TITLE

PREVALENCE OF OBESITY, ITS RELATIONSHIP WITH SOCIO-DEMOGRAPHIC CHARACTERISTICS AND ASSOCIATED MORBIDITY WITH RESPECT TO HYPERTENSION AND GLYCOSURIA IN AN URBAN POPULATION OF TANZANIA

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DECLARATION

I, Ferdinand Kawau hereby declare that this thesis is my own original work and has not been submitted for a degree in any other university.

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Dedication

This work is dedicated to Mwesaa and Masalema in remembrance of their dedication to my education

Abstract

This study served to determine the prevalence of obesity, its determinants and its associated morbidity in an urban population of Tanzania. Obesity, its determinants and accompanying morbidity in a randomly selected adult population aged 15 years and over were assessed through anthropometry, interview schedule and clinical examinations. All together 725 subjects were interviewed, measured and examined.

The prevalence of obesity was 26.5%. Important determinants of obesity among the population were income, sex and occupation. Hypertension was the most important morbidity among the obese with a prevalence of 31.2% as against 15% among those who were not obese. To a lesser extent, glycosuria was important in men aged 25 years and over.

The findings confirmed the investigator's impression that obesity was indeed an existing nutritional problem among the urban population of Tanzania and that hypertension was more common among the obese.

More studies to get a precise prevalence among urban populations, nutrition education with treatment for those already afflicted and school based public health programs as a long-term preventive focus were recommended.

Acknowledgment

My gratitude and appreciation go to the faculty in the Unit of Applied Human Nutrition under whose guidance I have been able to accomplish the requirements of the program. To Professor A. A. Kielmann for his advice, support and supervision throughout the period of my studies. To Dr. G. K. Maritim for his close guidance and assistance especially during data analysis and write up of this thesis. To IDRC for awarding me a scholarship for this program, and granting research funds which enabled me to carry out the work. Special mention and thanks go to my wife Mary and to my children Isaac and Janet whose support and endurance during the period I was away has made it possible for me to carry out the work successfully. To Messrs. F. Shirima, W. Daffa and Dr. J. Mbwambo for their assistance in collecting the data. Last but not least to the entire population of Tanga who voluntarily participated in the study and to all those I have not mentioned by names but in one way or other have contributed towards the successful completion of this work. I express my sincere appreciation to all of them.

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Abbreviations

AIDS - Acquired Immune Deficiency Syndrome

BMI - Body Mass Index (W/H^2)

BP - Blood Pressure

cm - Centimetre

DBP - Diastolic blood pressure

DF - Degrees of Freedom

EDS - Editors

Glycosuria
- Passage of urine containing sugar

H - Height (metres)

Hg - Mercury

IBW - Ideal Body Weight

IDRC - International Development and Research Centre of Canada

Kg - Kilogram

mm - Millimetre

p - Level of significance; usually at 5% (0.05)

Tercile
- A third from whole unit

W - Weight (kilogram)

WHO - World Health Organization

CHAPTER ONE

1. CHAPTER CONTENTS

1.1. Background

1.2. Statement of the problem

1.3. Objectives

1.4. Hypotheses

1.5. Limitations

1.6. Expected benefits

CHAPTER ONE

1.0. INTRODUCTION

1.1. Background

The study focused on the prevalence of obesity and its association with hypertension and glycosuria in an urban population of Tanzania.

1.2. Statement of the problem

Malnutrition may be classified according to two major categories. One category is that of undernutrition, which also includes mineral and the rare element deficiency. The other is overnutrition and either is detrimental to health. Whereas undernutrition has been extensively, and justifiably, researched into in Tanzania with abundant literature on undernutrition, few studies are documented on obesity.

Empirical evidence shows obesity to exist in Africa. Recently, Muthoni (1989), remarked: "Obesity is a major nutritional disorder that is catching up with our adult population. Walking round city streets one notices protruding tummies and double chins that more and more people are acquiring. Obese women find it difficult to conceive, and when they do become pregnant have a

thirty-five per cent chance of complications." However, the problems of obesity are not limited to women during pregnancy. There are a host of other conditions which are known to be associated with obesity. They include psychological disturbances (Butterfield, 1977), hypertension, diabetes, heart disease (Soutrel *et al*, 1984), additional risk during surgery (Edward and Lawrence, 1979), and the obese suffer inaccurate diagnoses when they appear before clinicians with illnesses (Maddox and Lierdman, 1969), among others. Slim is definitely healthier than obese so long as there is no evidence of energy, protein, vitamin or mineral deficiency (Simko *et al*, 1984). Observations made by Muthoni and those of the investigator suggest that obesity is found in urban settings among the adult population, and most likely more common in affluent communities. One would also expect to find increased morbidity among the obese.

Yet the prevalence of obesity, its determinants, and associated morbidity among urban populations in Tanzania is not known. It is this gap in knowledge that the study intended to fill.

1.3. Objectives

1.3.1. To determine the prevalence of obesity among the study population.

1.3.2. To determine the relationship between obesity and socio-economic characteristics, namely occupation, income, parental obesity and level of education.

1.3.3. To determine whether obesity is associated with hypertension and glycosuria among the study population.

1.4. Hypotheses

1.4.1. Obesity exists among the urban population of developing countries such as Tanzania.

1.4.2. Hypertension and glycosuria are significantly more common among the obese than among those with normal weight.

1.5. Limitations

The following limitations were adhered to in this investigation:

1.5.1. Hypertension as a systolic blood pressure 140 mm Hg and over; and a diastolic blood pressure 90 mm Hg and over.

1.5.2. Obesity as BMI 30 and over.

1.6. Expected benefits

Currently a rational approach which is cost-effective in delivering heath care and in tackling nutritional related problems among the population is through prevention. The popular saying

"prevention is better than cure" is yet to be proved wrong. While the official policy of most health ministries is to focus emphasis on preventive medicine, there is a continuous practice in spending larger shares of national health budgets for curative services. Moreover, most large medical centres cater for tertiary care providing relatively expensive curative services. They are located in major urban centres consuming large sums of money and only benefiting mostly urban dwellers who in developing countries of sub-Saharan Africa make only about 20-30% of the national populations.

An increase in the health consequences of obesity will certainly put more strain on the budget as curative expenditure continue to demand more and more so that less resources will be available for primary care services among the rural population. Ultimately this shall compromise the more rational policy of primary care emphasis supposed to benefit the rural majority.

If knowledge on the prevalence of obesity, its determinants and health consequences is available to policy makers and health planners, it would contribute towards planning of a timely and appropriate intervention to prevent the "obesity" problem. Eventually, the "obesity" problem and the expenditure on curative services for it would reduce. This is the task the study undertakes to do.

CHAPTER TWO

2. CHAPTER CONTENTS

2.1. Obesity; definition and assessment

2.2. Aetiologic and epidemiologic considerations

2.3. Risks and sequellae

2.4. Control of obesity

2.5. Summary

CHAPTER TWO

2.0. LITERATURE REVIEW

2.1. Obesity: definition and assessment

Definition

Gross obesity is obvious. Quite reasonably obese people are defined as those about whom no observer, either trained or untrained, would have any doubt that they are obese (Kekwick, Pawan, 1956). This definition will not be useful for less marked degrees of obesity, otherwise one could eliminate the "obesity" problem simply by finding a less stringent and more tolerant observer. To be useful, a definition must be as objective as possible. The definition of obesity given by Garrow (1974), Taylor and Anthony (1983), is that it is "a condition caused by an excessive amount of adipose tissue". This definition is satisfactory only if it is known what is meant by adipose tissue, and if it can be measured, how much of this material there is in a given individual patient. One also needs to say for certain if the amount is excessive. Adipose tissue is not too difficult to define and methods for measuring adipose tissue, or total body fat are also feasible. The greatest difficulty in applying the definition, therefore, is to say if the amount is excessive. In many

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borderline cases this is impossible by any objective criteria. Davidson and Passmore (1969), defined obesity as "an excessive accumulation of fat in the storage areas of the body," and suggested that this requires treatment when the deposition of fat has raised the body weight by 10% or more above the standard weight-for-height. This is a useful rule of thumb, but also here there may be difficulties in relation to individual cases. Thus in the definition of obesity accumulation of fat appears to be the main criterion but as it relates to weight. In Taylor's and Anthony's definition, overweight which is an excess of body weight relative to height is used synonymously with obesity in most situations, although strictly they are not identical as, for instance, a very muscular individual may have a high weight-for-height in terms of muscle mass but not be obese. One may, therefore, summarize that obesity is a condition characterized by excessive accumulation of fat in the storage areas of the body, expressed in weight above that desired for a given height, sex and age.

Assessment

If obesity is a state in which excess fat has accumulated, then in most cases it can be detected by visual inspection, and this usually suffices for diagnosis. But it is also important to assess the

degree of obesity, so as to be able to plan, monitor and regulate treatment.

There can be no consideration of the prevalence and the incidence of any anomaly without prior definition of the limits of normality. In the case of obesity, we are dealing with body "fattiness" and thus the regulatory systems concerned with utilization or storage of food energy. In mobile organisms living on land, the energetic "currency" carried in order to meet the needs resulting from an ever changing environment, the "metabolic dollar" to be spent or saved against future needs is almost exclusively composed of fat. This is so because lipid provides the highest caloric value per unit of weight and also because it can be deposited without simultaneous increase in intracellular water, thereby increasing its efficiency still further (Renold, 1981).

Fat deposition and subsequent utilization is under local metabolic and also under extensive endocrine, neuroendocrine and neural control. Furthermore, the setting of desirable values to "fattiness" has evolved during the differentiation of species in response to environmental conditions that may periodically change, resulting in an ideal "fattiness" quite differently defined at different times. For example, birds which migrate over long distances maintain one type of fattiness during

degree of obesity, so as to be able to plan, monitor and regulate treatment.

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most of the year, but during the cold seasons they accumulate fat during the weeks preceding migration, thereby achieving a physiological type of obesity so as to sustain flight over the course plotted by their instinct without the obesity being so great as to hinder the required exercise during flying thus enabling the required mobility.

What is presently considered is the optimal degree of "fattiness" in man? Is it that amount of fattiness that has been observed by the major life insurance companies and the very large numbers of human beings concerned by their statistics to be associated with the minimum mortality and morbidity (Metropolitan Life Insurance Company, 1960)? Before defining that optimal "fattiness", it is, however, necessary also to define how fattiness is measured, since direct estimation of total body fat, or fat content of lipid deposits, cannot be carried out during life. It is, therefore, necessary to resort to indirect measurements among which three shall arbitrarily be identified:

1. A simple rule of thumb is the Broca Index (Bray, 1976), when 100 is subtracted from the height in centimetres, the resulting figure, in kilograms, may be used to define the desirable weight by further subtracting 10% for males and 15% for females. Excluding extreme situations, this rule of thumb is acceptable and useful.

2. A more sophisticated definition is that comprised by the general description of relative weight of which two modalities are described. The first is to express the weight in relation to that empirically recorded in life insurance tables (Metropolitan Life Insurance, 1960) as being that which, at any given height and taking into consideration sex and age, is associated with the smallest mortality and morbidity and may thus be considered the "best" weight. The relative weight may also be expressed as a ratio of weight to height, the most accepted and generally used being the body mass index (Keys *et al.*, 1972; Womersley and Durnin, 1977; Garrow and Webster, 1985); weight in kilograms divided by height in metres, squared. Body mass index has the best correlation with body fat (Taylor & Anthony, 1983). Relative weight measurements always imply comparison with most ideal weight.

