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The Influence of Obesity on the Frequency and Distribution of Medication

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Summary: Obesity is a serious health problem in industrialized countries and is associated with a significant increase in total health care costs. Only few data are available about the costs of drug therapies in patients with an increased body weight treated under clinical routine procedures. Such data could support efforts to intensify obesity prevention and treatment programmes in order to reduce comorbidities and costs.

We have evaluated body mass index (BMI), diagnosis, and medication in 3360 outpatients (2175 women and 1185 men; mean age: 56.7 ± 17.5 years). All patients underwent physical examinations, including BMI determination, and provided a detailed record concerning medication. In 1809 patients, the percentage of body fat content was measured with a bioimpedance method (OMRON BF 302 body fat monitor). Continuous variables were compared using the *t*-test or Wilcoxon *U*-test. Frequency distributions were compared using chi-squared tests.

With respect to BMI, most of the patients ($n = 1793$; 53 %) were overweight or obese, 1349 (40 %) showed a normal BMI and 218 (7 %) a low BMI. The majority of cardiovascular (61 %), rheumatological (61.1 %) and metabolic (60.4 %) medication was administered to overweight and obese patients. Parallel findings could be obtained by analysing the percentage of body fat and the frequency of medication. Overall, 82.5 % of all medication was given to patients with a body fat content >20 %.

Our results support the importance of weight-reduction programmes in order to prevent an overall increase in the costs of medication as a consequence of overweight and obesity.   **(Acta Med. Austriaca 2003;30: 51–54)**

Der Einfluß der Adipositas auf die Häufigkeit und Verteilung der Medikation

Zusammenfassung: Die zunehmende Häufigkeit von Übergewicht und Adipositas geht aufgrund einer Reihe von Folgeerkrankungen mit steigenden Gesundheitskosten einher, wobei bislang nur wenige Daten über den Einfluß des Körpergewichts auf die Verteilung der Medikation in der klinischen Praxis verfügbar sind. Diese Ergebnisse könnten insbesondere aufzeigen, inwieweit durch Maßnahmen, die der Prävention und Behandlung von Übergewicht dienen, auch eine Einsparung von Medikamentenkosten zu erwarten ist.

Anhand der klinischen Daten von 3360 Patienten (2715 Frauen, 1185 Männer; mittleres Lebensalter 56,7 ± 17,5 Jahre) einer internistischen Praxis wurde die jeweils verordnete Medikation in Relation zum Body Mass Index (BMI) und dem Körperfettanteil, bestimmt mittels Bioimpedanz-Methode (OMRON BF 302 body fat monitor), evaluiert. Die statistische Auswertung erfolgte mittels *t*-Test, Wilcoxon-*U*-Test und Chi-Quadrat-Test.

Entsprechend den BMI-Werten waren ein Großteil der Patienten übergewichtig oder adipös ($n = 1793$; 53 %), 1349 (40 %) normalgewichtig und 218 (7 %) untergewichtig. Ein überwiegender Anteil kardiovaskulärer (61 %), rheumatologischer (61,1 %) sowie Medikation aus dem Stoffwechselbereich (60,4 %) wurde übergewichtigen und adipösen Patienten verordnet. Patienten mit einem Körperfettanteil >20 % erhielten insgesamt 82,5 % aller verordneten Medikamente.

Diese Ergebnisse unterstreichen die Notwendigkeit von Maßnahmen zur Gewichtsreduktion um die damit verbundene Zunahme an Medikamentenkosten zu verhindern.

Introduction

Obesity is among the most serious and urgent public health problems facing industrialized countries today. It is an important predisposing factor for hypertension, hyperlipidaemia, type 2 diabetes, certain types of cancer, and several other conditions (3–5, 14). In many countries, the prevalence of obesity is increasing rapidly and thus also obesity-associated diseases and health care costs. Various national studies have estimated that obesity accounts for 2–7 % of total health care costs in developed countries (1, 2, 8), but only few data are available about health care and drug therapy costs associated with obesity under clinical routine procedures (10). Detailed information about the frequency and distribution of medication in obese patients under clinical routine procedures might help to motivate patients, as well as their doctors, to improve and intensify weight-reduction programmes, especially with respect to the urgent need to save and focus health care costs.

