

Contextual trend in preventing obesity epidemic in developing countries: role of the key players

Christopher Ekpenyong, Ernest Akpan

Department of Physiology, College of Health Sciences, University of Uyo, Akwa Ibom State, Nigeria

Email address:

Chrisvon200@yahoo.com(C. Ekpenyong), akpansons200@yahoo.com(E. Akpan)

To cite this article:

Christopher Ekpenyong, Ernest Akpan. Contextual Trend in Preventing Obesity Epidemic in Developing Countries: Role of the Key Players. *European Journal of Preventive Medicine*. Vol. 1, No. 1, 2013, pp. 20-31. doi: 10.11648/j.ejpm.20130101.12

Abstract: Today, the World Health Organization warns that the greater future burden of obesity and diabetes will affect developing countries with the extent doubling with urbanization. Aside from the estimation that, currently, more than 1.6 billion (age 15+ years) adults are overweight and at least 400 million of them are obese, it was also estimated that obesity account for 2-6 % of the total health care cost in several developed countries and some estimates put the figure as high as 7%. The true costs are undoubtedly much greater as not all obesity related conditions are calculated. Some developing countries aim to attain the millennium development goals (MDGs) by 2015, which prospects the reduction in rate of tuberculosis, malaria, maternal and infant mortality rates, and childhood malnutrition, however little or nothing is done to curb the ever-growing obesity epidemic and its accompanying non-communicable diseases (NCDs) burden. The fact therefore is that, the developing countries' health sector garbles with the double burden of disease from the threat of both NCDs and infectious diseases. This review based on literature search from PubMed, MEDLINE, and Google Scholar aims to highlight the prospects of preventing and managing the obesity epidemic in developing countries through a multifactorial, multidimensional and proactive approaches. It concludes on the need for a less cost effective, multi-sectional, far reaching population based intervention plan by the key players of the health sector in such countries which should incorporate the need for regular exercising, good nutritional habits, body weight image assessment and reduced stigmatization of affected individuals.

Keywords: Obesity Prevention, Role Sharing, Developing Countries

1. Introduction

The obesity epidemic is attaining global proportions. Epidemiological data indicates that the prevalence of overweight and obesity has doubled or tripled in the past few decades in developed countries and even in many developing countries [1]. It is estimated that over 115 million people suffer from obesity related problems [2]; with more than 1.6 billion adults being overweight and at least 400 million of them clinically obese which is a major contributor to the global burden of chronic diseases and disabilities. Childhood and adult obesity have remained a public health concern among many countries and more alarming among the adolescents as they are the future of any society. Obesity therefore is one of today's blatantly visible-yet most neglected public health problems [2, 3]. With the passing years, these estimated values may double, tripled or quadrupled to reasons traceable to environmental predisposition. The World Health Organization (WHO) further projects that by 2015, approximately 2.3 billion adults will be

overweight and more than 700 million will be obese [3].

Obesity as a complex syndrome with a multi-factorial origin may be explained in some circumstances by monogenic mutations, but in most cases appears as a polygenic condition, which may be additionally affected by a myriad of environmental influences [4, 5]. Additionally, body weight is ultimately determined by the interaction of genetic, environmental, physiological and psychosocial factors [6-9]. Knowledge and attitudinal factors (such as self-esteem, body image attitudes, eating attitudes and health behavior knowledge except perception of ideal body size) had far less association with obesity than activity related behavioral factors such as diet, physical activity and inactivity [10].

More recently, epidemiological studies have used the Quetelet Index of body weight standardized for height (kg/m^2) and on the basis of data from these studies, the normal (desirable) range lies 18.5 to 24.9 kg/m^2 , with overweight defined as 25.0 to 29.9 kg/m^2 and obesity as 30.0 kg/m^2 [11].

Some modifications to the WHO definitions have been made by particular bodies. The surgical literature breaks down obesity into further categories, though the exact values are still disputed [12].

- Any BMI ≥ 35 or 40 is severe obesity
- A BMI of ≥ 35 or 40–44.9 or 49.9 is morbid obesity
- A BMI of ≥ 45 or 50 is super obese

Obesity can be divided into general and regional. There are 2 main types of regional obesity defined based on regional fat distribution and the risk for developing diseases: gynecoid and android. The gynecoid (“pear shaped; gluteofemoral; lower body) pattern of fat distribution is common in women. The main function of this pattern of fats distribution is an energy reserves to support gestation and lactation. The android (“apple” shaped; abdominal; upper body) pattern of fats distribution is common in men; however as women gain weight, they become likely to develop abdominal and upper-body fat [13, 14]. Abdominal fats in men appear to have β_2 adrenergic functions (antilipolytic) than those abdominal fats in women, perhaps this account for a “beer belly” or “pot belly” in men than in women [15-17].

The pattern of fat distribution is also associated with the risk of developing diseases. Numerous prospective longitudinal studies showed that the pattern of upper-body fat distribution is independently associated with higher risk of developing diabetes and cardiovascular diseases [15-1]. Cross-sectional studies show that abdominal fat distribution is related to various metabolic abnormalities and disorders in a manner similar to their relationship with high BMI or total fat burden [14, 18-19]. Obesity increases the risk for many disorders that are associated with higher mortality and morbidity, including diabetes, hypertension, and coronary heart diseases (CHD), dyslipidemia, gall bladder diseases, menstrual irregularities, psychological distress, osteoarthritis, cancer, and insulin resistance etc [14,20-2]. According to the London Department of Health Report [22], globally 58% of case of type 2 diabetes, 21% of coronary heart diseases and between 8% and 42% of some cancers are attributable to overweight and obesity. It was also found that, childhood obesity might affect school performance in terms of intelligence quotient (IQ) and school attendance [23], as it will also affect work place activities in adults [24].

