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Obesity in South Africa: challenges for government and health professionals

H Salome Kruger[1,*], Thandi Puoane[2], Marjanne Senekal[3] and M-Theresa van der Merwe[4]
[1]School of Physiology, Nutrition and Consumer Science, North-West University, Potchefstroom 2520, South Africa: [2]School of Public Health, University of the Western Cape, Bellville, South Africa: [3]Department of Physiological Sciences, University of Stellenbosch, Stellenbosch, South Africa: [4]Senior Consultant Physician Endocrinologist, Johannesburg General Hospital, Johannesburg, South Africa

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Abstract

Objectives: To review data on the prevalence, causes and health consequences of obesity in South Africa and propose interventions to prevent and treat obesity and related outcomes.
Methods: Data from existing literature were reviewed with an emphasis on changing eating and activity patterns, cultural factors, perceptions and beliefs, urbanisation and globalisation. Results of studies on the health consequences of obesity in South Africans are also reviewed.
Results: Shifts in dietary intakes and activity patterns to higher fat intakes and lower physical activity are contributing to a higher prevalence of obesity. Few overweight black women view themselves as overweight, and some associate thinness with HIV/AIDS. Glucose and lipid toxicity, associated with insulin resistance, play roles in the pathogenesis of the co-morbid diseases of obesity. Elevated free fatty acids in the black population predispose obese black patients to type 2 diabetes.
Conclusion and recommendations: Obesity prevention and treatment should be based on education, behaviour change, political support, intersectoral collaboration and community participation, local actions, wide inclusion of the population, adequately resourced programmes, infiltration of existing initiatives, evidence-based planning, and proper monitoring and evaluation. Interventions should have the following components: reasonable weight goals, healthful eating, physical activity and behavioural change. Genes and mutations affecting susceptibility to the development of co-morbidities of obesity and vulnerable periods of life for the development of obesity should be prioritised. Prevention should be managed in community services, identification of high-risk patients in primary healthcare services and treatment of co-morbid diseases in hospital services.

Keywords
Obesity
South Africa
Urbanisation
Cultural beliefs
Diet
Physical activity
Insulin resistance

Obesity as a risk factor for non-communicable diseases is a global public health concern. It is estimated that more than one billion adults are overweight, of which at least 300 million are obese[1]. Countries in economic transition from undeveloped to developed, such as China, Brazil and South Africa, are particularly affected and have an increased rate of obesity across all economic levels and age groups[2]. Over the past decade, the main focus of public health programmes in Sub-Saharan Africa has been the eradication of undernutrition and infectious diseases. While undernutrition remains a problem among children, particularly those residing in rural areas[3], obesity and associated non-communicable diseases such as type 2 diabetes, hypertension and ischaemic heart disease (IHD), which were thought to be a problem of affluent countries, are now increasingly becoming prevalent among all population groups in South Africa[4–6]. Ethnicity has a major impact on the incidence and pathogenesis of co-morbid diseases throughout Africa[7]. In urban areas, poor households undergoing industrialisation are particularly affected. In these households underweight often coexists with obesity[8,9]. This situation poses a challenge to government as to the type of interventions that are needed for this population.

Misrepresentation of health information in South Africa from the 1960s until the late 1980s led to the concept of 'benign obesity'[10]. Not surprisingly, this concept has compounded the problem of obesity, and treatment of some of the co-morbid diseases has been neglected. Fortunately, as an increasing number of studies draw us inevitably to the reality of the disease, the misperception of 'benign obesity' is being corrected[4–6,11–13]. This allows

*Corresponding author: Email vgehsk@puk.ac.za

us to address the real issues underlying the current epidemic, and to recognise and manage the co-morbid diseases, in particular type 2 diabetes.

Overweight is listed by the World Health Organization (WHO) as one of 10 leading risk factors for high mortality in developing and developed countries that contribute to the burden of disease, as measured by disability-adjusted life years[14]. Health consequences of obesity are increased morbidity and mortality, with significantly increased healthcare costs[15]. Obese individuals are at a social disadvantage and may be discriminated against in employment opportunities[16].

