Review Article

Once fat was fat and that was that: our changing perspectives on adipose tissue

WF FERRIS, NJ CROWTHER

Abstract

Past civilisations saw excess body fat as a symbol of wealth and prosperity as the general population struggled with food shortages and famine. Nowadays it is recognised that obesity is associated with co-morbidities such as cardiovascular disease and diabetes. Our views on the roll of adipose tissue have also changed, from being solely a passive energy store, to an important endocrine organ that modulates metabolism, immunity and satiety. The relationship between increased visceral adiposity and obesity-related co-morbidities has lead to the recognition that variation in fat distribution contributes to ethnic differences in the prevalence of obesity-related diseases. Our current negative view of adipose tissue may change with the use of pluripotent adipose-derived stromal cells, which may lead to future autologous stem cell therapies for bone, muscle, cardiac and cartilage disorders. Here, we briefly review the concepts that adipose tissue is an endocrine organ, that differences in body fat distribution underline the aetiology of obesity-related co-morbidities, and the use of adipose-derived stem cells for future therapies.

Keywords: adipocytes, obesity, cardiovascular disease, stem cells

Submitted 14/7/10, accepted 31/8/10

Cardiovasc J Afr 2011; **22**: 147–154 www.cvja.co.za

DOI: CVJ-21.066

A changing view of adiposity through the ages

The incidence of obesity and obesity-related co-morbidities has risen dramatically in the last century. The latest global data shows that in 2004 cardiovascular disease was the primary cause of death, above infectious and parasitic diseases, with the majority of cases attributed to an unhealthy lifestyle. This includes over-nutrition.[1] The increase in obesity has been accompanied by increased interest in fat and an abundance of research investigating the link between excessive adiposity and the associated pathologies. Currently there are over 130 000 research articles on obesity cited on PubMed and these publications show that our perception of the function of fat mass has changed considerably since the first entry cited from 1880. However, our knowledge of adiposity stretches back far beyond the 19th century. Although it is not known whether classical scholars recognised that adipose tissue is our major energy store, they did observe that excessive adiposity has negative health implications.

The Indian physician Sushruta (sixth century BCE) was probably the first to document a relationship between obesity and co-morbidities such as diabetes and heart disease. Not unlike today, he recommended exercise to remedy conditions that had arisen from a sedentary lifestyle and 'pampering the belly'.[2] Later in Europe, Hippocrates (460–377 BC) independently recognised the relationship between body composition, exercise and health, exemplified in his quote: 'If we could give every individual the right amount of nourishment and exercise, not too little and not too much, we would have found the safest way to health'. In a time of scant medical knowledge, his insight extended further, beyond his contemporaries, to include the pathogenicity of obesity, in writing: 'Repletion, carried to extremes, is perilous' and 'Corpulence is not only a disease in itself, but the harbinger of others'. He then subsequently noted that life expectancy was far shorter in the obese compared to lean individuals.[3]

Although the detrimental effects of obesity have therefore long been known, in the intervening millennia since Sushruta and Hippocrates, portliness was generally regarded as a symbol of affluence. This was primarily due to periodic food shortages and famine, which were only brought under control in the Western world in the last century yet still ravish the developing world today. This association between wealth and increased body mass was often reflected in the art of European masters such as Rubens (1577–1640) who depicted women with a full-bodied, hour-glass shape; a shape which was associated with opulence and fertility.[4]

By the 20th century, the use of intensive farming in conjunction with the mechanisation of the food industry helped to eradicate famine in the developed world. The increasing availability of highly palatable, high-energy foods and decreased levels of physical activity has lead to an increasing imbalance between energy input and expenditure in the general population. The consequence of this is a burgeoning of portliness and obesity. This rise in the prevalence of obesity is a global phenomenon, occurring in both the developed and the developing worlds. Data from the USA shows that in the period 1988–1994 the prevalence of obesity was 22.5%,[5] and rose to 32.2% in the period

Division of Endocrinology, Department of Medicine, Faculty of Health Sciences, University of Stellenbosch, Stellenbosch, South Africa
WF FERRIS, wferris@sun.ac.za

Department of Chemical Pathology, National Health Laboratory Services, University of Witwatersrand Medical School, Johannesburg, South Africa
NJ CROWTHER