3. On the basis of numerous measurements of skinfold thickness, therefore, directly including subcutaneous adipose tissue, relations have been established to other indices of body fattiness. Since determinations of body fat based on quantitative methods for estimating body water with deuterium oxide (D_2O), body potassium (^{40}K), or body density by underwater weighing are not possible in most clinical and field situations, an

assessment can be made from measurements of skinfold thickness. For this purpose the Harpenden calipers (of British make), or the American - made Holtain calipers, are recommended. Measurements are taken from four sites:

1. Triceps - midpoint from the tip of the acromion to the olecranon with the arm hanging vertically.
2. Biceps - midpoint of the muscle with the arm hanging vertically.
3. Subscapular - just below the tip of the inferior angle the of scapula.
4. Suprailiac - over the iliac crest on the mid-axillary line.

Womersley and Durnin (1977), concluded from their tables derived from their study that total body fat can be assessed with relative ease and reasonable accuracy in men and women of widely differing age that should make it of common use in many fields of medicine, physiology, anthropology and nutrition. Davidson and Passmore (1969), reported their experiences in practical classes with students and confirmed this view. However, to make measurements at four sites, the subjects have to be undressed and for survey work in which large numbers of people are being studied, this may be impractical. Thus a single measurement over the triceps is most useful and representative of body fat (Seltzer *et al*, 1970).

From the outlined indices of assessment, when using the Broca index, "ideal" body weight or body mass index, a body weight exceeding best weight by between 10% and 20% is generally considered as overweight, whereas obesity begins at 20% over the best weight. The difficulty of such definition criteria should be fully appreciated since body weight is a continuous variable without any implicit threshold. A gradual gain in weight year by year is commonly accepted as normal but because with aging there is a decrease in muscle and other lean-body mass components, in order to keep the same proportion between fat and other body structures we should lose weight gradually once we have passed the age of 30 years.

From epidemiological studies the following cut-off levels have been recommended for the assessment of obesity as it relates to risk of mortality and morbidity:

1. Broca index - 20% and over (Bray, 1976; Garrow, 1977).
2. Ideal Body Weight (IBW) - 25% and over for height and sex (Febler *et al*, 1985).
3. Body Mass Index (BMI) - 25 and over (Garrow, 1979), 30 and over (Bray, 1978; Taylor and Anthony, 1983; Faranghise *et al*, 1988).
4. Triceps skinfold - males 15 mm and over; females - 25 mm and over (Jelliffe, 1966).

It must be pointed out that the cut-off levels for the indices outlined are based on populations of the Western countries and the ranges based on populations in the less developed countries have not been fully assessed (James *et al* 1988).

2.2. Etiologic and epidemiologic considerations

Prevalence

Obesity, the most prevalent nutritional disorder in prosperous communities, is the result of an incorrect energy balance leading to an increased store of energy, mainly as fat. The physiological regulation of energy stores is complex and not fully understood. Fortunately, all that an obese subject needs to know and indeed must understand, is that obesity arises only as a consequence of taking in more energy through food than is expended in the course of activities in their daily lives; and furthermore, if the diet is restricted so as to supply less energy than is being used, then the body has to draw upon the stores in adipose tissue and weight is lost.

Despite the "social stigma" of being obese, at least among the Western community, the adverse effects of obesity on health, and the proliferation of new diets and treatments for obesity, the condition itself shows no sign of going away

(Taylor and Anthony, 1983). Eating and physical exercise are behavioral activities and as such controllable by will power. Obesity is, hence, a behavioral disorder. Obesity is rare in underdeveloped and impoverished societies and so it is in wild animals, but whenever prosperity has provided a plentiful supply of appetizing foods, there have been fat men and women, and also fat dogs and cats and fat pigs and cattle (Mason, 1970). Obesity is thus common wherever there is an abundant supply of appetizing foods among a community who can afford, as anybody can verify in the streets of a prosperous town or a holiday resort. Numerous surveys have recorded its prevalence in selected samples in communities mostly in the Western countries. As the condition is not notifiable, there is no reliable information on the prevalence in any country. In the United States, where a growing proportion of people live in highly mechanized urban areas, the needs and opportunities for physical activities have diminished consonant with increased environmental demands for eating and overeating. 14% of the men and 24% of the women in the 20-74 age range are 20% or more overweight (Bray, 1979). The figures for those in the 45-64 age range whose income is above the poverty line are 40% of black women and 28% of white women are obese, and 12% and 13% of

black and white men are obese respectively. Muthoni (1989), described the following situation among the urban community in a large town in East Africa: "Obesity is a major nutritional disorder that is catching up with our adult population. Walking around city streets one notices protruding tummies and double chins that more and more people are acquiring. (..) Whatever the cause, obesity should be tackled resolutely."

Aetiological Factors

Many factors studied have been linked as causal associations to obesity. The family, the environment and genetic factors are among the most important.

Obesity as a familial disorder

Fattiness as well as leaness runs along family lines. When both parents are obese the children tend to be obese. When both parents are lean, the children tend to be lean. Therefore, an obese child or adolescent is not an isolated individual but one fat person among several, and there are likely to be more obese family members at home for every obese propositus identified in a clinic or school. Purely on statistical grounds, it is urged that identification, therapy and control of obesity be accomplished on a family-line basis (Garn, Clark, *et al*, 1976). And more recently Stunkard (1988) reviewed that "The most important risk factor for

obesity is the family and that obesity is to an extraordinary degree a familial condition. Eighty per cent of the children of two obese parents will be obese, compared to 40% if one parent is obese and 10% if both parents are lean".

Environmental influence

Once the familial character of obesity had been firmly established the question arose as to what caused obesity to run in families. Until recently, speculation as to the causes far outdistanced solid facts. Among the factors which have been investigated are socio-economic statuses, nature of diets and eating habits, physical activity, culture, social pressures and stress. Stunkard (1988) has pointed out that every social factor studied has been correlated with obesity. Among the communities in the industrialized countries the strongest correlation with obesity is social class. Among women the correlation was 30% in lower class, 16% in middle and 5% in upper classes. The relationship between social class and obesity among men has been more ambiguous and the precise nature of this relationship has yet to be determined (Garn, 1977). In contrast, mean body weight or skinfold thickness (not obesity) is associated directly with increased socio-economic status in developing countries (Taylor and Anthony, 1983).

Another piece of evidence of the importance of

environmental factors in obesity comes from the veterinary literature. Mason, (1970) in a study of pet dogs, found that 44% of the owners of obese dogs were obese as compared with only 25% of owners of non-obese dogs. Diets that are high in fat, with a sweet taste and variety (and particularly a combination of the three) are important factors. Nibbling between meals for housewives who are fond of cooking, the social visiting often with the hostess tempting the guests with delicacies having high sugar and fat content, and the guests eating more than hunger dictates out of politeness, is a potential factor in initiating or maintaining obesity in many cultures. Cultural factors may contribute to obesity in various ways. For instance, in parts of Africa and the West Indies, moderate obesity in women is desired by their menfolk and admired by their sisters. The social pressures affecting women, as this is truly "a man's world" make women suffer much greater temptation to overeat than men do. Apart from the daily temptations involved in the preparation of food, the food remnants left by the children must not be wasted, and so the meal must often be consumed and finished. A mother's life is more subject to minor frustrations and the constant decisions and responsibilities involved in looking after the children of all ages. The boredom of the

daily household chores and sometimes, in addition, the strain of full-time work before the babies arrive and again when all the children are of school age make these women cry out for relief, and for many, eating is one method of obtaining solace. When there are no children in the family or perhaps live far away, it is usually the women who bear the brunt of emotional strain. The family ties bear more heavily on women as a rule and they have less opportunity to exercise to help them keep slim. Even in Western societies it is more often the man who gets the game of golf, and almost all active sports have more male adult participants than female (Craddock 1973).

Physical inactivity clearly contributes to obesity in both animals and humans. The amount of body fat in several forms of genetic obesity in experimental animals can be controlled, often to a considerable degree, by increasing their level of physical activity. Although the effects of physical activity have not been as precisely defined in humans, they appear to be no less important. There has been a strong evidence that links television-watching with the prevalence - and the growing prevalence - of obesity in children (Stunkard, 1988). Although the evidence cited is not experimental, it is non the less compelling and of great importance for policy decisions in public-

health practice.

Genetic factors

Stunkard *et al* (1986) in a twin study of human obesity assessed height, weight and body mass index in a sample of 1974 monozygotic and 2097 dizygotic male twin pairs. Concordance rates for different degrees of overweight were twice as high for monozygotic twins as for dizygotic twins. Classic twin methods showed a high twin heritability for height, weight and body mass index, at age 20 years with correlation coefficients of .80, .78, .77, respectively and at 25 year follow up, correlation coefficients of .80, .81 and .84, respectively. Height, weight and body mass index were highly correlated across time, and a path analysis suggested that the major part of that covariation was genetic.

Parents and their children

Garn *et al* (1976), examining fattiness level of children of parents of different levels of fattiness found that the level of fattiness of the children rises progressively with the level of fattiness of the parental mating combinations. Boys and girls with two lean parents tend to be the leanest, boys and girls of two obese parents tend to be the fattest, and the introduction of one obese parent significantly affects the fattiness

level of the offspring whether the parent is male or female. Both these results suggest that human fattiness is under substantial genetic control but these findings do not mean that obesity is determined at conception and that, as is the case with eye colour, environment has no effect. The demonstration of genetic influence tells us little about possible correlations and interactions between heredity and environment, and is certainly not a prescription for therapeutic despair. It has long been known that certain persons become obese more readily than others do, and that some people find it more difficult to lose weight than others do. Demonstration of the importance of genetic factors helps to explain these differences. Furthermore, this information can be valuable in developing programs for prevention, for it helps to restrict the size of target populations.

Current efforts to prevent obesity, at least in the West, are directed towards all children (and their parents) almost indiscriminately. Yet if family environment alone has no role in obesity, the efforts that are now directed towards persons with little genetic risk could be focused on the smaller number who are at risk. Such persons already can be identified with some assurance on the basis of the facts already reviewed. Children with two obese parents who currently have an 80%

chance of becoming obese, would certainly be the targets of an informed program of prevention and, since they constitute a relatively small percentage of the population, could receive special attention (Stunkard, 1988).

2.3. Risks and sequelae of obesity

Ever since the time of Hippocrates, health risks have been ascribed to obesity. However, it is to be noted that - at least since the time of Julius Caesar as reported by Shakespeare - obesity has also been the beneficiary of a good press.

According to Albrink (1968), boredom is a disease of a materialistic society whose physical needs have been fulfilled. It is a disease which undermines mental, physical health and well-being and provides outpatient clinics with perhaps 80% of its patients, predominantly affecting the affluent society. The other disease of affluence account for the bulk of organic diseases in the hospitals i.e. obesity with consequent acceleration of the diseases which, if they are not caused by overnutrition, are certainly aggravated by it. These diseases are atherosclerosis, diabetes and hypertension. Therefore, the two diseases, boredom and overnutrition are closely interrelated, for boredom has become a greater stimulus to eating than hunger for many persons. Most data available

strongly suggest that excess mortality accelerates rapidly among men and women as their overweight becomes increasingly severe.

Some of the conditions associated with obesity and its increasing severity include: high risk for coronary heart disease with an increased mortality associated with myocardial infarction, hypertension, diabetes mellitus, gallbladder disease, increased left ventricular filling pressure, hypovolaemia, obesity -hypoventilation - syndrome, cor pulmonale, circulatory congestion, osteoarthritis of weight bearing joints (particularly knee and back), psychosocial incapacity, thromboembolic disease (with pulmonary emboli), an increased operative anaesthetic risk, increased post operative risk of developing wound infection, dehiscence and late hernia formation, inferior vena cava and renal vein thrombosis which may result into secondary nephrotic syndrome, cardiomegaly, liver function and morphologic abnormalities, uterine fibroid and endometrial carcinoma, varicose veins of lower limbs with complicating stasis ulcers, interference with diagnosis of breast cancer and ovarian tumours. Minor problems such as menstrual irregularities and dermatoses have also been associated with obesity (Gastneau,1975; Edward and Lawrence,1979; Vav Italliae,1985).