In Austria, recent data about the epidemiology of obesity defined 8.5 % of the population as obese (BMI > 30 kg/m^2) and 14.5 % as overweight (BMI 27–29.9 kg/m^2) (6). In the present evaluation, we have studied the relationship of BMI to the frequency and distribution of medication under clinical routine procedures in a cohort of patients attending a medical outpatient clinic.

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Methods

We have evaluated body mass index (BMI), diagnosis, and medication in a cohort of 3360 patients (2175 women and 1185 men; mean age: 56.7 ± 17.5 years) attending a medical outpatient clinic for diagnostic and therapeutic procedures. All patients underwent physical examinations including blood pressure measurements, determination of body weight, height and body mass index, and provided a detailed record concerning medication. Using internationally applied ranges of BMI to define the degree of overweight, patients were assigned to five subgroups (Table 2) (15). In 1809 (1212 women, 597 men) patients, the percentage of body fat content was determined in the morning and after a resting period of at least 30 min by using a method of bioimpedance (OMRON BF 302 body fat monitor, Omron Healthcare Europe, Hoofdoorp, NL). Informed consent was obtained from all participants after the purpose of the study had been explained to the patients.

Statistical analysis

Data are characterized by means and standard deviation. Continuous variables were compared using the *t*-test or Mann–Whitney *U*-test. Frequency distributions were compared using the chi-squared test. A *P* value < 0.05 was considered statistically significant.

Results

Patients' characteristics are shown in Table 1 and the distribution of BMI in women ($n = 2175$) and men ($n = 1185$) in Table 2. The BMI of women (25.0 ± 4.3 kg/m^2) and men (25.9 ± 3.4 kg/m^2) revealed no significant difference ($P < 0.460$), while the mean percentage of body fat was significantly higher in women (33.5 ± 9.1 %) than in men (26.4 ± 3.5 %; $P < 0.018$).

With respect to BMI, most of the patients ($n = 1793$; 53 %) were overweight or obese, 1349 (40 %) showed a normal BMI and 218 (7 %) a low BMI. Also, the majority of men and women revealed an increased BMI, with 734 (62 %) of overweight and obese patients in the male and 1059 (49 %) in the female subpopulation.

The overall frequency and distribution of medication is shown in Table 3. Overall, 19.1 % of all patients were without drug therapy, 15.9 % were on cardiovascular, 10.8 % on rheumatological and 8.2 % on metabolic therapy. A similar distribution pattern for the most frequent medication was also found in the male subpopulation, where 19.8 % of all men were without drug therapy, 19.0 % were on cardiovascular medication, 12.3 % on rheumatological and 10.9 % on metabolic medication. In the female subpopulation, 18.7 % of all women were without drug therapy, 14.2 % on cardiovascular medication, followed by hormone therapy with a frequency of 10.4 %, rheumatological (9.9 %) and metabolic (6.7 %) drug therapy (Table 3).

With respect to BMI, 6.5 % of all medication was administered to patients with a low BMI, 39.6 % to those with a normal BMI, and 53.9 % to overweight and obese patients (Table 4).

The most frequent medication in patients with low BMI were antibiotics (11.4 %), followed by hormone therapy (11.0 %), minerals (10.0 %) and gastrointestinal medication (9.2 %).

In patients with a normal BMI, the frequency of medication did not show a pronounced difference between the various kinds of medication; antibiotics were found to be the most frequently administered medication (48.3 %), followed by hormones (43.4 %) and mineral substitution (43.3 %). The majority of cardiovascular (61 %), rheumatological (61.1 %) and metabolic medication (60.4 %) was administered to overweight and obese patients, while the frequency of all other groups of medication showed no pronounced difference between patients with normal and increased BMI.

When the applied medication was evaluated with respect to the percentage of body fat, 82.5 % of all medication was found to be administered to patients with a percentage of body fat >20 % (Table 5). Ninety-two per cent of the cardiovascular medication was given to patients with a body fat content >20 %, as well as 91 % of the rheumatological,

Table 1. Characteristic values of the patients.