The present paper explores factors behind this complex situation in South Africa. It further suggests interventions that will help reduce the prevalence of obesity and related outcomes.

Current South African situation

Childhood and adolescent obesity

Earlier regional studies reported that approximately 10% of children were relatively overweight for age and that overweight was almost non-existent among younger boys in rural areas[17–19]. Generally females were more prone to obesity, with more overweight occurring prior to the growth spurt at 10 years, as well as after menarche[19]. In a study of 447 rural children, none of the boys were overweight before the age of 15 years, after which there was an increase in subcutaneous skinfold thicknesses with a peak at 17 years. Over-fatness, defined by sum of triceps and subscapular skinfold thicknesses greater than the 85th percentile, increased markedly in girls after menarche and peaked at 17 years, with 11% of girls being over-fat[18].

The results of a nationally representative study of 1–9-year-old children showed that 6.7% of them were overweight and 3.7% were obese[3]. When the body mass index (BMI) standard proposed by Cole *et al.* [20] was used as a standard, 17.1% of the children were classified as overweight or obese. The highest prevalence of overweight was found among urban children (20.1%), followed by tribal children (15.8%), and the lowest prevalence was found among children living on farms (10.8%)[3]. The First South African National Youth Risk Behaviour Study of grade 8–11 schoolchildren (13–19 years) showed that 17% were overweight and 4% obese according to Cole's BMI standards[20,21].

Stunting and overweight

Popkin *et al.* described an association between stunting and overweight among children from developing countries, including South Africa[22]. In studies of stunted children aged 8–11 years[23], 10–15 years[24] and 9 years[25], a greater BMI is a reflection of the greater reduction in height rather than greater weight[26]. However, stunted children may be programmed to accumulate a greater percentage of body fat during adolescence, especially in the abdominal area[24–26]. Increased body fat deposits in stunted children may be due to a lower fasting fat oxidation rate, lower habitual physical activity, or both[26,27].

Obesity in adults

Research that was done among South African black (63.7% from rural areas) and white first-year female students indicated that black students are more likely to be either underweight or overweight/obese ($n = 231$: underweight 26.8%; overweight 18.2%; obese 6.5%)[28] than their white counterparts ($n = 361$: underweight 7.2%; overweight 10%; obese 0.8%)[29]. This clearly illustrates the coexistence of undernutrition and overnutrition in specific groups. If the 1987 weight status of white female students is considered, it is evident that the prevalence of overweight/obesity at that time point ($n = 361$; overweight 6.7%; obese 0.95%)[30] is similar to what was found in 2002[29], indicating a small increase in overweight over 15 years.

Several international studies have reported increases in obesity prevalence during the past decades[1,2,16]. A national survey of 1998 undertaken in all population groups reported that a third of men and more than half of women were overweight or obese[31]. This is a dramatic increase from the previous prevalence reported for black women[4,32]. Although the increase was observed particularly in black urban African women, a review of some regional studies in different ethnic groups found that rural women are equally affected, as 39–52% and 24–39% of rural women were overweight and obese[33]. In a study of 1040 black women in the North West Province it was found that rural women had a lower mean BMI than urban women. However, in this study, rural women still ingested less fat, had lower household incomes and higher physical activity than urban women[34]. Among 554 economically active South African adults, more than half of white men studied (56.4%) were overweight or obese. High percentages of black men (49.3%) and black women (74.6%) were overweight or obese, whereas the prevalence was lower among men (45.7%) and women (66%) of mixed ancestry, Asian men (35.5%) and women (37%), and white women (42.2%)[35].

