054 cost of their meals, and with a supplementary cost of consumed liquid, vitamin, regular exercise and taken medicines, this cost arises to daily HUF 2.892.

## 5. DISCUSSION

Comparing the data of a quarter century ago, the BMI has become higher in all age categories and the distribution of the population also tended toward being overweight, moreover obese, resulting a 2-4-fold increase in the percentage of incidence in some age categories. This shift has been more prominent among males. Their BMIs have been higher from the middle decades, while earlier women used to have larger surplus, which means rearrangement between categories, a shift from being overweight to becoming obese. Significant differences were found between the educational level and BMI categories. Although there were fewer obese persons among the subjects with higher education, being overweight was common, while women with a higher degree were less obese. Registered metabolic morbidities were strongly correlated with BMIs and both were inversely related to the level of urbanization.

In the financial year of 2012, the amount of public expenditures incurred in the Hungarian healthcare system for the obesity and overweight patients according to the calculation of public finance data was HUF 207 billion, with the addition of at least HUF 22 billion of individual expenditures. This funding is 11.6% of total public healthcare expenditure, 0.73% of GDP.

In 2013, this amount was nearly HUF 60 billion, which is 9.3% of the E-Fund, 0.28% of GDP, increased by the financial contribution of patients, with an additional HUF 25 billion.

There are significant differences in the funding data for the two years under review. The reason for this is that, for 2012, the National Health Insurance Fund provided the amount of the payment for all the cases where the named disease was encoded in the reports. Following the refinement of their data filtering methods in 2013, it was already possible to select only funding paid for inpatient care cases where the disease we have identified was reported as a leading diagnosis justifying nursing care. It is known that in clinical practice, in a specific case, it is not always easy to name the disease which is the most important from medical aspect at that particular moment in a potentially "multimorbid" patient.

By squeezing the given funding amounts for the two years, there was no significant difference in the number of case-by-case benefits in case of outpatient care. Large differences in inpatient care can be traced back to the fact that, based on filter diagnosis, the real cost of care is not reflected due to co-morbidity.

Medical expenditure on obesity is difficult to estimate. It is not easier for a particular person, even in the case of a patient's burden. At national level, it can be safely stated that obesity-related expenditures are around 1% of the total domestic gross national product.

Treatment and care of obesity and related illnesses are a significant part of Hungarian public healthcare expenditure, both from the aspects of budget and individuals. It is impossible to accurately measure the total cost of obesity, so we can only estimate the expected incidence of some chronic diseases and the proportion of obesity and overweight related diseases. These data cover only the direct costs of obesity, the indirect and intangible costs can hardly be estimated.

### **Limiting factors**

In our estimations, we did not have data on primary care expenditures since there is a normative funding and there are no available data from private providers where overweight patients are paying for their care.

The cost of doctor-visiting and hospitalization expenses is also difficult to quantify at the population level.

We did not have any data on patient transport and emergency care and bariatric surgery either. No account was taken of the cost of dialysis, nor was there any data on possible IVF and gestational diabetes costs.

Many anti-obesity products are available without prescription in pharmacies or on the Internet, which is a large and ever-growing segment of the "healing" market.

We did not account for the loss of income due to long-term reduced work ability ("disability pensions"). Personal expenses can be different for each individual.

The burdens of households are usually out of the calculations. Such items can also appear that overweight children are missing more from school, and their training, eating, and clothing may be costlier. Of course, not a single parent so obviously keeps these expenses accounted.

Lifestyle changes, the cost of using sports facilities, the higher prices of low-fat products and other recommended diets are usually not among the indirect costs. Without data we could not measure the intangible costs of obesity. Lost cost of production also cannot be estimated.

Unfortunately, calculations were made difficult because there is a lack of reliable data on the PAR calculation method among the Hungarian population. The strength of our investigations was that it is the first truly comprehensive estimate of obesity-related healthcare, especially regarding public expenditure, based on reliable sources in Hungary. Based on the data received from the National Health Insurance Fund within the framework of the public interest data application, it was possible to use financial data linked to the diagnosis.

### **Prevention as a cost reduction opportunity**

By emphasizing economic considerations, it is commonly argued that a "healthy" pre-obesity lifestyle, including the quality of nutrition and sports, is more expensive than a so-called traditional lifestyle which is accompanied by obesity. Long-term, even lifelong, physically active lifestyle means though cost to the individual, but it is likely to be at least equivalent because of the "saved" medication costs, but it is certainly a cost reduction factor in the healthcare system expenditures at the social level.

The sedentary lifestyle of the Hungarian population is well-known.

Three quarters of Hungary's population is physically inactive. Obesity and overweight often involve social exclusion, leading to a deterioration of the individual's quality of life, and stigmatization of society.

Bariatric surgery is primarily concerned with morbid obesity, and in a short period of time a spectacular result can be achieved, but the organization's compensation mechanisms mean uncertainty in the long run. The need for drug therapy is indisputable, but currently available drugs are expensive.