	All patients ($n = 3360$)	Men ($n = 1185$)	Women ($n = 2175$)
Age (years)	56.7 ± 17.5	55.4 ± 16.9	58.5 ± 15.5
BMI (kg/m^2)	25.5 ± 4.4	25.9 ± 3.4	25.2 ± 3.9
Percentage of body fat (%)	22.7 ± 9.0	24.8 ± 6.9	34.2 ± 7.1
Systolic blood pressure (mm Hg)	137.0 ± 24.0	140.0 ± 23.4	142.0 ± 24.3
Diastolic blood pressure (mm Hg)	84.1 ± 13.3	86.1 ± 11.2	85.4 ± 10.0
Fasting glucose (mmol/L)	6.0 ± 2.3	5.7 ± 1.4	6.1 ± 2.6
Cholesterol (mmol/L)	6.3 ± 1.1	6.4 ± 1.1	5.7 ± 1.1
LDL cholesterol (mmol/L)	4.1 ± 1.1	4.7 ± 1.2	3.6 ± 1.0
Triglycerides (mmol/L)	1.8 ± 9.9	1.8 ± 1.1	1.8 ± 1.2
HDL cholesterol (mmol/L)	1.4 ± 0.5	1.2 ± 0.3	1.6 ± 0

BMI = body mass index, HDL = high-density lipoprotein, LDL = low-density lipoprotein.

Table 2. Cross tabulation of body mass index (BMI) and sex.

	Women ($n = 2175$)	Men ($n = 1185$)	All ($n = 3360$)
Low BMI (<18.5 kg/m^2)	184	34	218
% of BMI	84.4 %	15.6 %	100.0 %
% of sex	8.5 %	2.9 %	6.5 %
Normal BMI (18.5–24.9 kg/m^2)	932	417	1349
% of BMI	69.1 %	30.9 %	100.0 %
% of sex	42.9 %	35.2 %	40.1 %
Overweight (25.0–29.9 kg/m^2)	655	567	1222
% of BMI	53.6 %	46.4 %	100.0 %
% of sex	30.1 %	47.8 %	36.4 %
Obesity (30–39.9 kg/m^2)	387	160	547
% of BMI	70.7 %	29.3 %	100.0 %
% of sex	17.8 %	13.5 %	16.3 %
Morbid obesity (>40 kg/m^2)	17	7	24
% of BMI	70.8 %	29.2 %	100.0 %
% of sex	0.8 %	0.6 %	0.7 %

Table 3.   Cross tabulation of medication and sex.

	Women	Men	All
No medication	406	235	641
% of medication subgroup	63.3 %	36.7 %	100.0 %
% of sex	18.7 %	19.8 %	19.1 %
Cardiovascular	309	225	534
% of medication subgroup	57.9 %	42.1 %	100.0 %
% of sex	14.2 %	19.0 %	15.9 %
Antibiotics	122	54	176
% of medication subgroup	69.3 %	30.7 %	100.0 %
% of sex	5.6 %	4.6 %	5.2 %
Rheumatological	216	146	362
% of medication subgroup	59.7 %	40.3 %	100.0 %
% of sex	9.9 %	12.3 %	10.8 %
Pulmonological	133	95	228
% of medication subgroup	58.3 %	41.7 %	100.0 %
% of sex	6.1 %	8.0 %	6.8 %
Metabolic	146	129	275
% of medication subgroup	53.1 %	46.9 %	100.0 %
% of sex	6.7 %	10.9 %	8.2 %
Gastrointestinal	142	87	229
% of medication subgroup	62.0 %	38.0 %	100.0 %
% of sex	6.5 %	7.3 %	6.8 %
Hormones	227	27	254
% of medication subgroup	89.4 %	10.6 %	100.0 %
% of sex	10.4 %	2.3 %	7.6 %
Neurological	176	71	247
% of medication subgroup	71.3 %	28.7 %	100.0 %
% of sex	8.1 %	6.0 %	7.4 %
Minerals	196	53	249
% of medication subgroup	78.7 %	21.3 %	100.0 %
% of sex	9.0 %	4.5 %	7.4 %
Others	102	63	165
% of medication subgroup	61.8 %	38.2 %	100.0 %
% of sex	4.7 %	5.3 %	4.9 %
Total	2175	1185	3360
% of medication	64.7 %	35.3 %	100.0 %
% of sex	100.0 %	100.0 %	100.0 %

Table 4.   The relationship between medication and body mass index (BMI).