Reasons for the obesity epidemic

Urbanisation and globalisation

The obesity epidemic among South Africans reflects globalisation, which is the primary driving mechanism towards nutritional transition. More freedom of movement of the black population and an increase in exposure to the global market economy led to a shift from traditional foods low in fat and rich in fibre, towards meat and dairy products containing high levels of saturated fats and more highly refined foods[5,36]. Globalisation thus increases the risk amongst the urban population by creating an

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environment that promotes consumption of food rich in fat and sugar[37]. As such, South Africa is no exception and has become the most important African market for 'Coca-Cola', and one of their largest markets in the world[38].

Rapid and unplanned urbanisation accelerates changes in traditional diets and physical inactivity, and provides ready access to tobacco products and high-fat foods, all risk factors for non-communicable diseases[39]. Migrants often settle in informal settlements on the periphery of cities. These living conditions have consequences for the preparation, consumption and hygiene of the food of urban blacks[5,39].

Socio-economic factors

South Africa is classified as a developing country and many South African households still live with poverty[40]. Factors such as poverty, violence, rapid social and economic changes, lack of education, inadequate services and urbanisation contribute to increasing cases of non-communicable disease as they do to HIV, tuberculosis and other communicable diseases[39–41]. Factors associated with an elevated BMI in South African children aged 1–9 years were living in a traditional house and having a flush toilet[3]. The link between low education level and higher BMI was confirmed in a group of economically active South Africans representing four different ethnic groups in the country[35]. In the 1998 national survey, obesity was associated with age, level of education, ethnicity and area of residence[31]. Similar risk factors were reported in the study of economically active people, in addition to inactivity and at least one overweight parent[35].

Cultural factors, perceptions and beliefs about body weight

Culture shapes eating habits. Social gatherings in some cultures encourage overeating, as there is abundance of food. Some African countries associate certain food with social status. These luxurious foods, high in fat and energy, are becoming more accessible to urban South Africans and include meat, animal fats, chocolates, biscuits, soft drinks and fried foods[42].

In the international literature it is proposed that, compared with white women, non-Westernised and some groups of Westernised black women adopt a larger ideal body size and that they are more accepting of being overweight. They also experience less pressure, especially from men, to be thin and are thus less likely to aspire to be thin[43]. Younger women and those with higher levels of education are aware of, and aspire to, the slim body shape[44]. The perception held by the black population in general reflects differently[9,45–47]. A national survey as well as small regional studies reported that few overweight and obese women view themselves as overweight, and that moderately overweight women are perceived by the community as attractive, and that this is associated with respect, dignity and affluence[9,31,45–47]. In certain instances black women associate thinness with illness and now with HIV/AIDS[45,48].

Many overweight and obese South African women do not want to lose weight although they may be aware of the health consequences of being overweight[9,45,47]. This acceptance of their own obesity, together with previous perceptions about 'benign' obesity, may hinder the effectiveness of weight-control programmes[11,47]. However, anecdotal reports and scientific research among black female students point to the fact that there are also signs of assimilation of Western cultural norms concerning body shape, eating attitudes and behaviours as well as weight management[28,46]. It is therefore always important to bear in mind that dieting, weight loss and weight cycling could be potentially harmful and that it could actually pave the way to the development of eating disorders.

Dietary practices

Weak correlations between dietary energy, fat intakes and BMI of South Africans have been reported[34,49], but foods consumed by urban subjects indicate a high fat intake and apparently contribute to increasing obesity among South Africans[34,36,49]. Dietary practices have been identified within this context and are illustrated in Box 1[48].

MacIntyre *et al.*[36] reported increasing fat intakes over five different strata of urbanisation, with a mean of 30.6% of the energy provided by fat among urban subjects, compared with 22.9% among rural subjects. The mean daily fat intakes of urban subjects were 23 g higher than those of rural subjects. In rural and township areas, shops and street vendors stock only full-cream dairy products, cheap fatty meat and fatty snacks such as '*vetkoek*' (fried fat cakes), and few fruits and vegetables[47–50]. Other fatty foods sold by street vendors include Russian sausage, deep-fried fish, cooked sheep head, fried liver, French fries, '*umhqamulo*' (cow's head), tripe, chicken pieces and giblets, cow's feet, chicken feet, heads and eggs[50].