Obesity and diabetes

Obesity and diabetes are intimately related, but they make strange bedfellows. It has been established that adult diabetics are often obese and alternatively, obese subjects are likely to have carbohydrate intolerance (Edwin *et al*, 1968; Paulsen and Lawrence, 1968; Febler *et al*, 1985). The beneficial effects of weight loss, for example on plasma glucose and insulin concentration (i.e. reduction of hyperinsulinaemia), and insulin-resistance in obese diabetics suggest that obesity is an important predisposing factor for diabetes (Mancini *et al*, 1981). It has been suggested that obesity and diabetes mellitus are secondary effects resulting from neurohumoroendocrine dysfunctions and therefore basically a disorder of the nervous system (Jeanrenaud, 1985).

Obesity and hypertension

Numerous observational studies have confirmed the relationship of weight and weight gain to blood pressure (and hypertension), (Stamler *et al*, 1975; Moyses Szklo, 1980). Chiang *et al* (1969) had earlier observed that the relationship is not an artifact due to larger arm circumference of obese individuals in a cross-sectional study. Later prospective studies in young adults confirmed the same findings (Paffenbarger *et al*, 1968; Oberman *et*

al, 1976). The potential for the prevention of hypertension by means of weight reduction in obese individuals is supported by studies from both animals and humans, which have shown that a reduction in weight leads to a reduction in blood pressure levels (Chiang *et al*, 1969), even when the initial blood pressure is within an almost "normal" range (e.g. DBP = 80-89 mm Hg). Stamler *et al* (1980), suspicious that weight reduction might lead to reduction in blood pressure levels chiefly because of a concomitant decrease in salt intake does not seem to be supported by findings from studies by Reisin *et al* (1978) because weight reduction alone without concomitant salt restriction did reduce blood pressure levels significantly. Perhaps for some diseases moderate obesity may have almost as adverse an effect as severe obesity, whereas the distinctly lean person may not be threatened. Expressed in another way, the relationship between obesity and a given disease, if it exists, may not be linear; and because of practical difficulties of measuring degrees of obesity and excluding other risk factors, the hazards of being obese may not be readily proven (Gastineau, 1975). Until quite recently, the relationship between increase in mortality and increase in body mass index (BMI)

obesity, the greater the risk to health has been widely accepted. And there has been a general agreement on the ill effects of obesity at higher levels of overweight. Recent years, however, have seen increasing controversy over health risks of obesity at lesser degrees. Thus, Andres *et al* (1985) has presented evidence that, with increasing age, the lowest mortality is associated with higher degrees of overweight. Furthermore, very recently, an important new finding has reversed radically our understanding of the relationship between obesity and health. This concerns the implications of body fat distribution (Stunkard 1988).

It had long been known (Vague, 1956) that body fat is distributed differently in different persons. Later reports showed that fat in the upper part of the body is associated with diabetes and hypertension to a far greater extent than is fat in the lower part of the body. Within the past five years, a measure of body fat distribution, the waist/hip ratio, has been shown to be a powerful predictor of disease (Larsson *et al*, 1984). Their findings suggest that an increase in waist/hip ratio, rather than an increase in BMI per se, is associated with an increase in the incidence of coronary heart disease. When they used body mass index in classifying obesity among their study

subjects, obesity was negatively associated with coronary heart disease i.e. the lower the BMI the greater the incidence of coronary heart disease. According to Stunkard (1988), upper body fat and a large waist/hip ratio afflict primarily men, while lower body fat and a small waist/hip ratio afflict primarily women. Thus, accordingly, men and boys are at far higher risk of the medical complications of their obesity than are women and girls. Nevertheless, social pressure to control obesity (at least in Western societies) are directed far more strongly towards women and girls than towards men and boys. The result is a paradox: men who have the most to fear from obesity are under little pressure to control their weight, while women and girls, for most of whom obesity is relatively a minor health problem develop excessive weight preoccupation and even anorexia nervosa and bulimia.

An illustration of this paradox is the fact that at the present time, in Europe and North America, well over 90% of all persons who are under treatment for obesity are females (Stunkard, 1988). A rational approach to treatment would place far greater emphasis on the treatment of obesity in men and the prevention of obesity in boys. Likewise, it would place far less emphasis upon the treatment of obesity in women for two reasons. First, obesity in

women is usually not associated with serious health consequences. Second, the current emphasis on the treatment of obesity in women is undoubtedly contributing to strong social pressures upon women to become thin. There seems little doubt that these strong social pressures toward thinness, which are exerted as early as 10 years of age, are contributing to the widespread weight consciousness of women and girls and probably to the manifestation of this weight consciousness in the form of anorexia nervosa and bulimia (Stunkard, 1988). However, the issue has not been fully resolved and there is still disagreement among researchers. It is believed that the health consequences of obesity are equally experienced by women as well as men.

2.4. Control of obesity

Considerations when attempting treatment

The ultimate goal in the treatment of obesity is to reduce body weight to a desired norm and maintain the weight at the reduced level. A shift in energy balance must occur via one of three mechanisms: (1) a decrease in calorie intake; (2) an increase in energy expenditure; or (3) both. Despite the fact that the prescription for weight reduction is simple, the results are often disappointing to both patient and his physician.

The reason for the prevalent failure is that the prescription, albeit correct, does not take into consideration the psycho-social entanglements that have taken hold on the patient preventing him from effecting a shift in his energy balance equation (Hashim, 1981). Many forms of treatment for obesity have been used, some of them potentially harmful, and most of them only partially successful. The ease with which a person can be weighed affects our concept of the problem and the way in which we are likely to evaluate the results of treatment. Without really thinking, doctors and patients generally assume that loss of weight means loss of a corresponding amount of adipose tissue, but, not all weight lost is fat. For instance, if desiccated thyroid, thyroxin or triiodothyronine is given in amounts greater than physiologic levels, some degradation of muscle and other components of the lean body mass may occur. A similar loss of lean body mass can occur with fasting, and the magnitude of such lean tissue loss may be appreciable (Albrink, 1969). Weight loss resulting from degradation of lean body mass or from dehydration does nothing to correct the excess of fat tissue. Yet the scales give an illusion of accomplishment (Gastineau, 1975).

Before embarking on treatment, both the patient and the doctor would have a clear idea of the

amount of work and inconvenience which is likely to be required of both parties, and the benefits which can be expected in return. Too often a doctor suggests some form of dietary restriction, and may or may not prescribe an anorectic drug or a diuretic, and does little more. If a doctor undertakes to review progress of obese patients at least monthly, this represents a considerable investment of time. On the other hand treatment without follow-up is so ineffective that it would be better not to have attempted treatment at all. A possible solution to the dilemma is the group method by which continuous supervision can be given to several patients, with less cost in time to the supervisor (Howard, 1969).

Whatever system of dietary control is used there will be some patients who will decide that the cure is worse than the disease. Astwood (1962) cites from literature of a patient who addressed his physician in 1825 thus: "Sir, I have followed your prescriptions as if my life depended upon it, and I have ascertained that during this month I have lost three pounds or a little more. But in order to reach this result I have been obliged to do such violence to all my tastes and all my habits - in a word I have suffered so much - that, while giving you my best thanks for your kind directions, I renounce any advantages from them and throw myself

for the future entirely into the hands of providence". No doubt there are many patients who share these sentiments though they may not speak them as such, and this is a fact which a physician must bear constantly in mind. Garrow (1974) says that if any doctor finds it extra-ordinary that his patient finds it difficult to adhere strictly to a diet, even though it is plainly in their interest to do so, let him try the experiment himself and the inconvenience of long-term dieting will soon become apparent. So the criteria for treating obesity should be that the gain to the patient is more beneficial than would otherwise have been without treatment.

Obesity, being a diagnosis used in medical care when excess body weight is considered to be directly or potentially detrimental to one's health, calls for treatment. The detriment may be in terms of longevity as derived from life insurance tables, or in terms of morbidity, keeping in mind the strong association of obesity with hypertension, diabetes, billiary tract and joint diseases and others. The detriment may also be an emotional handicap in terms of living in a society which, by and large, associates obesity with gluttony, indolence and lack of self control. Therefore the diagnosis and the enthusiasm of the physician to make the diagnosis depends on some

very subjective factors as well as the physical and mental state of the patient (Cahill, 1981).

A person aged 50, who is 20% overweight according to the standard life insurance tables, and who has mild non-insulin dependent diabetes or a diastolic blood pressure of 90 mm Hg, if an active contributor to the community, would be urged to lose weight and would be officially diagnosed as "overweight" (a socially more acceptable term than obese or fat). He or she would then be urged to alter their lifestyle, to lose 5-10 kilos and quite correctly, would be told that it would be beneficial to health and longevity. Conversely, if an unemployed person, particularly if a member of a less advantaged socio-economic group, 20% overweight and probably a female, might simply be diagnosed as obese and return to their environment without much effort at intervention, knowing the statistical futility of success resulting partly from a widespread lack of compliance with this sort of therapy. This lack of compliance results not only from an ineffective social pressure but also from not having an educational understanding of the physical sequelae of obesity. In certain lower socio-economic groups, obesity is even a status symbol as evidence of sufficient funds to be able to provide the calories.

What, therefore, is the norm and who should be

treated? Here is where the entire problem appears to be based on very doubtful criteria. But first a short review of some historical events on obesity follows. The citizen of the besieged medieval city stood more of a chance to survive if he/she were obese and the same could be said for the passenger on the Polynesian craft floating for weeks in mid-Pacific (Cahill *et al*, 1966). Conversely, the nomadic family cluster, dependent on the male jogging for hours in pursuit of the antelope herd for the family's supply of protein, did not survive if the male could not run for hours. In other words, this male should optimally be 5-8% lipid, like a marathon runner, a ballet dancer or a cross-country skier, in order for the family to survive. If 10-15% lipid by weight, as that norm given by the standard life insurance tables, the antelope would prevail and not the family. Thus for this social setting he would be "obese" if he were 10-15% lipid by weight, his particular ecological niche would necessitate the 5-8% lipid condition, similar to the subject with anorexia nervosa say in the North American society (Cahill, 1981). Through evolution, therefore, man has had a highly variable lifestyle and that at certain times, excess lipid accumulation, to the point of even massive obesity according to current norms, might have provided a selective survival advantage. At other times,

maintaining a minimal lipid mass to the degree associated with anorexia might have provided the advantage. Thus it is not surprising that in evolutionary terms, man might have been better off if he had discarded or at least suppressed any finely regulated calorostat which if dominant, would link body calorie stores closely to caloric intake. With his tremendous intellectual capacity, anticipation of caloric needs and stores was certainly a selective advantage to the fixed and invariable control as observed in migratory birds which fatten up prior to their seasonal flights. A similar process is observed in mammalian carnivores who accumulate calories prior to their winter sleep, best exemplified by the black bear of both sexes or by the pregnant polar bear. In the spring they eat little, but in autumn, prior to winter sleep, their appetite is voracious (Nelson *et al*, 1973).

With the lessened dependence on the lipostat in man as a control of caloric intake, it is not surprising that hedonism should result in a much broader weight distribution for man than for other animals. Obviously the distribution is distorted since weights of less than 30-40 kilos in the female of normal height or 40-50 kilos in the male of normal height are incompatible with healthy survival. The same can be said for those with

weights of 300, 400 or more kilos, the purpoted record being over 500 kilos (Cahill, 1981).

