A Study Of Portal Circulation And Liver Function In Obesity And Fatty Liver

Thesis

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By

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Dedication

To my wife for her support

and understanding

بسم الله الرحمن الرحيم

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OBESITY

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Introduction

The ability to store food energy as fat provides survival value when the food supply is scarce or sporadic where one gram adipose tissue yields close to the full theoretical equivalent of 9 k. cal, however in affluent societies the ability to store fat frequently is of negative survival value because of the resulting obesity which is associated with a significant increase in morbidity and mortality where a great many disorders occur with greater frequency in obese people than normal ones.

The death rate increases in proportion to the degree of obesity : relative weights of 130% are associated with an excess mortality rate of 35% and relative weights of 150% agreater than two-fold excess death rate. Patients with morbid obesity (Relative weight .200%) have as much ten-fold increase in death rate (Baron, 1993).

Obesity is one of the most common disorders in Medical practice and among the most frustrating and difficult to manage despite major changes that occured in understanding its causes and implications for health.

Definition :-

Obesity may be defined as a condition in which there is an excessive amount 0f body fat, the exact criterion for how much is too much remains controversial ***(Truswell 1991).***

Obesity may also be defined as deposition of excess fat in the body caused by ingestion of greater amount of food than can be utilized by the body for energy. The excess food either fat, carbohydrates or proteins, is then stored as fat in the adipose tissue to be used later for energy ***(Guyton, 1991).***

It has been defined also as adiposity in excess of that consistant with good health ***(Albrink, 1974).***

Measurement of obesity:-

Accurate quantification of body fat requires sophisticated techniques not usually available in clinical practice. In most situations physical examination is sufficient to detect excess body fat.

Two methods commonly used for more quantitative evaluation are relative weight and body mass index ***(R.B. Baron 1993).***

Body mass index (BMI)

BMI is calculated by dividing measured weight in kilograms by the height in meters squared. The normal body mass index is 20-25 kg/m^2. According to this method of measurement obesity can be calssified as in tabele (1)

The bodymass index is an objective index by which the level of risk of morbidity and mortality can be estimated (Tomkins). See table 1

Table (1) Classification Of BMI.

Grade	*BMI*	*Description*
0	20-25	Normal range of weight
I	26-29	Over weight
II	30-39	Obesity
III	> 40	Sever or morbid obesity

(Souhami, 1991)

Relative Weight (RW)

RW is the measured body weight divided by the desirable weight X 100. Desirable weight is defined as the midpoint value recomended for a medium-form person in the recently revised weight tables published by the united States Government ***(Baron 1993).*** See Table (2)

Table (2) Acceptable Weights (in Kg)
For Men and Women.

Height (m)	*19-34 Years*	*35 Years and Older*
1.52	34.5 - 57.5	48.5 - 62
1.54	45.5 - 59.4	50 - 64.4
1.58	47 - 16.7	51.8 - 66.6
1.60	48 - 63.5	53.5 - 68.4
1.62	50 - 65.7	55 - 70.6
1.64	51.4 - 67,5	56.7 - 73
1.68	53 - 70	58.5 - 75
1.70	54,5 - 72	60.3 - 77.4
1.72	56 - 74	62 - 80
1.74	58 - 76	64 - 82
1.78	59.5 - 78	66 - 84.6
1.80	61 - 80.5	68 - 87
1.82	63 - 83	70 - 89.5
1.86	65 - 85	71.5 - 92
1.88	66.6 - 87.8	74 - 94.5

Weight based on weighing without shoes or cloths.Source:US Department of health and human resources 1990.

Skin Folds

Skin fold thickness measurement possesses many of the same advantages as weight and height measurements. The calipers are inexpernsive and portable, the measurments are relatively simple to perform and acceptable to patients.

The triceps skin fold thickness is normally from 10-20mm in women and from 2 to 3 less in men. So measurements over 25mm in women and 20mm in men indicate too much subcutaneous fat and hence obesity ***(Jolliffe, 1962).***

Muller and stallones in 1981 found that skin folds could be separated into tow groups, the first consisted of sums of skin folds and related closely to body fatness. The second consisted of differences between trunk and extremity skin folds and was termed the fat-patterning index. The fat patterning index showed no correlation with the total body fatness component.