Physical activity

A few regional studies describe the physical activity pattern of South Africans. Low levels of physical activity have been documented in young women who did not complete their schooling, as well as the elderly[11,12,34]. In two large studies in urban black communities in the Western Cape, 30–40% of subjects reported low levels of activity during their work and leisure time[11,12]. Less than one-third of the study sample in the North West Province, which included rural and urban subjects, could be described as moderately active. Participants living on farms were the most active, due to hard physical work, daily walking and some sport activity in men[51].

Certain environmental factors prevent South Africans from engaging in optimal physical activity[5,12,51]. The absence of physical activity education in many South African schools and television viewing for more than 3 h daily are considered to be important factors contributing

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Box 1–Ecology of obesity[48]

Zanempilo provides primary healthcare services in the townships of Cape Town. Community health workers (CHWs), residents of Khayelitsha, shared the same socio-cultural and demographic profiles as ordinary members of this community. As part of an initiative to address the problem of obesity, a participatory approach was used to collect baseline data from CHWs on barriers to healthy living, including risk factors, prevention and treatment of diabetes.

Of 44 CHWs measured, two were normal-weight, two were overweight, 25 were obese and 15 were extremely obese. Most perceived moderately overweight women as attractive, associated with dignity, respect and confidence. Negative aspects were continuous body aches and tiredness. Photographs showed unhealthy food preparation and large portion sizes. Barriers to physical activity included fear of losing weight, personal safety and lack of exercising.

'*I am scared of exercising because I will lose weight and people may think that I have HIV/AIDS.*'

They also had a very limited knowledge about nutrition:

'*People who boil food are not civilised. Fried food is attractive and tasty such as "Kentucky Fried Chicken". If your neighbour boils food people say she is still backward because the food does not taste nor look attractive.*'

They also highlighted important environment factors:

'*There is a shortage of healthy, low-fat food and little fresh fruit and vegetables in the townships. The majority of local shops sell cheap fatty foods. Street vendors' stalls sell fatty meat and sausages.*'

'Low-fat milk is not available in our shops', stated one of the CHWs after she had tried to cut down on the fat in her diet.

to the increasing prevalence of overweight among schoolchildren[21]. A combination of poor environmental conditions with lack of facilities and high crime rates, and attitudes towards thin people, seem to contribute to low levels of physical activity among South Africans[21,51]. Maia *et al.*[52] reported that playing traditional games had a significant impact on the physical fitness of 8–12-year-old girls in Mozambique. In this group formal sports were not important and the girls relied on traditional games and household activities for their exercise needs. Apparently, with urbanisation South African children are not playing traditional games as often as before, possibly due to high crime rates in urban areas and fear of playing outside[5,21].

Physical activity index was negatively associated with BMI in African women in the North West Province[34]. In the same study men were significantly more physically active than women. The highest mean systolic blood pressure, serum total cholesterol and low-density lipoprotein cholesterol levels were found in the most inactive subjects[51]. Lack of physical activity in peri-urban subjects in the Western Cape was a significant risk factor for type 2 diabetes mellitus[11].

Health consequences of obesity

It has been recognised for some time in South Africa that urban black women have a lower mortality from IHD than do white women[53], and the black population has a less atherogenic fasting lipid profile compared with whites[54]. However, for almost three decades (1960s to the late 1980s), this notion was carried without examining the association of obesity with other co-morbid diseases, including glucose intolerance and type 2 diabetes, hypertension, cerebrovascular accidents and peripheral vascular disease. It was assumed that because there was no apparent association between obesity and IHD or an atherogenic lipid profile, obesity in black South Africans was without consequence[10]. Since that time, it has become evident that peripheral insulin resistance and type 2 diabetes are more prevalent in black women[55]. This highlights the importance of ethnicity with regard to the differential manifestations of the metabolic syndrome[56]. With regard to co-morbid diseases, urban black women who have a Westernised diet and lifestyle present with more hypertension (30% vs. 15%) and a higher prevalence of type 2 diabetes (7% vs. 3.6%) than do white women[57,58].