How much of eating behavior is social and environmental and/or hedonistic and how much is due to some hereditary polymorphism of the lipostat, if such exists after youth, as discussed? Studies of children reared in foster homes suggest a ratio of about 50/50 but this is for children in whom obesity is a relatively infrequent event. In other words, children have a much narrower index of weight variation than adults, and half of the variation appears to be genetic and half environmental. This also suggests that children, and probably adolescents and young adults as well, do indeed have a carefully controlled lipostat as do probably all wild animals who have achieved a growth plateau, except those whose life habits necessitate altered caloric reserves, i.e. the hibernating carnivore or the pre-migratory hyperphagia of the birds. One might then think of human obesity as a natural result of a selective advantage mature man might have had by eliminating any close physiological control of fuel homeostasis. The problem now is the penalty resulting from this lack of a calorostat, producing a kind of balanced polymorphism, analogous to the sickle cell trait which provided a selective advantage in a malarial area. However, with

mosquito control, the trait is certainly a disadvantage in the homozygous state to the population at large. To lose the "appetostat" was an advantage to the "primitive" man, now it is a handicap. To summarize, adult man probably lost the fine physiologic control of weight homeostasis as a selective advantage of survival. Therefore, why does he eat? The answer is simple. It is a rewarding process, providing biological and social comfort. In fact most societies are structured around food functions - man eats because it is time to eat, it feels biologically satisfying to eat and there is a tremendous social and emotional gratification in the eating process. Based on this premise, the therapy of obesity is simple in theory. All that is necessary is a decreased caloric intake relative to expenditure. The expenditure can be increased by physical activity and this should certainly be an adjunct to therapy, keeping in mind the large amount and the long duration of physical effort needed to expend only a few hundred calories. If the appetite mechanism, especially that involving satiation has been largely suppressed in man and eating is mainly social, emotional and environmental, therapy should be directed to these aspects. No matter what the diet, eventual success depends upon altering the lifestyle of the individual. Behavioural

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modification is the basis of all therapy, and unless behaviour is modified, any mode of therapy is not going to be successful on a long-term basis (Pomerleay *et al*, 1975). Behavioural modification coupled with different dietary programs has not achieved as a great a degree of long-term success as originally hoped, but where successful, it is logical that it is the basis of the therapy.

From a nutritional stand point, any diet that is appropriately balanced, which alters the patient's dietary patterns and is successful in altering his eating behaviour will be appropriate. But lest we forget, the change of the subject's behaviour is still the most important part of the program for a sustained success.

Modalities of treatment in use

Low risk treatments

These therapies are of particular importance because they are potentially applicable to the large number of people needing help. The treatments include dieting, where diets can be divided by the number of calories they recommend. The diets may also recommend a balanced reduction in caloric intake or recommend an unbalanced reduction of caloric intake. Reducing carbohydrate intake lowers caloric intake since most fats are taken along with carbohydrates. Thus low carbohydrate diets are also

usually low in calories. In addition to reducing the level of calories consumed in a diet, all dieters should consider the frequency with which meals are eaten. The frequency with which food is eaten influences both serum cholesterol and glucose tolerance (Young *et al*, 1971). Behavioral factors which might be termed motivation play a central role in the success of any treatment. Still of interest is the fact that some people obviously succeed and others do not and that some clinical settings appear to be better than others (Bray, 1981). Adolescent clinical programs have been developed for the treatment of obesity in Australia (Stunkard, 1988). Until recently, weight reduction mode of treatment for the adolescent has been characterized by high attrition rates, only modest weight losses, poor maintenance of these losses and untoward emotional reactions to the dieting. The introduction of behavioural therapy into the treatment has changed this gloomy picture with gratifying results. Added on the traditional dietary measures are increased consumption of fruits and vegetables. Physical activity is promoted through various behavioral methods. Self monitoring, or a description of the behavior to be controlled, is a key element of these programs, and adolescents can show considerable skill in keeping records of their food intake and their physical

activity. Efforts are made to control the stimuli that precede eating, as in the adult programs so as to reward judiciously the exercise of the appropriate behaviours. Finally cognitive restructuring is utilized to help patients achieve a more positive outlook on their abilities and their treatments (Brownell *et al*, 1983).

Public health measures have also been employed. The very large commitment of time, effort and money that is required for the conduct of clinical programs means that such measures will be available for only a fraction of the vast numbers of obese persons. If obesity is to be controlled other more cost-effective measures must be employed. A prominent candidate is a public health approach. This approach seems indicated because of the special requirement for the long-term control of obesity i.e. an enduring change in lifestyle and personal habits. Such change is best brought about by changes in the environment; not by efforts that focus on individual behaviour. It is most effective if it is not targeted on the control of body weight. Adolescent boys are unlikely to make the strenuous effort to change their lifestyle solely to control their body weight. Girls might well make the effort but the improvement in health is likely to be so small, and the danger of encouraging an eating disorder is so great, that

programs for girls seem contraindicated (Stunkard, 1988). Nevertheless, public-health measures may be effective in the control of obesity in boys, if the control of obesity is secondary to other issues that are more important to them. Prominent among these issues is physical fitness and efforts to improve physical fitness may not only improve fitness but also control obesity. The ideal site for the introduction of public-health programs is the school and attention is now being focused on this area (Stunkard, 1988).

Among the low risk treatments, drugs have also been employed. Some of the agents widely used include the thyroid hormones (Gordon *et al*, 1963), derivatives of amphetamine which act as appetite suppressants (Dahms *et al*, 1978) and human chorionic gonadotropins, though it has not shown to be as effective (Stein *et al*, 1976). Acupuncture has also been tried, but alone seems ineffective (Bray, 1981).

High risk treatments

For some massively obese (morbid obesity) individuals the low risk group of therapies have proved ineffective. For them the use of surgical procedures is then carefully evaluated and when the individual has agreed they may be undertaken. Some of the surgical techniques which have been tried are intestinal bypass procedures and gastric

operation and these procedures generally carry a mortality of around 3% (Van Italliae, 1980). On the other hand, these techniques are associated with substantial weight loss which is usually maintained over a prolonged period of time (Bray, 1981). However, the operative techniques are high risk not only because of the resultant mortality but also the severe complications which may occur. Mortality and complications left aside, they are also expensive, needing 2-3 surgeons operating for 6-8 hours (Van Italliae, 1980).

Jaw wiring (attaching wires to hold the jaws together) has been done as a means to limit food intake. However the results have been poor because on removing the wires, patients tend to regain their original weight. Moreover, there are the potential risks to the dental structures as well as the hazards of aspiration. In this view jaw-wiring is best reserved for rapid weight loss prior to some other form of surgical therapy and for this reasons jaw-wiring is included among high risk treatments.

Fasting or zero calorie diet has been in use in the treatment of obesity for over 20 years. The weight loss in the early days of fasting is predominantly water. As this early and rapid loss of water slows, the contribution to weight loss made by fat becomes a greater percentage of the

total weight loss, gradually raising to 70%. Against the benefits from fasting is the fact that several deaths have occurred in the hospital during total fasting (Garrow, 1978). It has been suggested that fasting or very low calorie diets composed of protein alone can be hazardous and they are only appropriate for those who have high risks associated with their obesity (Bray, 1981).

2.5. Summary

Obesity, a form of malnutrition, has been reviewed with respect to aetiologic and epidemiologic considerations, the health risks and control. By far it is the most common and serious nutritional disease in the industrialized world. Empirically it seems to afflict the affluent and prosperous urban populations in the developing countries as well. The social factors which predispose to obesity are increasing rather than decreasing, so, unless some positive steps are taken, the prevalence is likely to increase (Garrow, 1974). There is little evidence that food intake is controlled in relation to energy expenditure either in the short-term or in the long-term and it appears that in modern man, the physiological signals of hunger and satiety are relatively easily overridden by social pressures and non-nutritional influences. According to

Stunkard (1988), the environment exerts a strong effect on the development of obesity: a diet high in fat, a sedentary lifestyle and membership of a lower social class all predict obesity in the Western society. Recently, heredity has also been shown to be a risk factor for obesity. Much of the familial characteristic of obesity is of genetic origin, the early family environment apparently playing a negligible role. The demonstration of genetic factors in human obesity is not a cause of therapeutic despair. Persons with strong genetic predisposition toward obesity, as indexed by obese parents, simply have a harder time losing weight, which they have known all along. Obesity has long been considered to have untoward health consequences and the greater the level of obesity the more severe the health consequences. More recently, it has been determined that the distribution of body fat has even more important health consequences. Whereas upper-body (abdominal) fattiness is associated with a variety of disorders including hypertension, diabetes and coronary heart disease, lower-body (hip and thigh) fattiness is essentially without severe complications. Upper-body fattiness is primarily confined to men and boys, lower-body fattiness to women and girls. Therefore, men and boys are at far higher risk of medical complications of their obesity than are

women and girls. Nevertheless, special pressures to control obesity (as observed in Western societies) are directed far more strongly toward women and girls than toward men and boys. The result then being a paradox: men who have the most to fear from obesity, are under little pressure to control their weight, while women and girls for whom obesity is relatively a minor health problem, develop an excessive preoccupation with their weight to an extent that may lead to eating disorders. The way obesity behaves differently in men and boys and in women and girls suggest that programs for the control of obesity in girls should be different from those for boys. Clinical programs of weight control have had reasonable success. However, a greater hope for the future lies not in clinical efforts but in public-health measures that are designed to prevent obesity before it occurs or when it is still limited. Such measures are directed optimally toward physical fitness and only secondarily toward obesity. School-based programs are a potential area which offer promise for success in future.

Referring to the African region most recently Muthoni (1989), states that more efforts should be directed to the prevention of this disease (obesity) and whatever the cause obesity should be tackled resolutely.

CHAPTER THREE

3. CHAPTER CONTENTS

3.1. Summary statement

3.2. Description of study setting

3.3. Design

3.4. Sample size determination

3.5. Materials used

3.6. Training of enumerators

3.7. Pilot

CHAPTER THREE

3.0. METHODOLOGY

3.1. Summary Statement

The study was cross-sectional, with descriptive and analytic components designed to determine the prevalence of obesity in an urban setting and its association with hypertension and glycosuria. Family history and socio-economic characteristics such as occupation, income and educational levels were examined in relation to obesity among the study population.

3.2. Description of the study setting

The study was conducted in Tanga situated along the northern coast of Tanzania (see maps in appendix 1 & 2). The town covers an area of 536 square kilometres and is the second largest sea port in the country on the Indian Ocean. Apart from serving Tanzania, the port also receives goods which are destined for the western neighbouring countries, Uganda, Rwanda and Burundi. The town is well served with major roads and, therefore, accessible to the other major trading centres in the country such as Arusha to the north, Dar-es-Salaam to the south, Morogoro and the new capital city of Dodoma to the west.

There are four hospitals, three health centres

and thirteen dispensaries. The largest hospital is a referral centre and it is owned by the government. The other three are run privately.