In a study of Mexican Americans it was found that both the waist to hip ratio and the subscapular to triceps skin folds ratio (an indictor of trunkal versus peripheral fat distribution) were associated with higher rates of diabetes mellitus, low high density lipo-proteins, cholesterol levels and high triglyceride levels ***(Haffiner SM et al., 1987).***

There are several problems that must be considered when using skin fold measurements, they include the following :

1- The amount of tissue picked up to form skin-fold may vary between observations.
2- The fat muscle interface cannot always be palpated.

3- Skin fold thickness is impossible to measure at some sites on obese individuals because the skin fold exceeds the maximum opening of the caliper .
4- The caliper tips may slide on larger skin folds .
5- Inter-observer difference in measurements of skinfolds. (Martin,1985).

Martin et al in 1985 suggested that there is a linear relationship between subcutaneous fat and internal fat and that the later is about 15% of the former.

Under water weighing involves the principle of Archimeds; the body displaces a weight of water equivalent to its own volume and this displacement is reflected in the change in weight of the individual when weighed under water rather than in air, unfortunately allowance in the figure for body volume must include the large residual volume of air in the lung and this is normally measured directly by nitrogen or helium dilution in the subject at the same time. Intestinal gas is neglected in this calculation and the subjects need to be trained to control their breathing while being weighed under water.

The body volume can be measured by under water weighing after correction for lung volume and body density can be calculated by dividing body weight by volume ***(Siri W. 1981).***

The amount of body potassium can be estimated by measuring the amount of naturally radioactive isotope k^{40} in the whole body countor. From this figure the lean body mass can be caulculated as lean body mass = total mass K+ (mmo1)/68.1. Total body fat can be caulculated as total weight minus lean body mass (Xavier, 1993).

Total body water can be measured by dilution with tritiated or deuterated water. Water is then measured to be a fixed proportion of fat free mass (FFM=water mass /0.73) and the fat free mass is subtracted from total body weight to obtain total body fat (Xavier, 1993).

Tobec is a new device which depends on the difference in electerical activity and dielectric properties of fat and fat -free tissue . It is simple for the patient but the equipment is quite expensive **(Presta E,Segal K et al., 1983).**

Etiopathogenesis

When energy intake exceeds expenditure the excess calories are stored in the adipose tissue and if this net positive balance is prolonged, obesity results; i,e there are two componenets of weight balance and an abnormality of either side (intake or expenditure) can lead to obesity.

Regulation of eating behavior is incompletely understood but to some extent appetite is controlled by discrete areas in the hypothalamus: a feeding center in the ventrolateral nucleus of the hypothalamus and satiety center in the ventromedial hypothalamus. The cerebral cortex receives positive signals from the feeding center that stimulate eating (see figure 1) and the satiety center modulates thisprocess by sending inhibitory impulses to the feeding center(Olefsky, 1994).

Eating behavior
↑
Cortex ← Social, Cultural
↑ Genetic influences
Feeding center VLH ← Setpoint or a dipostat
↑
Satiety center VMH
↑
Gastric distension - plasma glucose Adrenergic influences
- insulin

Fig. 1 : The regulation of eating (Olefsky, 1994).

In animals destruction of the feeding center results in decreased food intake and destruction of satiety center leads to overeating and obesity.

The satiety center may be activated by increase in plasma glucose level and insulin that follows a meal. Meal induced gastric distension is another possible inhibitory factor for eating. Additionally the hypothalamic centers are sensitive to catecholamines and beta adrenergic stimulation inhibits eating behavior, this provides at least one rationale for the anorexiant effect of amphetamines ***(Olefsky 1994)***.

Xavier in 1993 said that there is a setpoint of body weight suggesting that each person has a control system that "sets" how much weight or alternatively how much fat he or she should have. How the control system is regulated, that is, where the feedback signals form "weight" or "fat" originate and how they might be transmitted (humoral, neuronal, both) to the hypothalamic feeding and satiety areas are totally unknown.

Fat people do not eat generally more than lean people and many eat less. Since mass and energy is conserved, it is clear that at some time in life obese individual consumed more calories than he expended. This temporarly imbalance between energy intake and expenditure could be the cause which may be due to several factors involving the central nervous system and the adipocyte itself. Reduced sympathetic activity manifested by lower plasma norepinephrine and epinephrine levels, reduced fat mobilization or low thermogenic response to food and exercise could reduce energy mobilization and expenditure. Enhanced parasympathetic activity typical of ventromedial hypothalamic lesions may augment food consumption, and at least in theory the brain may be insensitive to normal neural or humoral satiety signals ***(Donald 1991).***