In black South Africans with type 2 diabetes attending primary healthcare services in urban and rural areas, obesity was prevalent in 15–16% of men compared with 35–47% of women[59]. In Indian patients with a transiently impaired glucose tolerance, lower prevalence of obesity is associated with reversion to normal glucose tolerance[60]. In black South African women measures of central obesity were more strongly associated with components of the metabolic syndrome than BMI[13,61]. Severe obesity was present in 36.5% of diabetics under care in the public health sector in a district in rural KwaZulu-Natal[62]. In addition, stroke is a major public health problem amongst black South Africans, possibly because of an increase in hypertension, obesity, smoking habit and hyperfibrinogenaemia during various stages of urbanisation[6].

Black South Africans may still be protected against IHD because of favourable serum lipid profiles (low cholesterol and high level of high-density lipoprotein cholesterol)[54]. However, increases in total fat and animal protein intakes of affluent black South Africans, who can afford

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Western diets, are associated with increases in BMI of men and women and in serum total cholesterol. These exposures may increase IHD risk in the future[4,6].

Since the early 1990s the influence of ethnic variability on the pathogenesis of metabolic and anthropometric differences that accompany obesity, as well as its co-morbid diseases, have been redefined. With regard to metabolic changes, when compared with white urban women matched for BMI and body composition, black women have:

- A higher degree of insulin resistance, once hypertension is present[63].
- A higher degree of adipose tissue insulin resistance *in vitro* and *in vivo*[64,65].
- Higher post-absorptive free fatty acid and leptin concentrations with relative insulinopenia[66].
- A brisker rate of adipose tissue lipolysis *in vivo*[66–68].
- Lower fasting and 3-hour triglyceride concentrations[69,70].
- Lower fasting cortisol[70].

With regard to anthropometric differences, when compared with white urban women matched for BMI and body composition, black women have less visceral fat. The greater visceral fat mass in obese white women may have been promoted by higher cortisol levels and may lead to a more atherogenic fasting and postprandial lipid profile[66–71].

To summarise, contrary to previously published data, insulin resistance appears to be an important factor in black South African patients with hypertension, obesity and diabetes (the metabolic syndrome)[64–69]. The cause of the insulin resistance appears to be related to insulinopenia and elevated free fatty acids from enhanced lipolysis[64–71]. Elevated free fatty acids in the black population may be partly explained by the reduced antilipolytic effect of insulin on adipocytes[64–67] and may therefore predispose obese black patients to adverse clinical consequences, such as type 2 diabetes[72]. The consideration of certain new therapeutic options, such as the insulin sensitisers, may be of particular use in the treatment of obese black patients with type 2 diabetes.

Possible interventions to prevent and treat obesity

Prevention programmes

From a public health point of view it is essential to focus on obesity prevention to address the steady rise in the prevalence of obesity. At the first WHO Expert Consultation on Obesity, the development and implementation of effective obesity prevention strategies were identified as an immediate action priority[73]. To guide this process, South African researchers and health workers should take note of the following proposed principles upon which obesity prevention should be based:

1. Interventions should focus on education and address environmental and social factors to promote and support behaviour change.
2. Increased physical activity.
3. Sustainability of programmes is crucial to ensure positive change in diet, activity and obesity levels over time.
4. Political support, intersectoral collaboration and community participation are essential for success.
5. Local actions within the context of national initiatives allow programmes to meet needs, expectations and opportunities.
6. All parts of the population must be reached.
7. Programmes must be adequately resourced.
8. Integration of new programmes within existing initiatives.
9. Programme planning should be evidence-based.
10. Programmes should be properly monitored, evaluated and documented to ensure dissemination and transfer of experience.

Kumanyika *et al.* [73] emphasise that the impact outcome relating to the ultimate level of obesity in a population, as well as the process outcomes, could take years to achieve.

