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WAIST–HIP RATIOS: THEIR USE IN LIFE ASSURANCE EXAMINATIONS

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Assessment of obesity in life assurance candidates can be made with the aid of tables produced by insurance companies, giving either ideal or average height and weight measurements at various ages.[1,2] These measurements can be contracted into a weight for height standard[3] or the body mass index (BMI).[4] Additional information can be obtained by including the waist measurement at the umbilicus and in a previous study it was shown that obesity might be defined as beginning with a BMI of over 30 and a waist measurement of over 100 cm in men and 85 cm in women.[4] None of the above takes into consideration the distribution of adipose tissue, particularly abdominal obesity. Scandinavian studies[5–7] now show that the ratio of waist to hip measurement (W/H) gives a better indication of prognosis and the risk of coronary disease, stroke or death than any other anthropological measurements. Hip measurements are not asked for by insurance companies in the course of their medical examinations.

This paper records a study of BMI and waist–hip ratios in 177 subjects in consecutive medical examinations for life assurance from 1993 to 1995. Statistical testing demonstrates that W/H cannot be assumed without making actual hip circumference measurements.

Subjects and methods

The subjects consisted of consecutive candidates (138 M, 39 F) for life assurance examined between March 1993 and August 1995. The age range was 21–73 years, with a mean of 44 years. Height and weight measurements were made as previously described.[4] Waist and hip measurements were made with the candidate undressed and standing, at the level of the umbilicus and at maximum hip circumference respectively, both to the nearest centimetre. BMI was calculated to one place of decimals and W/H to two. Correlation coefficients (r_s) were calculated by the Spearman rank method as neither BMI nor waist measurement nor W/H values showed strictly normal distributions on graphing. Standardised normal deviate (c) values for the differences between the correlation coefficients were calculated by the method of Meng *et al.*,[8] after appropriate adjustments of r_s.[9] The significance of the correlation coefficients compared with zero and the significances of the c values for the differences were read in the appropriate tables.[10]

All calculations were made with a desk calculator and checked by computer.

Results

The relationship of BMI to waist measurement and BMI to W/H are shown graphically in Figs 1 and 2 respectively. Vertical dotted lines in both indicate a BMI of 30 to represent the upper limit of normal for both sexes[4] and two horizontal dotted lines in each figure represent the upper limits of normal for

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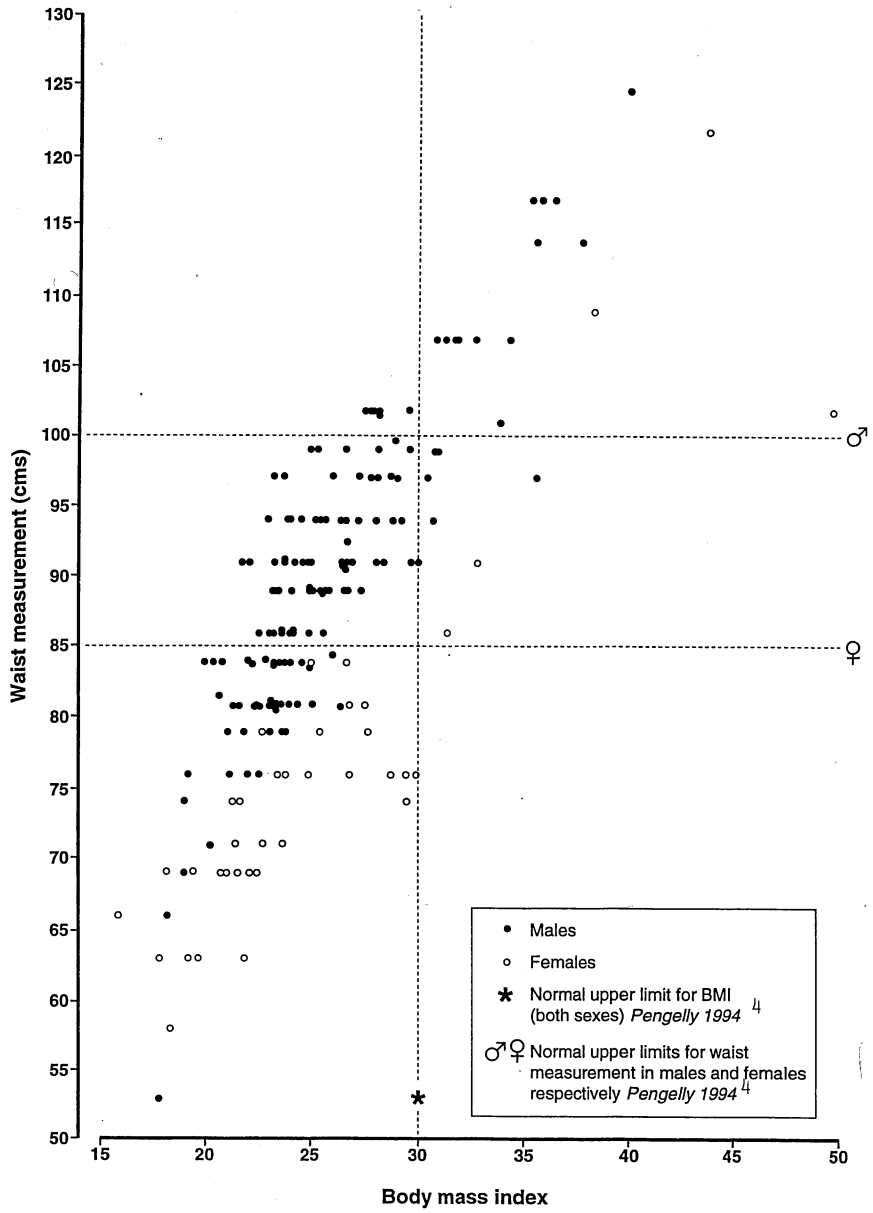