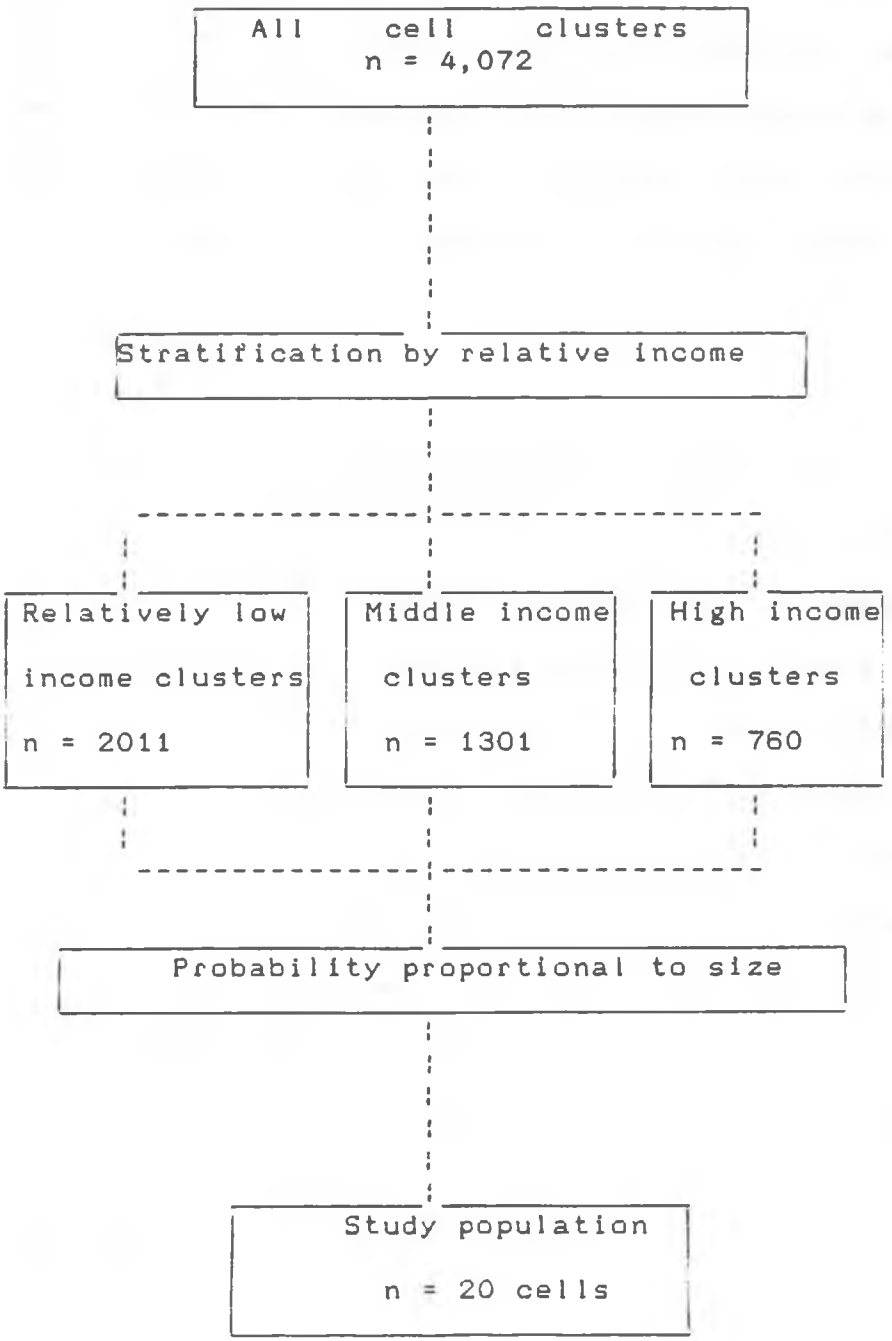
The communities are organized at the lowest level, by households grouped into "cells", each consisting of ten households. Each cell composed of these households is under the care of one person known as the "ten-cell leader" who is a functionary of the ruling party as well as the government representative at the grass-root level. The leader is elected in office by the adult members resident within the cell every five years during which period he/she becomes responsible for the leadership of the cell. There are 4,072 such cells within the town making a total number of 40,722 households with a total population of 187,455 people of whom 96,259 are males and 91,196 are females (Tanzania National Census, 1988). The population is scattered along residential clusters with relatively high, middle and low income residential clusters.

3.3. Research design

The study population was obtained from the population of 15 years and over, resident within the town drawn from the cells in the residential clusters by probability sampling. Figure 3.1 shows the schema of the basic design.

Figure 3.1

A schema of the research design.



3.4. Sample size determination

The sample included both sexes drawn from the population, 15 years and over resident within the town boundaries. However, during subsequent survey and interview, pregnant women whose gestation was three months or more were excluded. The following formula was used to determine the sample size:

$$N = \frac{Z^2 \, p \, q}{d^2}$$

Where: N = the desired sample size (the target population was greater than 10,000).

z = the standard normal deviate (approx.2, corresponding to 95% confidence level)

p = the proportion in the target population that was estimated to be the prevalence of obesity. Since it was not possible to give a reasonable estimate, the 50% (0.5) was used.

q = (1.0 - p).

d = the degree of accuracy desired, set at 5% (0.05).

Therefore $N = \frac{2^2 \, (0.5)^2}{(0.05)^2} = 400$

The minimum sample size was estimated to be 400.

3.5. Materials Used

The questionnaire

The questionnaire was designed to obtain the information needed for the objectives of the survey. Advice was sought from the investigator's supervisors during the designing stage. A pilot study was conducted by the survey team comprising of the investigator and three enumerators during which the questionnaire was pre-tested. A community in one of the suburbs was selected for the purpose and all members of the team carried out actual interviews and filled out pilot questionnaires. Depending on the experience during and after the pilot survey the questionnaires were modified and improved. Some questions were addressed differently, some deleted and some were added before the final version of the questionnaire was adopted (see appendix 3). The responses for most of the variables were initially precoded e.g. female=0, male=1, and finally for the remaining variables, a special coding system was devised to recode them so as to facilitate the data entry into the computer using the "D-Base III" program and subsequent analysis of the data was done using the "SPSS" program. Results are reported separately.

Anthropometric Measurements

Bathroom scales were used to measure weights, wooden heightmeters for measuring heights and skin-calipers with tape measures to measure skinfold thicknesses.

Clinical Observations

For the clinical observations sphygmomanometers of 13 cm cuff size with stethoscopes were used to measure blood pressure, and dextrosticks were used to test urine for sugar.

Collected information was filled in the appropriate sections of the questionnaire, one questionnaire for each client. The techniques employed in measuring are detailed under the chapter on research implementation.

3.6. Training of enumerators

Enumerators were recruited from among experienced practitioners, one of whom was a general physician and two nursing officers all with more than five years of field experience. A theoretical review of taking weight, height, skinfold, and blood pressure measurements as well as testing urine for sugar was initially conducted by the investigator, and later practical sessions followed in a clinical setting. After this stage the techniques and skills were adequately

mastered by each member of the team and a standard method agreed and adopted by the team. An exercise was also carried on outside the clinical setting to get the feel for the field situation before undertaking the pilot study. The training was completed in four weeks of at least two hour-sessions a day.

3.7. Pilot phase

This phase was planned to serve two purposes namely to test the questionnaire's ability to collect the desired information for answering the study objectives as well as to enable the team to adopt a standardized method for carrying out the measurements and for filling in the questionnaires correctly. These were accomplished before the main survey. The pilot study was conducted in a suburb located at the periphery of the town with an environment similar to that of the study area.

CHAPTER FOUR

4. CHAPTER CONTENTS

4.1. Preliminary visit

4.2. Sampling procedure

4.3. Data collection techniques

4.4. Resources and problems

CHAPTER FOUR

4.0. RESEARCH IMPLEMENTATION

4.1. Preliminary visit

Having obtained permission from the authorities at various levels to conduct the survey, preliminary visits were initially at the level of divisional headquarters. The main purpose of the study was explained to the executive officers and party secretaries who were leaders at this level, and having understood the purpose of the study, they agreed and convened meetings for the team and the ten-cell leaders at the ward level. These leaders in turn having understood what the study team was intending to do, agreed to convene meetings with their respective heads of households within their cells. Finally, after sampling, the actual survey started. Apart from explaining the purpose of the survey and obtaining permission, the meetings also served to familiarize the study team with the leaders and especially so with the ten-cell leaders who worked very closely together with the team during the survey. An explanation was given to the leaders by the team that it was due to the constraints of time and resources that only those who were selected through a random process would actually be visited. Having participated in the sampling exercise the leaders understood and

even explained the situation to the community in their respective cells.

Subsequently, for each visit within the sampled cells, the ten-cell leader would be informed in advance. He in turn would inform the heads of the households to be visited and most of the time the leader or his representative would accompany the enumerator into the houses for the purpose of introducing the team member to the clients.

4.2. Sampling procedure

All the population resident within Tanga municipal boundaries was the sampling frame from which the study population was obtained. With the help of the executive officers and the party secretaries a list of all cells in the three relative-income residential clusters was compiled for the whole town. The study cells were subsequently drawn randomly, using a probability proportional to size (P P S) technique. Thus it was found that within the town, there were 4,072 cells and the cluster distribution as follows: Within the relatively high income clusters were 760 (i.e. 18.66%) cells, the relatively middle income clusters were 1301 (i.e. 31.95%) cells and the relatively low income clusters were 2011 (i.e. 49.39%) cells. Working on the assumption that a household would have at least two of its members to

be 15 years of age and over, to get the minimum required sample size of 400 subjects, it was, therefore, necessary to survey a minimum of 200 households. By applying the "probability proportional to size technique" 4 ten-cell leaders were randomly drawn from the relatively high income clusters, 6 from the relative middle income clusters and 10 from the relatively low income clusters making a total of 20 cells and hence 200 households for the survey (see the design schema pp. 49).

4.3. Data collection techniques

A preliminary survey was done in which all the households chosen were marked with identifying numbers. All together, 725 subjects from 200 households were interviewed and examined. Whenever a household was visited during the main data collection phase and an eligible client was not available on that day, subsequent visits were arranged. Each incomplete or incorrectly filled questionnaire found on data screening at the end of a day's work, entailed a return visit for correction of the questionnaire.

Weight was measured to the nearest 0.1 kg. using bathroom scales with the subject wearing only light clothing and without shoes. Zeroing of the scale was done everytime before the weight was taken. Each subject was weighed twice and the average

weight of the two measurements was used for analysis, if the difference was not a kilogram or more as this would warrant re-weighing.

Height was measured using a wooden heightmeter where both the subject and the meter were placed to stand on a levelled base, the subject without shoes. Again, two measurements were taken and the average worked out to the nearest 0.5 centimetre and used for analysis.

Triceps skinfold thickness was measured using skin calipers on the left arm, midway between the acromion and olecranon processes. As above the values used in final analysis was the average of two measurements, reduced to the nearest millimetre.

Clinical examinations involved measuring blood pressure and testing urine for sugar. Blood pressure was determined using a 13 cm cuff sphygmomanometer, measured on the right arm with the subject in a sitting position. One measurement was taken at the beginning and one at the end of the interview. From the two readings obtained the lowest was adopted. At the same sitting, a sample of urine was collected and tested for sugar using dextrosticks and the results recorded as either positive or negative.

4.4. Resources and problems

Considerable time was spent in meetings with ten-cell leaders explaining the purpose of the study and the way the community would benefit from it. In light of the AIDS threat communities were understandingly apprehensive about the nature and risks of examinations. However, once it was explained and understood that no blood taking would be done, the anxieties were allayed and "informed consent" was obtained for the team to carry out the survey. Arrangements with the surrounding clinics and the referral hospital were made so that the newly screened persons with seemingly severe symptoms of diabetes or hypertension were referred for more elaborate workups and management while those already with established diagnosis and on treatment received a limited supply of medicines at the time of the visit. Those found with other ailments were either referred, or advice and/or treatment was prescribed by one of the physicians among the team. For those found absent during the initial visits, other subsequent visits were planned so as to cover all the eligible members in a household. Such follow-ups contributed considerably to the team's work load as well as overall time requirement.

CHAPTER FIVE

5. CHAPTER CONTENTS

5.1. Overall prevalence of obesity

5.2. Occupation and body mass index

5.3. Income as it relates to the BMI

5.4. BMI and parental obesity

5.5. BMI and the level of education

5.6. BMI, blood pressure and hypertension

5.7. BMI and glycosuria

CHAPTER FIVE

5.0. RESULTS

The investigation determined the prevalence of obesity, its relationship with socio-economic factors namely occupation, income, parental obesity, educational levels, as well as its asscciation with hypertension and glycosuria.