To ensure the correct focus for obesity prevention, the US Institutes of Medicine suggest the following three levels of prevention:

1. Universal prevention interventions, focused on everyone in an eligible population irrespective of their current level of risk, that may be family-based, school-based, work site-based or community-wide[74].
2. Selective prevention interventions, focused on the prevention of obesity in selected high-risk groups, based on known biological, psychological or social/cultural risk factors, will focus on the development of lifetime behavioural patterns that will prevent obesity[16,74].
3. Targeted prevention that focuses on individuals who are overweight and aims to prevent weight gain, as well as the development of co-morbidities[16,74].

Obesity prevention initiatives should be focused on children to ensure the adoption of a healthy lifestyle from an early age.

All programmes should aim to empower individuals/groups to take responsibility for making permanent lifestyle changes towards healthy dietary intake and physical activity through behavioural modification[75], with the components described in Table 1.

Finally, the mode of delivery of prevention programmes needs to be considered. Thomas[74] mentions the following possibilities:

1. Do-it-yourself in self-initiated or group settings. Self-help programmes are seen as low-intensity, cheaper intervention methods, associated with better longer-

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term compliance but poorer weight loss outcomes than higher-intensity methods[76].

2. Non-clinical programmes provided to individuals/groups by trained professionals, not necessarily registered healthcare professionals. Information on diet, exercise and behaviour modification is provided at regular meetings. These programmes are popular and often commercially franchised[74].
3. Clinical programmes, provided by registered healthcare professionals with specialised training in weight management[74]. These could involve a consultation with a dietitian, medical doctor or a multidisciplinary team.

Primary healthcare interventions

In the treatment of actual obesity all the above-mentioned components for prevention programmes need to receive attention. Additional issues in this process include the rate of weight loss, the energy deficit that needs to be created, the possibility of pharmacological and/or surgical treatments, and the role of genetics in this whole process. Obesity needs to be viewed as a disease in its own right and one that warrants intervention even when co-morbidities are not present. To ensure long-term success emphasis should be placed on repeated small but permanent losses of no more than 0.5–1.0 kg per week[78].

Lifestyle interventions

According to the US National Institutes of Health, safe weight-loss diets (combined with physical activity) should ideally not provide less than 5020 kJ for women and 6300 kJ for men[79]. A combination of resistance training as well as aerobic exercise, 45–60 min on most days, is needed to optimise the reduction in visceral adiposity, decrease the percentage body fat and increase the percentage muscle mass[80].

Stakeholders from government (Departments of Education, Health and Safety and Security) need to understand factors contributing to decreased physical activity among children, as well as adults, and the effects of inactivity on health. They should initiate programmes to increase physical activity among South Africans. Stakeholders from the health professions, non-government organisations and communities should also become involved in these efforts. In all interventions aimed at preventing and managing overweight and obesity, systematic assessment and evaluation should be a routine element. The incorporation of BMI and waist circumference as part of a risk factor tool to be used at primary healthcare level may be the first step in the direction of recognition of chronic non-communicable diseases by the Department of Health. Measuring of fasting glucose in all patients with BMI $>30\,kg\,m^{-2}$ may be the most significant move by government, to date, in identifying the most life-threatening and prevalent complication of obesity, namely type 2 diabetes. However, lifestyle modification as an isolated tool for weight management has a high failure rate and less than 5% of patients have been reported to remain successful after 5 years[81].