FIGURE 1

Showing relationship of body mass index and waist measurement in 177 candidates for life assurance.

waist measurement in males and females respectively in Fig 1 and similarly for W/H in Fig 2: those in Fig 1 are from a previous publication by the author[4] and in Fig 2 from Larsson *et al.* (1992)[7] (both approximately the mean plus one SD). The former (Fig 1) indicate 100 cms for men and 85 cms for women. The latter (Fig 2) show 0.98 for men and 0.81 for women. The plots for men are solid dots and those for the women open circles.

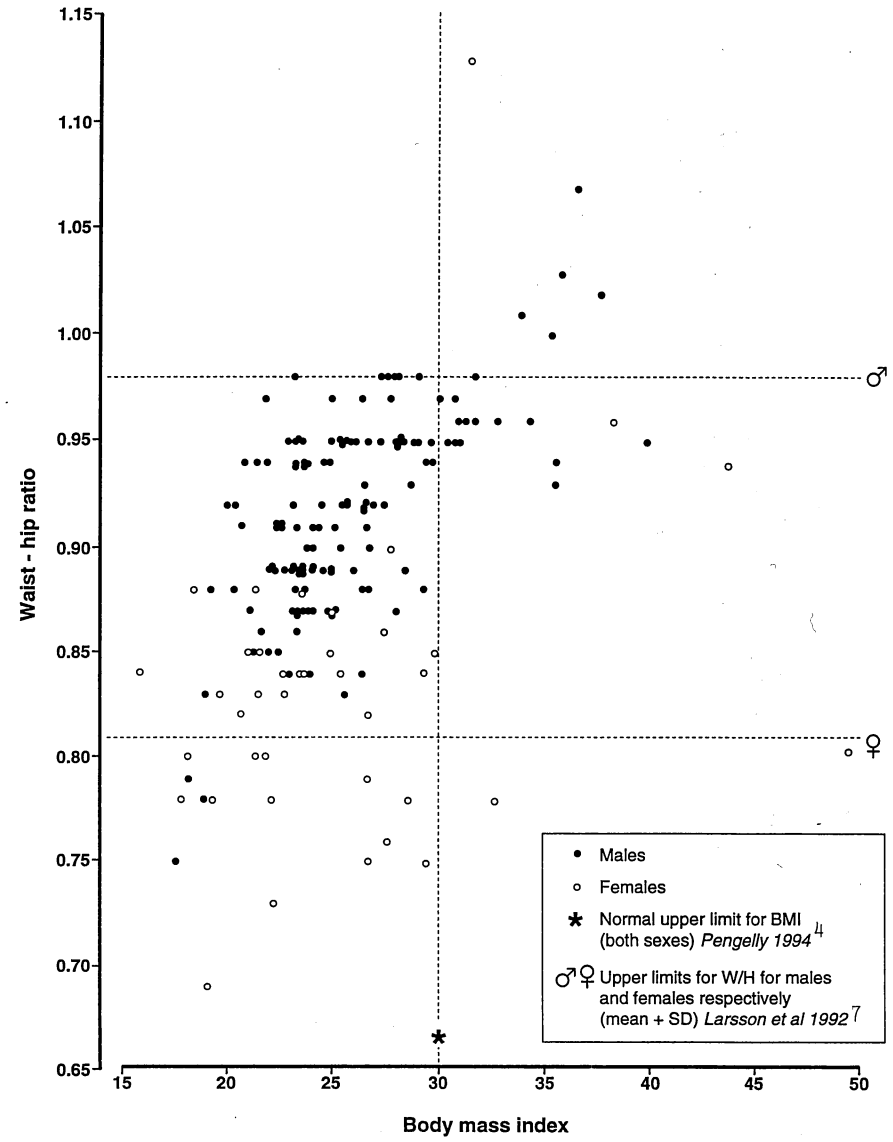

FIGURE 2

Showing relationship of body mass index to waist–hip ratio in 177 candidates for life assurance.

There was obviously a better correlation between BMI and waist measurement (W) (Fig 1) than between BMI and W/H (Fig 2). In Fig 1 there are 18 subjects (13 M, 5 F) with both a high BMI and waist measurement. In Fig 2 there are only 8 subjects (5 M, 3 F) with a BMI of over 30 and an abnormally high W/H, representing a reduction of 56%. The 8 subjects in Fig 2 were all included within the 18 in Fig 1.