Often, we are talking about the phenomenon of "obesity paradox", but not always in the right context. In justified medical interventions due to obesity, not a rigorous categorization into the BMI category should be considered but a realistic health hazard for the person concerned.

The importance of the role of primary care cannot be emphasized enough, which is why it would be necessary to reform it both in terms of methodology and practical medicine and financing.

In our examinations, we compared the dietary and lifestyle expenditures in the sample diets and the results obtained were set in descending order, with which the following conclusion can be drawn:



- The most expensive diet is made up from bio-foods because foods free of chemical and preservative had to be payed, and organic farming results in lower yields, it is more sensitive to weather changes, and foods free of preservatives are more perishable.
- At second place, there is a diet recommended for diabetics. The resulting excessive weight predominantly precedes many years before the onset of diabetes and plays a decisive role in triggering it, so it is important to prevent the onset of the disease. There are at least 772.000 known diabetics in Hungary, and most of them have excess body mass. For overweight diabetics, weight reduction and, if possible, normalization would be essential. The earlier this is done, the more the life expectancies of the individual will improve: favourably, even the diabetes itself can regress, but at least it can be more easily balanced. So, the main treatment of overweight diabetes is a diet therapy. The diet is also important for insulin-treated diabetics because the effect curve of the insulin preparations used does not cover the elevated blood glucose elevations caused by carbohydrates absorbed from food even in the most up-to-date formulations. For diabetic patients without insulin-treatment, it is important because insulin secretion is slow during meals and cannot fully exert its effect due to insulin resistance.
- Third place in terms of cost, there are sedentary, high-calorie diets. Consumption of inadequate quality and quantity of food contributes to overweight. Inadequate patterns of bad nutrition are also passed on to our children.
- The most cost-effective is a balanced diet with low energy content. It would be possible to prevent obesity and the development of diabetes as well as nutrition and life-style related chronic diseases and it could improve the quality of life.

In this estimate, it should be mentioned as a limiting factor that the recommended sample diet is not necessarily realized, and individuals use a very varied diet and nutritional habits throughout their lives.

Treatment requires a broader, more consistent co-operation between society and the government, including the provision of resources as well. It would be beneficial to transform the primary healthcare system on a professional basis and to ensure the conditions for prevention.

In Hungary, the spread of "obesity pandemic" remains a real danger, and this is a large number of tasks to be solved by the population, government, stakeholders and primarily the healthcare system.

It is clear that prevention is economically the least expensive even on the basis of the cost analysis of the diets presented by us. Much more resources could be reallocated within healthcare if less treatment of obesity-related disease would be needed.

Our calculations were based on estimates made from more accurate data from publicly funded healthcare, with the method of continuously corrected data. These were modified by textbook and literature population prevalence (PAR) data. In addition, we had to count the imitation factors listed above. So, in addition to the exact data, in many areas only estimates and calculations could be left. Based on these, public and individual expenditures related to obesity and overweight are estimated to be close to 1% of the gross domestic product of the year, which may account for nearly a fifth of the E-Fund.

## 6. SUMMARY

Similarly to the global context, the economic burden of obesity and overweight in our country is becoming increasingly significant, and the amount spent on these diseases and complications within health spending is constantly increasing year by year.

In our anthropometric survey, BMI values in each age group showed an increase compared to the 30-year study. The higher proportion of overweight people became obese. The highest levels of obesity were among the highest educated, but the highest was the proportion of overweight. Metabolic diseases were higher in higher BMI categories.

According to the method used, 0.73% of GDP in 2012 and 11.6% of health expenditure were spent on treating obesity and complications. This amount of money was HUF 207 bn for public expenditures and at least HUF 22 bn for individual expenditures.

In the 2013 data, public spending on health is nearly HUF 60 billion and an additional contribution of HUF 25 billion from patients, which is 9.3% of the total E fund and 0.28% of GDP. The difference between the financing data for the two years examined is that for 2012, the National Health Insurance Fund provided the total amount of payments for all cases of illness, as well as the accompanying diagnosis, while in 2013 only the diagnosis was the leading diagnosis. labeled.

Foods from organic food have proved to be the most expensive diet, and the second is the diet for people with diabetes. Calorie-eating has also proved to be a costly diet; the cheapest was a balanced, low-energy diet.

Increasing numbers of overweight and obese people need more attention in health, society, and higher awareness. The financial consequences of obesity and overweight are very significant, both in terms of the state budget and the contribution of the population.

On this basis, we can say that the money spent on obesity and co-morbidity at the national economy is about 1% of GDP.

## 7. LIST OF PUBLICATIONS



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Subject: PhD Publikációs Lista

Candidate: Gabriella Iski  
Neptun ID: MFG97V  
Doctoral School: Doctoral School of Health Sciences

### List of publications related to the dissertation

1. **Iski, G.**, Rurik, S. E., Rurik, I.: Expenditures Of Metabolic Diseases: an Estimation on National Health Care Expenditures of Diabetes and Obesity, Hungary 2013.  
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