Pharmacotherapy

The use of drug therapy should be aimed at long-term weight management to reduce the need for other drugs that are often prescribed for the complications of obesity such as analgesics, lipid-lowering, antihypertensive and oral hypoglycaemic drugs. On average, a weight loss of 5–15% can be expected over a period of approximately 3–6 months on the available prescription drugs[82]. Patients losing 2 kg by 1 month, or 5% of initial body weight by 12 weeks, should be encouraged to remain on lifelong therapy. It is speculated that 19% of the obese patient population displays the characteristics of psychological readiness for intense treatment strategies, including pharmacotherapy. Drugs previously used in the management of obesity had addictive potential and serious side-effects, such as pulmonary hypertension and valvular heart disease[82], and have been withdrawn. Weight loss as well as improved health have been reported after treatment with sibutramine, a satiety enhancer[83]. Two large prospective studies have shown remarkable long-term success of obesity management with sibutramine[83] and orlistat[84]. Studies evaluating the effect of growth hormone replacement[82] and rimonabant[85] on body

Table 1 Essential components for weight management interventions

Component	Description/guidelines
Reasonable weight goals	Individualised, realistic, maintainable, contribute to general well-being[76]
Healthful eating component	Based on the 2004 South African food-based dietary guidelines[77] Limiting energy, fat and alcohol intakes[78]
Physical activity component	Accumulate 45–60 min of moderate-to-vigorous activity on most days – accumulating 10 min here and there is acceptable Increased activity of daily living, fitness and recreational activity, strength and flexibility exercises[78]
Behavioural and psychological component	Long-term lifestyle (dietary and physical activity) changes; self-concept, body image, stress management, communication and environment management, cognitive behavioural skills necessary to bring about change To ensure success the 'stage of change' of the individual/target group needs to be considered[75,76]

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composition have illustrated a potential for drug treatment.

Surgical treatment

Bariatric surgery for weight loss includes gastroplasty and procedures involving bypassing a portion of the intestine. The surgical treatment of obesity is recommended as a treatment option for adults or adolescents in whom the epiphyses have closed, with morbid obesity, where intensive conventional treatment has failed. Patients should not be at anaesthetic risk or have clinical or psychological contraindications. Significant weight changes for surgically treated patients were documented over 8 years in the SOS (Swedish Obese Subjects) study, with significant improvement of co-morbidities[86].

Nutrition genomics

With the completion of the human genome project, a new era in nutrition-related health management, namely nutrition genomics, started evolving. Nutrition genomics focuses on the fact that dietary components affect molecular processes such as DNA synthesis, gene expression and metabolism, which in turn may affect disease initiation, development or progression. The fact that genetic variation can influence nutrient metabolism, as well as the effectiveness of medications for the treatment of obesity, is also considered[87]. Determining individual and population patterns in genetic makeup and possible relationships with environmental factors such as diet and physical activity could possibly contribute to the formulation of individual- or population-specific dietary and physical activity guidelines for personalised treatment. Obesity prevention and treatment can thus focus on those lifestyle factors that interact with a specific individual's genotype[88].

Conclusion and recommendations

It seems therefore, that in a country undergoing rapid industrialisation, both glucose and lipid toxicity play roles in the pathogenesis of the co-morbid diseases of obesity. Different ethnic groups are not necessarily affected to the same degree, but insulin resistance is the most frequently documented factor underlying the individual components of the metabolic syndrome. Obesity and its related insulin resistance should not be viewed as a benign condition amongst any ethnic population of South Africa.

Obesity cannot be managed solely at the individual level. Communities, governments, the media and the food industry need to work together to modify the environment so that it is less conducive to weight gain and to create a supportive environment using a multisectoral approach, including antipoverty measures, food production strategies, water, sanitation and proper housing. Strategies should include consumer education, appropriate food labelling, nutritional and physical activity education, as well as efforts to ensure scientific management of the content of advertising. Trade policies should prevent the flooding of local markets with cheap and unhealthy foods that also impact negatively on agricultural employment.

It is essential that the full range of factors implicated in the pathogenesis and development of obesity, from both an individual and a population perspective, should be fully investigated. In particular, the identification of genes and mutations responsible for the susceptibility to the development of co-morbid diseases and the relative importance of vulnerable periods of life for the development of obesity should be highly prioritised. In South Africa, obesity management programmes should be established within healthcare and community services. Primary healthcare services should play a dominant role in identification of high-risk patients, but hospital and specialist services will be required to deal with complicated patients and to provide optimal treatment of the co-morbid diseases.

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