The actual correlation coefficients between BMI and W and BMI and W/H

are shown in Table 1. Data for all subjects and males and females separately are shown. In all instances the differences between the paired correlation coefficients (r_s) were highly significant ($p<0{\cdot}0001$).[8,9] All correlation coefficients were also highly significant compared with zero ($p<0{\cdot}001$) except that of BMI and W/H in females which was not significant ($p>0{\cdot}05$).[10]

TABLE 1

Showing the correlations (r_s) of body mass index (BMI) with waist measurement (W) and with waist–hip ratio (W/H) and the significance of their differences.

	Number	r_s *BMI & W*	r_s *BMI & W/H*	*Significance of the differences*[8,9]
Subjects	177	0·7583	0·5126	$p<0{\cdot}0001$
Males	138	0·8461	0·6011	$p<0{\cdot}0001$
Females	39	0·8777	0·1933	$p<0{\cdot}0001$

DISCUSSION

Insurance companies are interested in the heights and weights of their life assurance candidates in order to see if they are significantly underweight or overweight. For this purpose they can use height and weight tables, perhaps the best known of which are those of the Metropolitan Life Assurance Company of America.[1] These represent ideal measurements rather than average ones. More recently tables have been provided by the Mercantile & General Reinsurance Company, a subsidiary company of the Prudential Corporation in this country.[2] These are more representative of average values. All insurance companies now ask for measurement of abdominal girth and with the height and weight measurement from which Body Mass Index (BMI) can be calculated, a good idea of whether or not an individual is significantly overweight can be gained. It has been shown that individuals can be regarded as overweight if their BMI is more than 30 and in men, if the waist measurement is greater than 100 cms and in women if greater that 85 cms.[4]

None of these considerations specifically draws attention to excessive abdominal obesity, this particular type of weight distribtion being demonstrated by a high waist–hip ratio (W/H) which has been shown by Scandinavian observers to be a better indictor of prognosis with regard to stroke, coronary disease and death, than any other measurement.[5–7] Normal values for W/H are given in textbooks as below 0·95–1·00 in men and 0·80–0·85 in women[11,12] but the Scandinavian authors' extensive studies give normals of 0·927 (SD 0·054) for men and 0·754 (SD 0·055) for women (giving a mean +SD of approximately 0·98 for men and approximately 0·81 for women).[7]

This study showed that using W/H and BMI (Fig 2) instead of W and BMI (Fig 1) reduces the number of subjects with both a high BMI and a measurement (W or W/H) indicating obesity from 18 to 8, a reduction of 56%. Accepting the premise that W/H is a better index of prognosis than other measurements,[5–7] then W/H is a more practical measurement for indicating significant obesity than simple waist measurement alone, especially in conjunction with BMI.

Waist–hip ratios (W/H) correlated badly with BMI compared with waist measurements alone and the difference was very highly significant (Table 1); consequently W/H is not accurately predictable without actually taking hip

circumference measurements. Therefore hip measurements (and hence W/H) should be included in every medical examination for life assurance.

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EARLY DIAGNOSIS, SCREENING AND TRUTH-TELLING: SOONER MAY NOT BE BETTER

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The clinical consultation is a meeting of patient and doctor to assess the significance of symptoms, signs, and investigations; usually in that order. In it emphasis is on detection of organic disease. This paper will not consider primary psychiatric disorders.

What is meant by early diagnosis? The aim of diagnosis is to categorise diseases. In some respects this follows the classification of plants introduced by Linnaeus but it is more complex and not based solely on appearance. It may depend on pattern recognition, analysis of the findings, or a specific test. In clinical diagnosis there may be a bias towards recognition of conditions which are known to respond to treatment.

Early diagnosis introduces a time-scale and this is determined by the natural history of the disease under consideration. For acute illnesses such as infections or myocardial infarction diagnosis within a few hours may be crucial in controlling the disease. In chronic conditions such as rheumatoid disease diagnosis is less urgent and might be considered early if within three months of the onset of symptoms.

Screening involves a search for disease in the absence of symptoms. It emphasises the fact that all disease is initially latent. Screening may be done at random or restricted to people who show a predisposition to a disease as revealed by the earlier medical or family history.

SCREENING

Screening is carried out on volunteers and it is important that its purpose is adequately explained and the possible consequences considered.

Screening when there is predisposition

When there is known to be a predisposition to disease it would be advantageous to have a diagnostic test which could be used at a stage when the patient is asymptomatic. An example of this would be the level of creatine phosphokinase in blood which is frequently raised in patients with impending muscular dystrophy. A more recent development is the molecular test on blood or other tissues used to diagnose Huntington's chorea.[1] This autosomal dominant disorder usually develops in middle age and there is no effective therapy. The test may reassure people in whom the result is negative but it creates problems for those found to have latent disease. There is a need for counselling and there may be difficulties within a family. For example, a subject may not wish to know the result of the test while his spouse is eager to have this information.[2] Huntington's chorea is one of the most clearly defined genetic disorders. Increasing knowledge

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