Medication	Low BMI	Normal BMI	Overweight/obese BMI
No medication	42	271	328
% of medication	6.6 %	42.3 %	51.2 %
Cardiovascular	18	190	326
% of medication	3.4 %	35.6 %	61 %
Antibiotics	20	85	71
% of medication	11.4 %	48.3 %	40.3 %
Rheumatological	13	128	221
% of medication	3.6 %	35.4 %	61.1 %
Pulmonological	17	96	115
% of medication	7.5 %	42.1 %	50.4 %
Metabolic	7	102	166
% of medication	2.5 %	37.1 %	60.4 %
Gastrointestinal	21	91	117
% of medication	9.2 %	39.7 %	51.1 %
Hormones	28	110	116
% of medication	11.0 %	43.3 %	45.7 %
Neurological	17	103	127
% of medication	6.9 %	41.7 %	51.4 %
Minerals	25	108	116
% of medication	10.0 %	43.4 %	46.6 %
Others	10	65	90
% of medication	6.1 %	39.4 %	54.6 %
Total	218	1349	1793
Total medication	176	1078	1465
% of medication	6.5 %	39.6 %	53.9 %

87.9 % of the metabolic and 85.2 % of the hormone medication (Table 5).

Discussion

An increase in body weight is associated with an increase in overall morbidity and mortality, with a steep increase when the BMI is higher than 30 kg/m^2 (3, 5, 9). Our evaluation of 3360 patients attending an outpatient clinic revealed that more than half of all medication is administered to overweight and obese patients, which underlines the increasing health care costs associated with obesity (1, 2, 8). To our knowledge, no detailed data about the frequency and distribution of medication at different BMI values have been published yet, especially with respect to clinical routine procedures.

In Austria, 8.5 % of the population were found to be obese and 14.5 % to be overweight (9). Thus, about 25 % of the population is overweight or obese, which is similar to the results for other industrialized countries, with an incidence of overweight and obesity of about 30 % (7, 11). In our cohort of 3360 patients attending the outpatient clinics, 53 % were overweight or obese, which underlines the increased morbidity associated with weight gain.

While antibiotics, mineral substitution and hormones were the most frequently administered medication in patients with a normal BMI, cardiovascular, rheumatological and metabolic medications were the most frequent forms of drug therapy in overweight and obese patients.

Cardiovascular medication (e.g. antihypertensives) and metabolic therapy (e.g. lipid-lowering drug therapy and treatment for type 2 diabetes mellitus) are highly effective with respect to the reduction of cardiovascular events and mortality (12, 13, 16, 17). However, these therapies are expensive and have to be taken for a long treatment period.

Considering our finding that 53.4 % of all medication was given to overweight and obese patients, the increasing costs for medication should force us to improve and intensify weight reduction programmes.

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Table 5.   The relationship of different medications to percentage of body fat content.

Medication	<20 % body fat content	>20 % body fat content	Total
No medication	61	250	311
% of medication	19.6 %	80.4 %	100.0 %
% of body fat category	18.9 %	16.8 %	17.2 %
Cardiovascular	21	242	263
% of medication	8.0 %	92.0 %	100.0 %
% of body fat category	6.5 %	16.3 %	14.5 %
Antibiotics	51	70	121
% of medication	42.1 %	57.9 %	100.0 %
% of body fat category	15.8 %	4.7 %	6.7 %
Rheumatological	16	173	189
% of medication	8.5 %	91.5 %	100.0 %
% of body fat category	5.0 %	11.6 %	10.4 %
Pulmonological	32	98	130
% of medication	24.6 %	75.4 %	100.0 %
% of body fat category	9.9 %	6.6 %	7.2 %
Metabolic	19	138	157
% of medication	12.1 %	87.9 %	100.0 %
% of body fat category	5.9 %	9.3 %	8.7 %
Gastrointestinal	28	105	133
% of medication	21.2 %	78.9 %	100.0 %
% of body fat category	8.7 %	7.1 %	7.4 %
Hormones	22	127	149
% of medication	14.8 %	85.2 %	100.0 %
% of body fat category	6.8 %	8.5 %	8.2 %
Neurological	19	106	125
% of medication	15.2 %	84.8 %	100.0 %
% of body fat category	5.9 %	7.1 %	6.9 %
Minerals	35	114	149
% of medication	23.5 %	76.5 %	100.0 %
% of body fat category	10.8 %	7.7 %	8.2 %
Others	19	63	82
% of medication	23.3 %	76.8 %	100.0 %
% of body fat category	5.9 %	4.2 %	4.5 %
Total	323	1486	1809
Total medication	262	1236	1498
% of medication	17.5 %	82.5 %	100.0 %
% of body fat category	100.0 %	100.0 %	100.0 %

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