Obesity in Childhood *

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In considering the subject of obesity in childhood we are at once faced with difficulty in definition and diagnosis. In most of the well-defined diseases of childhood, it can be said categorically that the child's condition is pathological. In the case of height, weight, and fat-deposition, however, there is continuous variation from extreme leanness to extreme fatness, and from extreme shortness to extreme tallness. The very tall thin child of a particular age may actually weigh more than one of the same age who is short and fat.

Many attempts have been made to compile tables showing the "ideal" weight for height at each age of childhood. These are based on the measurements of large numbers of healthy children in a particular community, and it is often arbitrarily stated that if a child is more than 20 percent over the ideal weight for height, age, and sex, he or she should be classified as obese. It is obviously absurd, however, to claim that a child who is 19 per cent overweight is 'normal' and one who is 21 per cent overweight is 'pathological'. It would be truer to say that a degree of fat deposition which is compatible with perfect health passes gradually into a degree of fatness which is an encumbrance to the child's activity and carries potential dangers to his health.

Some additional information with regard to nutritional status can be obtained by measurement of thickness of skin and subcutaneous tissue in two or more standard positions, e. g. below and lateral to the inferior angle of the scapula and above the crest of the ilium (Stuart and Meredith, 1946). The thumb and forefinger are placed 3 cm. apart and a double layer of skin and subcutaneous tissue elevated by approximating the thumb and forefinger. The thickness of the fold can then be measured wtih calipers.

For assessing response to treatment, however, regular weighing remains the most reliable guide, provided that it is carried out under standard conditions, on a beam balance accurately checked, with the child naked or wearing exactly the same clothing on each occasion, and preferably at the same time of day.

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Factors in the Causation of Obesity.

Racial and Cultural Factors. It is commonly observed that obesity occurs more frequently in some races and cultures than in others. It is seldom possible to ascribe this with any certainty to genetic differences, though the peculiar steatopygous deposition of fat over the buttocks peculiar to certain African tribes would suggest more than a purely environmental origin. In generalised obesity, any genetic inclination which may possibly be present as a racial characteristic is likely to be overweighed by cultural differences, particularly in child rearing and diet.

If obesity in infancy, childhood or adolescence is considered socially desirable, it is likely to be achieved by the type and manner of feeding. In the Western hemisphere, and more particularly in the United States, the paradoxical position has been reached in which parents congratulate themselves if their baby is large and greedy, with an appetite for soft solids before the first dentition has appeared, whilst expecting their adolescent girls to be slender and sylph-like at an age when increased adiposity might normally be expected. In Africa one could point to the exact reverse. There are tribes in which the minimum of trouble or interest is taken in the toddler's diet, but with the onset of menstruation adolescent girls are put into a fatting-house where they are not only stuffed with food but take little or no excercise. After one or more years the fatted adolescent is paraded in the village preparatory to marriage.

Diet and Exercise. In the last analysis, fat deposition will depend upon the balance between the calories consumed on the one hand, and the caloric requirements for maintenance, growth and activity on the other. When a child has already become obese, he may maintain his obesity on a diet which at first sight does not appear grossly excessive. Although this is often partly due to reduced activity, the result of the obesity, it is also found that the obese child may stabilise on a diet which is sufficient to mantain, but not necessarily increase, his obesity.

In such cases, reduction of weight can be effected by reducing caloric intake to a level at which the child utilises his own body fat for energy requirements, whilst continuing to grow in height. Once he has reduced his weight to a degree appropriate for his height, his diet can be restabilised at a level which satisfies appetite without allowing for excessive fat deposition. Since reduction in weight will commonly lead to an increase in activity, the final diet may differ little in total calories from that on which obesity was previously maintained.

The child who is becoming progressively more and more obese (rather than remaining in a condition of static obesity) presents a slightly different problem. Here both appetite and caloric intake will be found to be grossly excessive, and the diet is commonly over-weighted with carbohydrate. In this case treatment must aim specifically at re-education of appetite.