5.1. Overall prevalence of obesity

All together 725 subjects were studied. Of these 419 (57.8%) were women and 306 (42.2%) were men with their age distribution ranging from 15 to 65 years. From that population 192 (26.5%) were found to be obese i.e. BMI $\geq$ 30 (Bray, 1978; Taylor and Anthony, 1983; Faranghise *et al*, 1988); the rest were normal i.e. BMI < 30. From among all males 67 (22%) were obese, 239 (78%) of normal BMI. Among women 125 (30%) were obese and 294 (70%) of normal weight. There was significant ($p < .0211$) difference on the prevalence of obesity with regard to sex with a tendency for women to have higher BMIs. It was also found that the BMI increased with increasing age and so was fattiness. Conversely, leanness decreased with increasing age up to 35 years. Other investigators have reported similar findings (Taylor and Anthony, 1983). Table 5.1. shows the distribution of the study population by BMI and sex.

Table 5.1. *Distribution of the study population by BMI and sex (n = 725).*

	SEX					
	Males		Females		Total	
BMI	n	%	n	%	n	%
≥30	67	21.9	125	29.8	192	26.5
<30	239	78.1	294	70.2	533	73.5
Total	306	100.0	419	100.0	725	100.0

5.2. Occupation and body mass index

The population was classified into 4 occupational categories, namely the unemployed, casual labourers, housewives and/or small businesses and those with regular monthly salaries. The housewife and/or small business category was grouped so because 61% under this group were housewives conducting small businesses. Overall this was the category with the highest proportion of subjects 369 (51%), table 5.2. Casual labourers were the least 19 (2.6%), of whom 16 (2.2%) were males. There was a significant correlation between occupation and BMI among the population for both sexes ($r = .2142$, $p < .001$). Table 5.2. shows the distribution of the population with respect to BMI and the different occupational categories.

Table 5.2. *Distribution of population with respect to BMI and the different occupational categories (n = 725).*

	BMI					
	≥ 30		< 30		Total	
Occupation	n	%	n	%	n	%
Unemployed	25	18.7	109	81.3	134	100.0
Cas.labour	6	31.6	13	68.4	19	100.0
Small business	94	25.5	275	74.5	*369	100.0
Reg.mon.salary	67	33.0	136	67.0	203	100.0
Total	533	73.5	192	26.5	725	100.0

$X^2 = 9.10$, DF = 3, $p < .0280$

Cas. labour = casual labour
Reg. mon. salary = regular monthly salary
*Most women with small businesses were also housewives.

5.3. Income as it relates to BMI

Generally income was significantly correlated with body mass index ($r = .1301$, $p < .001$). For the purpose of analysis, the population was grouped into 3 income categories of low, middle and high income, then men and women were examined separately.

From the total of 419 *women*, 248 (59.2%) fell under the low income group, 134 (32.0%) in the middle and 37 (8.8%) in the high income group. The total number of *obese women* was 125. Of these 77

(31.0%) were in the low income group, 32 (23.9%) in the middle and 16 (43.2%) in the high income group. Though the difference between the proportion under low income and that of high income among the obese women was obvious, 31.0% and 43.2% respectively, the proportion which was under middle income i.e. 23.9% was even lower than the proportion of the obese under the low income. Therefore among women the relationship between BMI and the levels of income was not definite in either direction. Table 5.3.1. shows the distribution of women with respect to income and BMI.

Table 5.3.1. *Distribution of women with respect to income and BMI (n = 419).*

	Income							
	Low		Middle		High		Total	
BMI	n	%	n	%	n	%	n	%
≥30	77	31.0	32	23.9	16	43.2	125	29.8
<30	171	69.0	102	76.1	21	56.8	294	70.2
Total	248	100.0	134	100.0	37	100.0	419	100.0

$X^2 = 5.622$ DF = 2 $p > .0602$

From a total of 306 *men*, 140 (45.8%) fell under the low income group, 87 (28.4%) in the middle and 79 (25.8% in the high income group. From among 67 *obese men*, 21 (15.0%) were in the

low income group, 19 (21.8%) in the middle and 27 (34.2%) in the high income group. Here the relationship was quite definite in that among the obese men there was a significant ($p < .0005$) increase in the proportion of the obese with increase in income; 15.0%, 21.8% and 34.2% respectively. Table 5.3.2. shows the distribution of men with respect to income and BMI.

Table 5.3.2. *Distribution of men with respect to income and BMI (n = 306).*

	Income							
	Low		Middle		High		Total	
BMI	n	%	n	%	n	%	n	%
≥30	21	15.0	19	21.8	27	34.2	67	21.9
<30	119	85.0	68	78.2	52	65.8	239	78.1
Total	140	100.0	87	100.0	79	100.0	306	100.0

$X^2 = 10.861$ DF = 2 $p < .0005$

5.4. BMI and parental obesity

With regard to the subjects' history of parental obesity, 149 (20.6%) subjects had at least one of their parents lean, 367 (50.6%) had at least one parent mildly obese and 209 (28.8%) had at least one parent frankly obese. Body mass index was significantly correlated with history of parental obesity ($r = .2196$, $p < .001$). From among the

obese, 22.9% of subjects had parents who were not obese while 35.4% had obese parents. Table 5.4. shows the distribution of the population with respect to BMI and history of parental obesity.

Table 5.4. *Distribution of the population with respect to BMI and history of parental obesity (n = 725).*

	Degree of parental obesity							
	Normal		Mild.obese		Fran.obes.		Total	
BMI	n	%	n	%	n	%	n	%
≥30	34	22.8	84	22.9	74	35.4	192	26.5
<30	115	77.2	283	77.1	135	64.6	533	73.5
Tot.	149	100.0	367	100.0	209	100.0	725	100.0

X^2 = 16.5 DF = 2 p < .0011

Mild. obese = Mildly obese
Frank.obese = Frankly obese

5.5. BMI and the level of education

When the level of education was examined in relation to BMI among the study population there was a negative correlation (r = - .1138, p < .01). Table 5.5. shows the distribution of the population with respect to BMI and level of education.

Table 5.5. *Distribution of the population with respect to BMI and years of schooling showing the level of education (n = 725).*

	Level of education									
	0yrs		1-7yrs		8-13yrs		≥14yrs		Tot.	
BMI	n	%	n	%	n	%	n	%	n	%
≥30	34	31.2	118	25.3	32	28.6	8	21.1	192	26.5
<30	75	68.8	348	74.7	80	71.4	30	78.9	533	73.5
Tot	109	100.0	466	100.0	112	100.0	38	100.0	725	100.0

$X^2 = 2.39$ DF = 3 $p > .4953$

The results did not show any definite relationship between obesity and level of education. The test for chi-square was not significant either.

5.6. BMI, blood pressure and hypertension

The correlation between BMI and blood pressure was highly significant ($p < .001$). The correlation coefficient was .3463 and .4016 for the systolic and diastolic blood pressures respectively. The prevalence of hypertension among the obese was 31.2% as against 15.0% for those who were not obese. Tables 5.6.1.and 5.6.2. show the distribution of the population with respect to BMI, blood pressure and hypertension.

Table 5.6.1. *Distribution of the population with respect to BMI, Systolic blood pressure and hypertension (n = 725).*

	Systolic BP					
	Norm.(BP<140)		High(BP≥140)		Total	
BMI	n	%	n	%	n	%
≥30	132	68.8	60	31.2	192	100.0
<30	445	83.5	88	16.5	533	100.0
Tot.	577	79.6	148	20.4	725	100.0

$X^2 = 17.98$ DF = 1 p < .0000

Table 5.6.2. *Distribution of the population with respect to BMI, Diastolic blood pressure and hypertension (n = 725).*

	Diastolic BP					
	Norm.(BP<90)		High(BP≥90)		Total	
BMI	n	%	n	%	n	%
≥30	132	68.8	60	31.2	192	100.0
<30	453	85.0	80	15.0	533	100.0
Tot.	585	80.7	140	19.3	725	100.0

$X^2 = 22.6$ DF = 1 p < .0000

Next, the population was grouped into 3 corresponding categories of BMI and age (*terciles*) with respect to hypertension as follows:

1. Lower tercile (BMI1)
   Range: BMI = 13.52 - 23.54
   Age = 15 - 24 years.

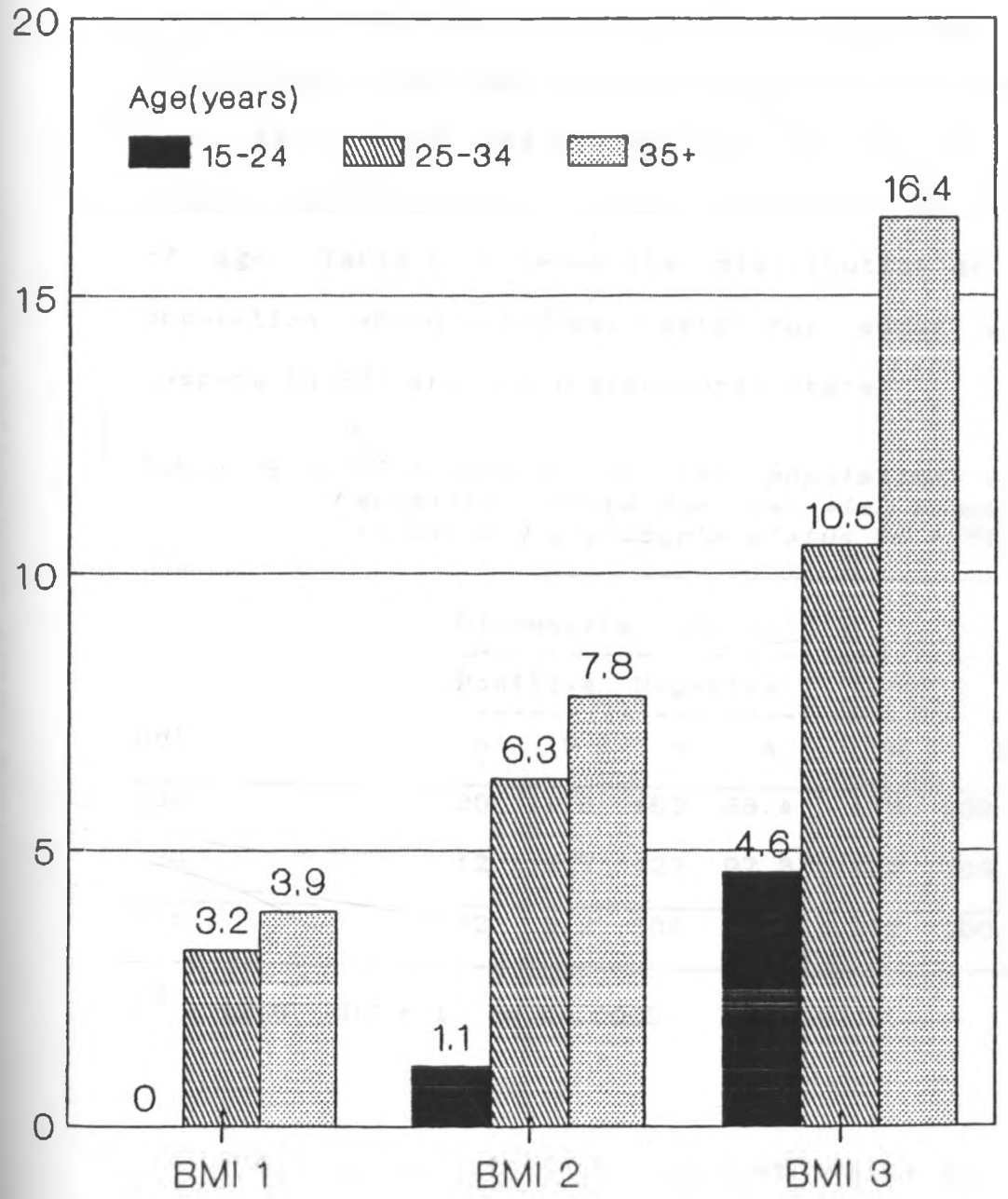
2. Middle tercile (BMI2)
   Range: BMI = 23.55 - 29.10
   Age = 25 - 34 years.

