Obesity in a Somerset town: prevalence and relationship to morbidity

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SUMMARY. Body mass index was determined for 953 subjects, randomly selected from the electoral roll of a town in south-west England. Morbidity was estimated using a questionnaire.

The prevalence of obesity (body mass index <28) was 21 per cent for males and 22 per cent for females. Overall morbidity was significantly increased in obese females. The three main disease groups that were more prevalent in both the obese males and females were hypertension, cardiovascular disease and musculoskeletal disorders.

Introduction

OBESITY is one of the avoidable factors affecting mortality[1,2] yet little is known about the degree to which it affects morbidity. This study demonstrates the ranges of body mass index among a randomly selected population in the town of Frome and examines the relation to morbidity.

The three main aims of this survey were, first, to find what percentage of the population are obese; second, to see whether they had more diseases than the rest of the population; and third, to see which diseases in particular they suffer from.

Method

Between September 1982 and January 1983, 953 adults (424 males and 529 females) aged between 16 and 90 years were selected from the electoral roll of the town of Frome. Each person on the roll is numbered sequentially and subjects were chosen by use of random number tables. Subjects were sent a questionnaire and asked to attend the health centre. If they failed to respond they were sent a second letter and another copy of the questionnaire. The questionnaire, which consisted of 33 closed questions that had to be answered Yes or No, was designed to detect 21 diseases. At the health centre the author went through the questionnaire with the subjects and then measured their weight in indoor clothes (kilogrammes) and height without shoes (metres). Body mass index was then calculated by dividing the body weight by the square of the height (kg/m^2).

The questionnaire was evaluated in February 1982 using a pilot study with 40 subjects selected in the same manner as in the main survey. Information about disease detected from the questionnaire was then compared with a search of the general practitioner's notes. The correlation coefficient kappa (κ)[3] showed a close correlation between these of 0.69.

When measuring the subject's height and weight, the author also measured skinfold thickness over the triceps with Harpenden skin calipers. Percentage body fat was then calculated using these three measurements in equations derived from the Canadian Health Survey.[4] When percentage body fat and body mass index were compared the correlation was 0.61 for all subjects.

Results

Questionnaires were completed by 233 males (55 per cent) and 276 females (52 per cent) who attended the health centre. The mean body mass index for males and females was 25.2 and 25.0 respectively. The standard deviation for females (±5.0) was greater than that for males (±3.6). The figures for the males were similar to those of the Whitehall study,[5] which observed 18,403 civil servants between 1967 and 1969.

Table 1 shows the distribution of body mass index. The difference between males and females was not significant. The ideal ranges of body mass index were derived from American data.[6] The figure of 28 was selected as 'high' as it represented the fifth quintile used in the Whitehall study and also corresponded to '110 per cent of average body mass index' used in the American Cancer Society Study.[7]

Table 2 shows that, as expected, the number of diseases increased with age. This was significant for both sexes ($P<0.01$). There was an increase in morbidity, as measured by the questionnaire, in subjects both with low and high body mass index compared with ideal groups as shown in Table 3. This increase was only significant in females when those with 'ideal' body mass index were compared with those with 'high' body mass index ($P<0.05$; $\chi^2=9.54$).

Table 1. Distribution of body mass index.

Body mass index (kg/m^2)	Number (%)
Males	
Low <20	15 *(6)*
Ideal 20–25	112 *(48)*
High >28	49 *(21)*
Females	
Low <19	15 *(5)*
Ideal 19–24	123 *(45)*
High >28	61 *(22)*

Table 4 shows increased morbidity in males aged over 55 years and females aged 35–54 years who had a high body mass index. These differences were not statistically significant.

When individual diseases were studied there was a higher incidence of all diseases in subjects with a high body mass index. The incidence of smoking for males and females with an ideal body mass index was 43 per cent and 28 per cent respectively. For subjects with a high body mass index the figures were 31 per cent and 15 per cent respectively.

Table 5 shows the three diseases with the highest difference in prevalence between high and ideal body mass index. The significance was determined by calculating the standard error of the difference between the two proportions.[8] Hypertension and cardiovascular disease was significantly more common in subjects with a high body mass index. Musculoskeletal disease was only significantly more frequent in females with high body mass index.