Excessive or exclusive carbohydrate intake stimulates insulin production, with the result that a carbohydrate meal is followed two to three hours later by a fall in blood sugar. This relative hypoglycaemia produces a demand, through the appetite, for more carbohydrate, so that a vicious circle is established. It has been found experimentally that when the first meal in the day contains a substantial proportion of protein rather than carbohydrate, the time-interval before further food is required is prolonged. This means in practice that the child feels progressively less desire to eat sweets or starchy foods between meals, and is satisfied with a protein-rich diet containing substantially less calories than one consisting predominantly of carbohydrate.

The staple diet on which children are normally reared will depend to a large extent on three factors (1) economic circumstances of the parents (2) local food production and agriculture, and (3) the cultural pattern and food habits of the community. With the general rise in the standard of living which has occurred in most European countries during the past decade, the differences in diet between different social and economic groups are being gradually reduced. It is generally true, however, that first class protein tends to be more expensive than carbohydrate and starchy foods and is the factor most likely to be neglected.

The second factor—local food production and agriculture—is still of considerable importance in countries where there are limited facilities for import, transport, refrigeration or preservation of foodstuffs. Here children will tend to be provided with the food that is readily available locally. Until comparatively recently the Scottish child would eat considerably more oatmeal and considerably less beef than the English child, and he still receives a minimum of salads, green vegetables and fruit compared with children in countries where these are grown in abundance. In many tropical areas, e. g. West Africa where transport and preservation of food still present major difficulties, differences in physique between children in fish or meat eating communities and those living in areas where root crops form the staple diet are often very marked. The latter tend to be of short

stature with distended abdomens, whereas the fish eaters are taller and more slender.

The cultural pattern of child rearing and feeding will be influenced, but not exclusively determined, by the foods most readily available and the economic demands of society. The decline in breast feeding in Western Europe and the United States may have its origin in the demands for female labour in industry, but it has certainly been increased by the ready availability of dried and condensed milk. Even in the most under-developed countries, where malnutrition is common, it is significant that many valuable foodstuffs which are available are in fact uneaten owing to religious embargo or cultural prejudice. It is understandable that the type of child feeding practised by a particular community, including the availability and price of refined sugars in the form of sweets, is likely to have an influence on the incidence of obesity.

The Hypothalamus. It has been shown experimentally in rats that appetite is controlled by twin centres laterally placed in the hypothalamus, and satiety, or inhibition of appetite, by the central or medial area (Brobeck, 1957). Under normal circumstances, activity of the appetite centres will be aroused by a variety of stimuli such as hypoglycaemia or contraction of the empty stomach. When the resulting hunger is followed by adequate food intake, the satiety centres will become activated, and a sense of repletion, or lack of appetite experienced. It is probable that consistent overeating or neglect of the early symptoms of repletion, will tend to raise the threshold at which satiety is experienced.

Occasionally the satiety centres may be so damaged by trauma or disease (such as intracranial infection or tumour), that appetite remains uninhibited by the taking of food. It should be emphasised that these cases of voracious and uncontrollable hunger are extremely rare and readily distinguishable as pathological. The hunger may be compared to the thirst of diabetes insipidus, where a child will drink his own urine if fluids are restricted. Demonstrable damage to the hypothalamus is only found in a very small proportion of cases of childhood obesity.

Endocrine Factors. There is an unfortunate tendency amongst the medical profession to attribute very many cases of simple obesity to endocrine dysfunction, when there is no real evidence that the endocrine system or hypothalamus is pathological. The description "Fröhlich's syndrome" or "adiposodystrophia genitalis" is often applied when there is no evidence of either infantilism or genital hypoplasia.

It should be remembered that Fröhlich's original case suffered from a craniopharyngioma probably involving both the pituitary and hypothalamus, and that the boy showed true infantilism (small size and retarded development) in addition to obesity.

Genital hypoplasia should only be diagnosed with caution in fat boys before the normal age of puberty, since it is commonly found that if there is a heavy deposit of suprapubic fat the testicles and penis are overlapped by fat or retracted but are otherwise normal, and develop normally with the onset of puberty. In such cases there is no indication for hormone therapy, and there may well be undesirable psychological effects from a mistaken diagnosis of hypogenitalism made in later childhood.

The majority of cases of simple (non-endocrine) obesity occur in children who are actually above the average height for their age, with advanced skeletal development. This is in striking contrast to the rare cases of obesity with infantilism.