3. Upper tercile (BMI3)
   Range: BMI = 29.11 - 48.49
   Age = 35+ years.

There was a direct relationship between BMI and blood pressure in that with increasing level of BMI there was a corresponding increase in the blood pressure level, an increase that was highly significant ($p < .0001$) for both systolic and diastolic blood pressure even when controlled for age. Figure 5.2. shows the association between BMI and diastolic hypertension.

Figure 5.1

Association between BMI, age and diastolic hypertension



5.7. BMI and glycosuria

Urine was obtained from 612 (84.4%) subjects and tested for sugar. In the remaining 113 (15.6%) subjects urine could not be obtained for the test. Generally, the prevalence of glycosuria among the population tested was very low. The results showed that association between BMI and glycosuria was highly significant ($p < .0005$) in men over 25 years of age. Table 5.7. shows the distribution of the population whose urine was tested for sugar with respect to BMI and their glycosuric state.

Table 5.7. *Distribution of the population who submitted urine for test with respect to BMI and glycosuria status (n = 612).*

	Glycosuria status					
	Positive		Negative		Total	
BMI	n	%	n	%	n	%
≥30	20	11.6	153	88.4	173	100.0
<30	12	2.7	427	97.3	439	100.0
Tot	32	5.2	580	94.8	612	100.0

$X^2 = 17.8$ DF = 1 $p < .0005$

Additionally, further analyses using a correlation matrix and multiple regression equation models were performed to test the nature of the relationship among the variables BMI, sex, income, level of education, parental obesity and

occupation in the presence of each other. Bivalent variables were assigned for sex, BMI and parental obesity (parhx) as female=0, male=1; BMI=0 for non-obese subjects, BMI=1 for obese subjects; and absent=0, present=1 for parental obesity respectively. Also to be able to use type of employment (occupation) in the equation models, dummy variables were assigned as follows:

$OcVar_1$=1 if unemployed, 0 if other
$OcVar_2$=1 if casual labour, 0 if other
$OcVar_3$=1 if small business, 0 if other
$OcVar_4$=1 if regular monthly salary, 0 if other

Finally the variables income and level of education* were given values as follows:

Tscore=income; with values of
0 = Low income
1 = Middle income
2 = High income

Edlev=Educational level; with values of
1 = 0 years of schooling
2 = 1-7 years of schooling
3 = 8-13 years of schooling
4 = >14 years of schooling.

The results of the correlation matrix and the regression equation are shown in tables 5.8.1. and 5.8.2.

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* Unfortunately, information on education was precoded at the time of collection, so that it could no longer be used as a continuous variable in subsequent data analysis. The same holds true for "income".

Table 5.8.1. *A matrix showing significant correlations among the variables sex, income, occupations and educational level (n=725).*

	sex	Tscore	ocv1	ocv2	ocv3	ocv4	edlev
sex	1.0000	.2018**	-----	.1395**	-----	-----	.0971*
Tscore	-----	1.0000	-.1896**	-----	.2795**	1314** (-.)	-----
edlev	.0971*	----	----	----	-.2849**	.2725**	1.0000

2-tailed Signif: * - .01 ** - .001

Table 5.8.2. *Multiple regression equation summarizing for the dependent variable BMI; with variables sex, income, educational levels, parental obesity , and occupation, stepwise (n=725).*

Variable in the equation	B	SE B	T	Sig T
Ocv4	.11231	.03654	3.074	.0022
Sex	-.00584	.03362	-3.148	.0017
Tscore	.06544	.02245	2.915	.0037
Constant	.23716	.02638	8.992	.0000

Variables not in the equation	Beta In	Partial	T	Sig T
Parhx	-.05192	.05249	1.410	.1589
Ocv1	-.04001	-.03760	-1.010	.3130
Ocv2	.05432	.05400	1.451	.1472
Ocv3	.1809	.01364	.366	.7144
EDLEV	-.05870	-.05703	-1.533	.1258

From the analyses, it was found that sex was significantly correlated with income in favour of

males, and that the unemployed had the lowest income. Those with regular monthly salary also had higher income and highest educational level. Over all, the results showed that if one was a female, conducting small business or earning a regular monthly salary or a male conducting small business he/she had a higher probability of being obese.

CHAPTER SIX

6. CHAPTER CONTENTS

6.1. Introduction

6.2. Prevalence and significance of obesity

6.3. Determinants

6.4. Obesity, blood pressure and glycosuria

6.5. Conclusion

6.6. Recommendations

CHAPTER SIX

6.0. DISCUSSION

6.1. Introduction

The main objective of the study was to determine the prevalence of obesity among the urban population of Tanga and its relationship to occupation, income, familial obesity, level of education as well as the associated morbidity with respect to hypertension and glycosuria. To achieve this, a cross-sectional survey of randomly selected population within the urban setting was conducted. Obesity, the determinants and morbidity were assessed by anthropometry, interview and clinical examinations.

6.2. Prevalence and significance of obesity

Unfortunately during data management the variable identifying house holds was lost and therefore, the analysis was based on the total population surveyed. The overall prevalence of obesity was found to be 26.5%. This compares well with prevalence figures from the industrialized countries which range from 12% to 40% (Bray, 1979). The findings suggest that obesity seems to be an important nutritional problem also among the population studied. If this is in fact true we

would also expect to find increased morbidity levels known to be associated with obesity.

6.3. Determinants

A. Occupation was found to be a significant determinant of obesity among the population studied and especially so for those who were either running small businesses or getting a regular monthly salary. Among women, over 61% were housewives and they were also running small businesses. Thus they earned extra family income and/or lead comparatively a more sedentary life style.

B. Income was significantly associated with obesity. However, when sexes were compared at three levels of income i.e. low, middle and high income groups, the relationship was found to be highly significant in males ($p < .0005$), so that in males the higher the income the higher the body mass index and obesity. Other studies have shown that fattiness decreases with increasing income in the adult female (Garn *et al*, 1977) and yet the relationship was not clear cut in males (Van Italliae, 1985) whereas findings from this study have been the opposite. One would be tempted to speculate that with increasing income and consequently affluence, men in that community have an increased tendency to eat extra snacks and meals outside homes while this may not be so with

most women because fewer women eat outside home as compared to men. On the other hand, women with the highest educational level and a regular monthly salary or those running small businesses also had a higher probability of being obese.

C. The proportion of the population with low education compared to the proportion of those with high education did not differ significantly ($p > .4953$) with respect to the prevalence of obesity. In other words the association between BMI and level of education in absence of the other factors was not definite. Surprisingly the findings suggest that education was not an important determinant of obesity among the population although it has been reported that most of the social factors studied have been associated with obesity (Stunkard, 1988).

6.4. Obesity, blood pressure and glycosuria

The study findings indicated that with increase in body mass index there was a corresponding rise in blood pressure, and therefore the higher the risk for hypertension even when the age factor was corrected for. The relationship was highly significant ($p < .0001$). Thus at the lower tercile (BMI and age), the prevalence of hypertension was zero while at the middle tercile (BMI and age), the prevalence of hypertension was

1.1%, rising to 4.6% at the upper tercile (BMI and age). Therefore BMI was the most important predictor of hypertension in the population though the prevalence of hypertension found may be on the higher side due to the low cut-off levels used for analysis 90 and 140 for diastolic and systolic blood pressure respectively in this study.

Analyzing for diastolic blood pressure as a dependent variable to BMI and controlling for sex, it was found that the higher the BMI the higher the diastolic blood pressure and this was more significant in females as compared to males ($p < .0000$ and $p < .0140$) respectively. Stunkard, (1988) though very critical on the health consequenses of obesity among women and girls, this fact may probably not be universally applicable to all population groups as has been found in this survey. Another possible explanation could be that African women have the male type of body fat distribution.

With respect to glycosuria it was found that men over 25 years of age had significant glycosuria ($p < .0005$) suggesting that age was an important factor with respect to glycosuria during adulthood. Why this should be so only among males and not females can not yet be answered with the findings. As it has been suggested by some investigators, (Jeanrenaud, 1985), obesity and diabetes are secondary effects resulting from dysfunctions of

the nervous system and not the primary cause. The results could also be due to a large number of subjects 113 (15.6%) whose urine was not tested for sugar.

6.5. Conclusion

Obesity exists among the population with a prevalence of 26.5% which compares well with prevalences from Western societies. Important determinants were income and occupation, which in turn depended on ones' sex. Level of education was not a significant determinant of obesity except as it relates to income. Among the obese, the most important associated morbidity was hypertension. Glycosuria was found to be important in men over 25 years of age but not females.

For Tanzania's policy makers and health planners, the results make it imperative to reorient nutrition research so as to focus attention on overnutrition as well. Efforts must be directed towards determining a country-wide prevalence among urban populations, the determinants and health consequences of obesity. Based on the findings, measures for short- and long-term intervention are to be planned and implemented.

6.6. Recommendations

1. Studies on the prevalence of overnutrition (obesity) be done among other urban populations in

Tanzania and its neighbours to establish the prevalence of obesity country wide together with the associated morbidity because findings from this study indicate that the problem exists.

2. Intervention in the form of nutrition education emphazing the dangers of obesity as it relates to hypertension and diabetes, with a program to treat those already afflicted, be planned and implemented in urban Tanga.

3. School based public health programs by health planners in collaboration with education experts be designed and introduced as an early preventive measure to the youth so that it may be a long-term preventive focus for the adult population.

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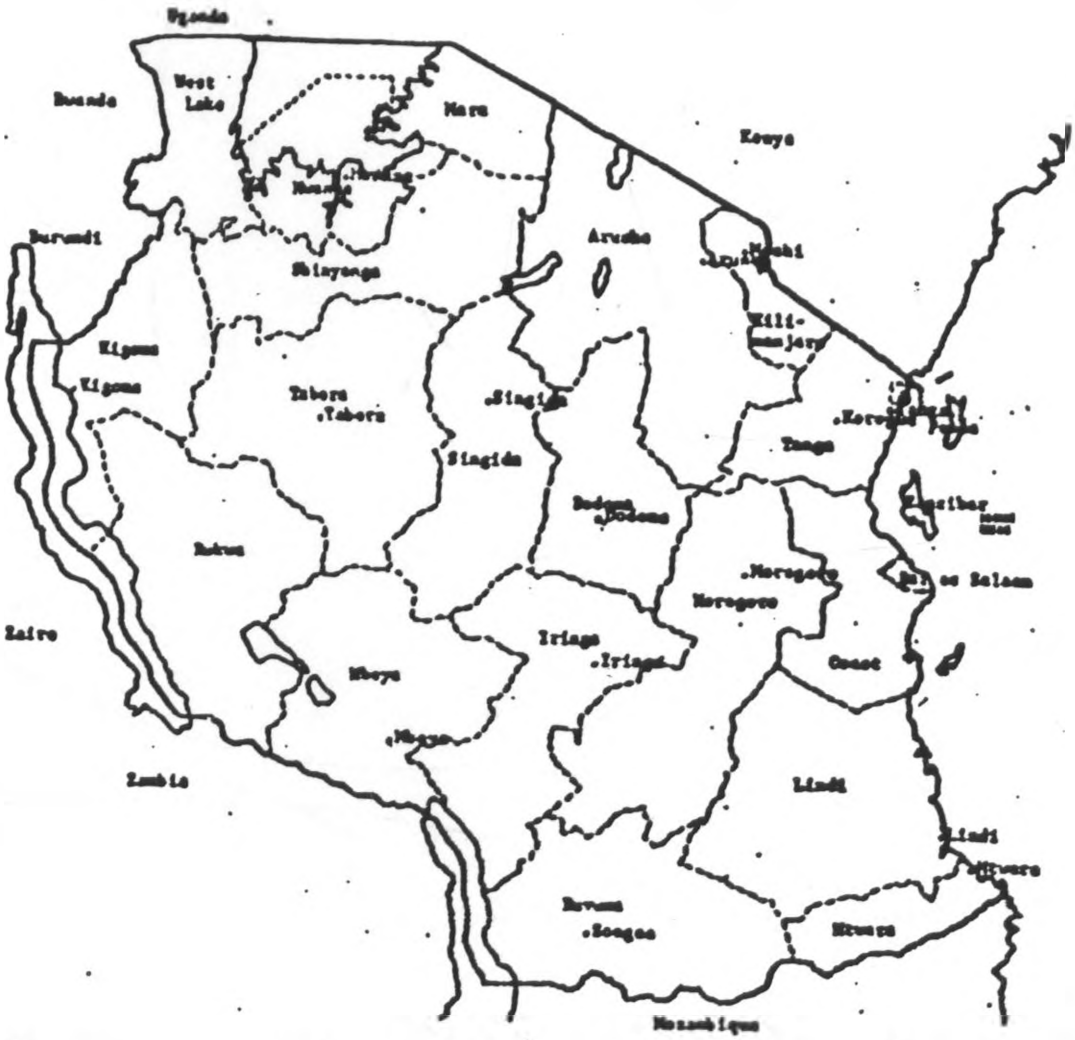
Appendix 1