Discussion

The first difficulty in this study was finding a definition of obesity. In clinical practice the weight and height charts derived from the American Society of Actuaries Study in 1959[9] are the most widely used. The main fault with this system is the subjective use of frame size. The use of body mass index avoids this problem. There is no need for a chart and its single unit makes it easy to use for comparison. The only drawback is the absence of agreed 'ideal' or 'high' values. As more work is done it is hoped that a wider acceptance of normal values will emerge.

In this study and in the Whitehall study 40 per cent of the population had a body mass index greater than ideal. If all these people are at risk through being obese then the importance of obesity as a contributing factor in increased morbidity and mortality may equal that of cigarette smoking.

The prevalence of obesity in this study was higher than that found in a recent national study.[10] The Office of Population Censuses and Surveys (OPCS) had a similar selection procedure, the difference being that it selected families as opposed to individuals. The prevalence of obesity (body mass index > 28) found in the OPCS study was 13 per cent and 14 per cent for males and females respectively. The corresponding figures in Frome were 21 per cent and 22 per cent. The differences between these surveys may not be wholly attributed to

Table 2. Distribution of number of diseases by age.

Age (years)	Number of diseases (%) 0	1	2	≥3	Total
Males					
16–34	15 (19)	25 (31)	22 (27)	19 (23)	81 (100)
35–54	10 (14)	19 (27)	17 (24)	25 (35)	71 (100)
>55	6 (7)	11 (14)	22 (27)	42 (52)	81 (100)
Females					
16–34	12 (17)	27 (38)	12 (17)	20 (28)	71 (100)
35–54	9 (9)	24 (24)	29 (29)	38 (38)	100 (100)
>55	5 (5)	19 (18)	21 (20)	60 (57)	105 (100)

Table 3. Distribution of number of diseases by body mass index.

Body mass index (kg/m²)	Number of diseases (%) 0	1	2	≥3	Total
Males					
Low <20	1 (7)	4 (27)	3 (20)	7 (47)	15 (100)
Ideal 20–25	18 (16)	25 (22)	26 (23)	43 (38)	112 (100)
High >28	4 (8)	12 (24)	12 (24)	21 (43)	49 (100)
Females					
Low <19	1 (7)	5 (33)	2 (13)	7 (47)	15 (100)
Ideal 19–24	19 (15)	36 (29)	28 (23)	40 (33)	123 (100)
High >28	3 (5)	11 (18)	16 (26)	31 (51)	61 (100)

Table 4. Distribution of number of diseases by body mass index and age.

Age (years)	Body mass index (kg/m²)	Number of diseases (%) 0	1	2	≥3	Total
Males						
16–34	Ideal <25	11 (19)	17 (30)	14 (25)	15 (26)	57 (100)
	High >28	2 (15)	6 (46)	3 (23)	2 (15)	13 (100)
35–54	Ideal <25	6 (18)	8 (24)	6 (18)	14 (41)	34 (100)
	High >28	1 (6)	5 (31)	4 (25)	6 (38)	16 (100)
>55	Ideal <25	2 (6)	4 (11)	9 (25)	21 (58)	36 (100)
	High >28	1 (5)	1 (5)	5 (25)	13 (65)	20 (100)
Females						
16–34	Ideal <24	11 (23)	20 (43)	5 (11)	11 (23)	47 (100)
	High >28	0 (0)	1 (17)	2 (33)	3 (50)	6 (100)
35–54	Ideal <24	7(14)	14 (27)	17 (33)	13 (25)	51 (100)
	High >28	1 (5)	4 (19)	5 (24)	11 (52)	21 (100)
>55	Ideal <24	2 (5)	7 (18)	8 (20)	23 (58)	40 (100)
	High >28	2 (6)	6 (18)	9 (26)	17 (50)	34 (100)

Table 5. Incidence of disease in subjects with ideal and high body mass index. Percentages are given in parentheses.

Body mass index (kg/m²)	Hypertension	Cardiovascular disease	Musculoskeletal disease
Males			
Ideal <25	5 (4)	11 (10)	39 (35)
High >28	9 (18)	13 (27)	23 (47)
	$P<0.01$	$P<0.01$	NS
Females			
Ideal <24	15 (12)	9 (7)	49 (40)
High >28	19 (31)	11 (18)	37 (61)
	$P<0.01$	$P<0.05$	$P<0.01$

NS = not significant.

the minor difference in selection procedure. The conclusion is that Frome has a higher prevalence of obesity than the national average.