In considering the comparatively small group of cases where there is definite pathology of the endocrine system, or hypothalamus, the following types can be recognised.

Obesity with Infantilism. These include cases where new growths, infection or trauma have involved both the pituitary and hypothalamus. The history, for example, of a preceding meningitis or encephalitis, or the associated symptoms and signs, such as headache, vomiting, papilloedema, or spread of sutures in the case of a tumor will usually point to the diagnosis.

The Lawrence-Moon-Biedl Syndrome, which is extremely rare, consists of obesity associated whith infantilism, mental defect, polydactyly, and a peculiar type of retinitis pigmentosa. The condition is genetically determined and shows a familial incidence. It is probably due to a linkage of genes. The bizarre nature of the associated abnormalities makes the condition readily recognisable.

Ovarian Agenesis (Turner's syndrome) is in some instances associated with obesity, though this latter is not of constant occurrence. The patients show the external genitalia of a female, absence of ovaries, and chromosomal pattern of a male. There is commonly complete failure of development of secondary sexual characters. The patients are dwarfed and show webbing of the neck associated with an increased carrying-angle at the elbow.

Primary Hypopituitarism. In most cases in which there is a congenital hypoplasia of the anterior pituitary, infantilism is much more in evidence than obesity. Even when there is abnormal deposition of fat over the

chest and hips, this is commonly only noticeable when the child is seen naked.

Hypothyroidism. Although simple hypothyroidism in childhood will tend to produce myxoedema rather than true obesity, there is some evidence (Talbot, 1952) that it may also result in pathological storage of fat, at least in older children. The symptoms of hypothyroidism (lethargy, slow pulse and constipation) will be associated with a lowered basal metabolic rate. Thyroid therapy should be reserved for patients showing clear evidence of hypothyroidism and is contraindicated in all cases of childhood obesity where the thyroid is not involved.

Cushing's Syndrome and Adrenal Hyperplasia. The clinical picture of moon-faced obesity, hypertension, hirsuties and striae atrophicae is occasionally encountered in childhood as a primary disease, as distinct from the same clinical picture produced by steroid therapy. Although Cushing attributed his original cases to the presence of a basophil tumour of the pituitary, primary hyperplasia of the adrenal cortex is now regarded as the more likely cause. Surgical treatment may be effective in selected cases where the adrenals are hyperplastic.

General Considerations

It should be emphasised again that obesity due to gross endocrine pathology is extremely rare, and that such cases only represent a minute fraction of all cases of obesity occurring in childhood.

The disabilities experienced by the child who is grossly overweight may be considered broadly as psychological, mechanical, and hypertensive.

Psychological. In most communities the obese child is considered ridiculous and unsightly after the age of infancy, and suffers at the hands of schoolfellows in consequence. This is more likely to occur if the obesity interferes with participation in sport. At the same time, it may be found that psychological factors are also the cause of the obesity. The child who is deprived or feels himself inferior in other ways may take refuge in over-eating as a solace. In other cases the child may be mentally dull. Careful psychological assessment of the case should precede treatment, since treatment is most likely to be successful if the co-operation of both child and parents can be obtained.

Mechanical Disabilities resulting from obesity are essentially those due to excessive weight carrying. The great majority of obese children show knock-knee, which may interfere seriously with activity, and this in turn will tend to increase the obesity. Under treatment most children will experience an increase of well being and energy which will be a major factor in ensuring co-operation.

Hypertension is almost invariably present in the grosser cases, and systolic pressures of 160 or 180 mm. Hg are not uncommon in older children. The diastolic pressure is significantly raised also during activity.

The blood pressure, however, is at first labile, and shows a marked difference between the figures obtained when the child is up and about, and those recorded after a day's bed rest. The blood pressure returns readily to normal under treatment, depending on the amount of weight lost. However, if the obesity is allowed to persist throughout childhood and adolescence into adult life, the hypertension is much less readily reduced and is liable to lead to vascular degeneration. The risks to life and health of obesity in adult life are sufficiently familiar to require little emphasis. It is important to remember, however, that a significant proportion of cases of adult obesity have their origin in childhood or adolesccence, and could have been successfully preventcd if treatment had been undertaken earlier.

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