The United Republic of Tanzania
Regions

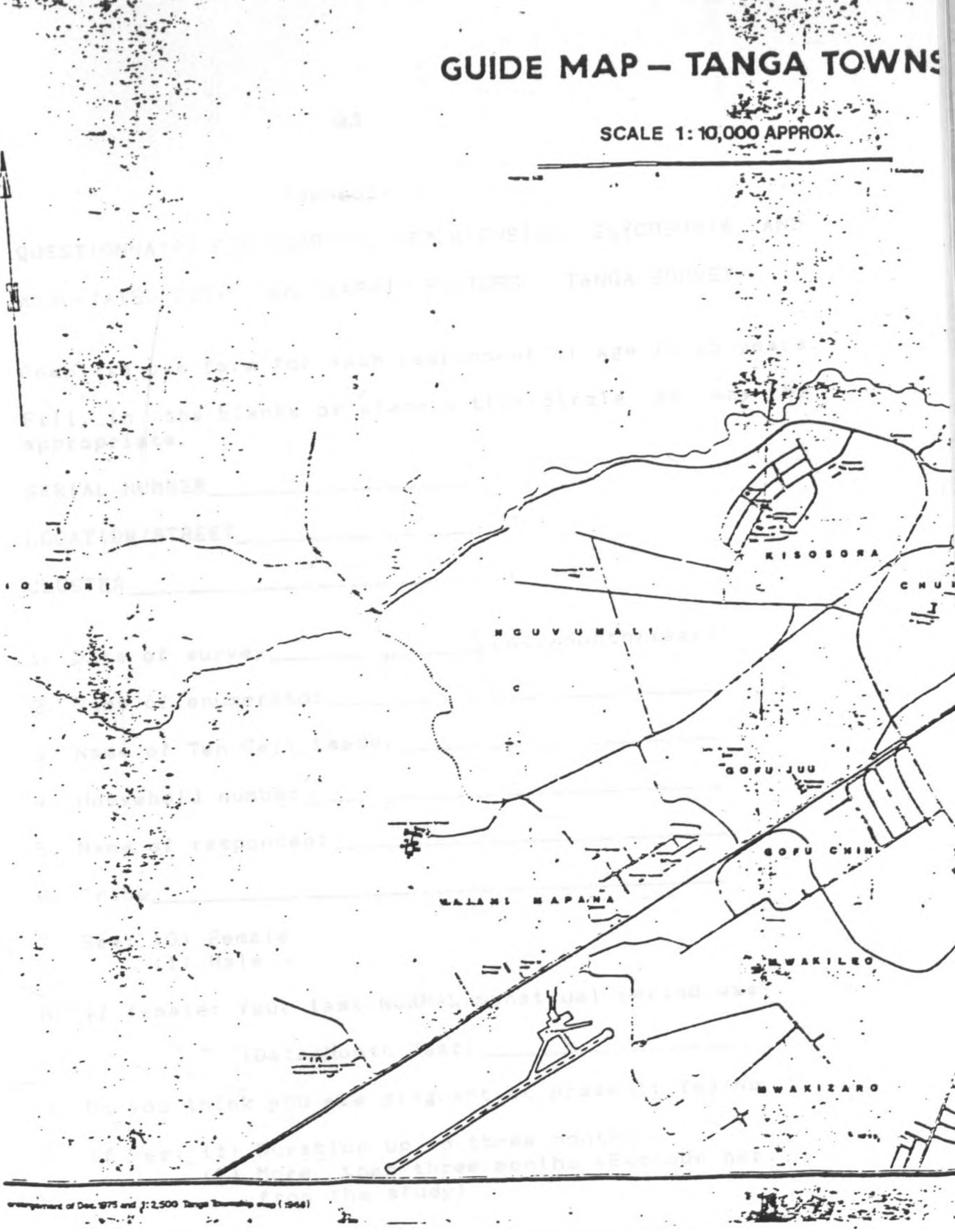


Appendix 2

Map of Study Area

GUIDE MAP – TANGA TOWNS

SCALE 1: 10,000 APPROX.



...arrangement of Dec. 1975 and 1: 2,500 Tanga Township map (1968)

Appendix 3

QUESTIONNAIRE FOR OBESITY, HYPERTENSION, GLYCOSURIA AND ASSOCIATED SOCIO-DEMOGRAPHIC FACTORS - TANGA SURVEY

Complete one form for each respondent of age 15-65 years.

Fill in the blanks or place a tick/circle as may be appropriate.

SERIAL NUMBER_____

LOCATION/STREET_____

CLUSTER_____

1. Date of survey_____(Date/Month/Year)
2. Name of enumerator_____
3. Name of Ten-Cell Leader_____
4. Household number_____
5. Name of respondent_____
6. Tribe_____
7. Sex: (0) Female
   (1) Male
8. If female: Your last NORMAL menstrual period was

   (Date/Month/Year)_____
9. Do you think you are pregnant at present: Yes/No
10. If yes: (1) Duration up to three months
    (2) More than three months (Exclude her from the study)
11. Date of birth_____ If not known
    Approximate age in years_____
12. Marital status (1) Married
    (2) Single
    (3) Separated
    (4) Widowed

13. Level of education
    (1) None/Literate class only
    (2) Primary Education
    (3) Secondary Education
    (4) Post-secondary Education

14. Occupation
    (1) Unemployed
    (2) Casual Labourer
    (3) Business/Housewife
    (4) Regular monthly salary

15. Type o work
    (1) Hard/Manual labour
    (2) Light/Sedentary work

16. Residence
    (1) Rented
    (2) Owned
    (3) Other (Specify)_____

17. If rented, monthly rent:
    (1) < 1000 Tsh
    (2) > 1000 < 2000 Tsh
    (3) > 2000 Tsh
    (4) Not applicable
    (5) Don't know/No answer

18. Ownership of Durables:
    (1) A kiosk / Shop
    (2) Refrigerator
    (3) A motor car/cycle
    (4) Video/TV
    (5) Radio/Cassette player
    (6) Sewing machine
    (7) None of those

CLINICAL EXAMINATION & ANTHROPOMETRY

19. Initial BP - Systolic
    (1)_____ (2)_____
    - Diastolic
    (1)_____ (2)_____

20. Weight (Kg to nearest 0.1)
    (_____._) (_____._)
    (_____._)

21. Height (Cm to nearest 0.5)
    (_____._) (_____._)
    (_____._)

    $WT(kg)/HT(m)^2$ (_____.__)

22. Triceps skinfold thickness
    (____._) (____._)
    (____._)

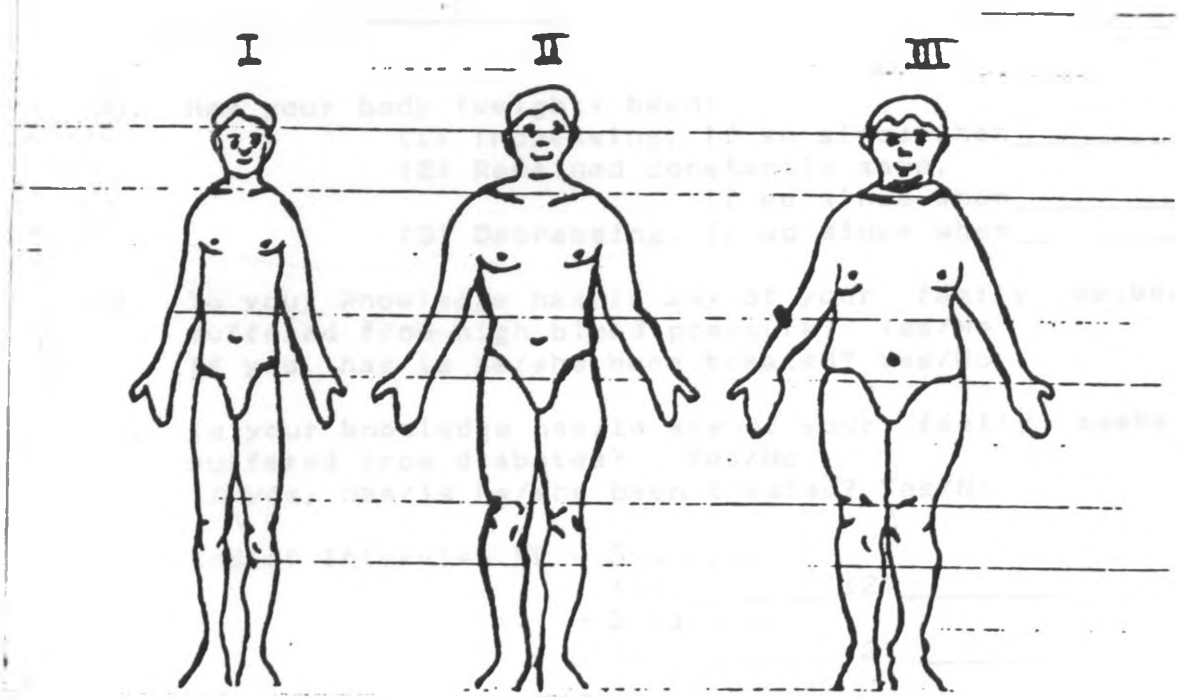
23. Waist circumference (Cm to nearest 0.5) midway between lower rib margin and iliac crest
(_____._) (_____._)
(_____._)

24. Right thigh circumference at the level of gluteal fold (____._) (____._)
(____._)

25. Urine sugar (0) Negative
(1) Positive
(00) Not tested

26. Subject's own impression of his/her weight:
Do you think you are overweight?
(1) Yes
(2) No
(3) I don't know

27. Through the use of the drawings below, identify your parents (father/mother) and siblings body build:



	Type I	Type II	Type III
Father			
Mother			
Brothers			
1			
2			
3			
4			
5			
Sisters			
1			
2			
3			
4			
5			

28. Has your body (weight) been:
    (1) Increasing, If so since when_____
    (2) Remained constantly same,
        If so since when_____
    (3) Decreasing, If so since when_____

29. To your knowledge has/is any of your family member suffered from high blood pressure? Yes/No
    If yes, has/is he/she been treated? Yes/No

30. To your knowledge has/is any of your family member suffered from diabetes? Yes/No
    If yes, has/is he/she been treated? Yes/No

31. End of interview BP - Systolic
    (1)_____ (2)_____
    - Diastolic
    (1)_____ (2)_____