There was an increase in morbidity associated with high body mass index, though this was only significant for females. Females whose body mass index was greater than 24 had 1.4 times more diseases than those whose body mass index was ideal. This ratio remained constant with increasing body mass index for females in contrast to males for whom the prevalence of disease rose with increasing body mass index.

The three diseases whose prevalences in this survey were most affected by obesity were hypertension, cardiovascular disease and musculoskeletal disorders. The relationship of obesity to hypertension and cardiovascular disease has been clearly shown in several large surveys.[11] Although it is often suggested that obesity contributes to low back pain and arthritis, the epidemiology showing this relationship is scarce; this survey should add more evidence to the case for weight loss to help prevent low back pain.

It is almost impossible to prove obesity as a cause of disease. Certainly the mechanism by which it may exacerbate disease is not fully understood. However, two things are clear from this study; first, obesity is common in the population and second, it is associated with increased morbidity.

References

1. MRC Working Group (J. C. Waterlow, chairman). Special report: research on obesity. *Nutr Rev* 1977; **35:** (9).
2. Sardie P, Gordon T, Kennel WB. Body build and mortality. The Framingham study. *JAMA* 1980; **243:** 1823-1831.
3. Pecoraro RE, Inui TS, Chen WS, *et al.* Validity and reliability of a self-administered questionnaire. *Public Health Rep* 1979; **94:** 231.
4. Messinger HB. Body fat estimation in field surveys. *Can J Public Health* 1980; **71:** 58-65.
5. Jarrett RJ, Shipley MJ, Rose G. Weight and mortality in the Whitehall study. *Br Med J* 1982; **285:** 535-537.
6. Garrow JS. Weight penalties. *Br Med J* 1979; **2:** 1171-1172.
7. Lew EA, Garfinhel L. Variations in mortality by weight among 750,000 men and women. *J Chronic Dis* 1979; **32:** 563.
8. Bradford Hill A. *Principles of medical statistics.* London: The Lancet, 1971.
9. Society of Actuaries. *Build and blood pressure. Vol 1.* Chicago: Society of Actuaries, 1959.
10. Office of Population Censuses and Surveys. SS81/1. London: OPCS, 1981.
11. Rabkin SW, Mathewson FA, Ping-Hwa H. Relation of body weight to development of ischaemic heart disease in a cohort of young North American men after a 25 year observation period. The Manitoba study. *Am J Cardiol* 1973; **39:** 452-458.

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Drug therapy and arthritis

Many clinicians believe that slow-acting therapeutic agents, such as gold, penicillamine, the antimalarials, and cytotoxic drugs, can retard joint destruction in rheumatoid arthritis. The authors reviewed 60 published studies employing these drugs to evaluate critically the evidence that drug therapy can slow the radiographic progression of disease. Seventeen studies were found that included radiographic assessment of both treated and control groups; they were analysed using methodologic criteria known to be important in affecting the results of drug trials. Numerous deficiencies were found. They found evidence suggesting that both gold and cyclophosphamide can retard radiographic progression of joint destruction. Inadequate studies prevent provisional conclusions concerning other agents.

Source: Iannuzzi L, Dawson N, Zein N, Kushner I. *New England Journal of Medicine* 1983; **309:** 1023-1028.

Morbidity in childhood

The morbidity experienced in a six-year period by a total of 2,591 children who were continuously enrolled in a prepaid medical plan was examined. The children had received 19,291 diagnoses, each of which was assigned to one of 14 types of morbidity, and the frequency of each type was determined. Although the typical child had at least one problem in five of the 14 types of morbidity in the six-year period, over 20 per cent of children had at least eight different types of problems during that time.

These findings indicate that morbidity, like use of health services, occurred in clusters in this population of children. Therefore, an understanding of the cause and projected outcome of morbidity among children will be incomplete if the focus is only on specific diseases.

Source: Starfield B, Katz H, Gabriel A, *et al.* Morbidity in childhood—a longitudinal view. *N Engl J Med* 1984; **310:** 824-829.