The International Obesity Taskforce Report [25] asserts that the cause of the obesity epidemic are twofold an abundance of energy dense foods and drinks, leading to a pervasive “passive over consumption” of energy and an environment that limits opportunities for physical activity, leading to an almost universal sedentary state. The rapid increase in obesity incidence over recent years suggests environmental and lifestyle influences in addition to other physiopathology or genetic determinants which independently affect the energy balance equation adjustment [26, 27]. It is estimated that 40-70% of the variation in body mass index (BMI) is heritable, while cultural and societal

factors may explain at least 30% of the variation [28, 29]. The consequence of economic transition and globalization is rapid and unplanned urbanization which results in nutritional transition with exposure to consumption of high fats and refined food, physical inactivity, alcohol and tobacco consumption as obtained in both low and high-income countries [30-32]. Actually, the growing obesity prevalence worldwide is mainly attributed to changes in lifestyle (increase consumption of high-energy yielding foods enriched with carbohydrates and fast reduction of lifestyle physical activity etc.) that specifically may impact genetic susceptibility [9, 33]. A positive energy balance between the amounts of energy consumed over the energy expended in day-to-day life underlies the etiology of weight gain [8]. Regulation of energy balance is highly complex, involving societal, behavioral, genetic, hormonal, and neural influences [34].

According to Damcott et al [29], individuals with thrifty or saver genes are more resistant to malnutrition. This explains why a large proportion of verse populations are susceptible to becoming obese. Maternal over nutrition, leading to an increase of transfer of nutrients to the fetus, may change energy metabolism in the fetus leading to obesity [35]. Also maternal smoking during pregnancy has been associated with later obesity in children [36, 37]. Infant feeding is also important in the development of obesity with children who were bottle fed having higher rates of obesity than those who were breastfed [38, 39] but this relationship have been inconsistent in adults [40,41]. Also while childhood obesity does not necessarily indicate adult obesity, epidemiological studies have found that a half of obese school children become obese adults [42]. According to the World Health Organization, the society change and worldwide nutrition transition are driving the obesity epidemic. Economic growth, modernization, urbanization and globalization of the food market are just some of the forces thought to underlie the epidemic [2, 3, 43, 44]. The prevention and management of obesity currently and in future requires multi-strategy interventions across a wide range of sectors concerned with public health [45]. In developed countries, many policies had been made and some implemented [1, 46] however, developing countries still grapples with her own challenges especially at attaining the millennium development goals (MDGs). With the growing trend of childhood/adulthood obesity, there is a need for less cost effective, multi-sector, multidimensional, proactive approaches in order to reverse this trend for the future generations of such countries.

2. Methods

A literature search was conducted on MEDLINE, PubMed and Google Scholar using the key words ‘obesity prevention’. This was also repeated using authors known to have published studies concerned with obesity prevention in Nigeria and globally. Information including data col-

lected were scrutinized, compared and conclusions drawn appropriately.

3. Obesity Epidemic and Prevention: the Key Players

Despite the desire to get slim among the population in developing countries, one can still find cases of some who are obese in all age ranges. Beyond an individual action, the government, food producers, manufacturers, wholesalers, retailers, caterers, transporters, urban planner, employers, community groups, the media, intervention by school, and policy makers at all levels of government could formulate and implement a multi-strategic intervention plan to promote healthy eating, regular physical activity and also treat those who already are overweight or obese and prevent future obesity [47, 48]. In Nigeria, like in other developing countries of sub-Saharan Africa, obesity epidemic is taking another dimension as shown in box 1 below.

Box 1. *Obesity in developing countries: Some Summary Facts*

Existing research in most developing countries including Nigeria have shown that:

Obesity was prevalent in the urban areas than the rural areas and the prevalence rate of obesity was more among middle-aged women living in the urban area than middle-aged women living in the rural areas.

Obesity/overweight was more prevalent among less physically active individuals and occupations.

The trend of urbanization has been associated with the trend of obesity thereby showing a clear difference in the obesity prevalence in the urban area and rural areas in these countries.

References: [49-54]

3.1. The Role of Government

The government in most developing countries expends millions of currency yearly in the achievement of the Millennium Development Goals (MDGs) which address health issues like maternal mortality, HIV/AIDS, tuberculosis, poliomyelitis, malaria prevention and treatment which tends to take a pandemic toll [55-58], however, non-communicable diseases such as hypertension, coronary heart diseases, diabetes, and cancer are on the rise [59]; which are said to be the co-morbidities associated with obesity with very little attention given to them. Obesity as a silent killer is seen to be the disease of the rich (affluence). However, with increasing urbanization, there might be a shift of the obesity burden to sections of the poor urban population who may not have the knowledge or financial resources to adopt healthier lifestyles [60-62].

Based on the health care system structure [58], the Federal government's role in health management are policy formulation, strategic guidance, co-ordinated supervision, monitoring and evaluation at all levels, operational responsibility for disease surveillance, essential drug supply and vaccine management. The federal ministry of health by means of its operational arms and parastatals such as: Na-

tional Agency for Food and Drug Administration and Control (NAFDAC), Standard Organization of Nigeria (SON), etc could address various public health issues, draft various intervention policies and follow through their implementation. Why must the Nigerian government act to address the obesity issue? The WHO report on diet, nutrition and prevention of chronic diseases placed obesity at the top of the public health agenda as the major avoidable risk factors for developing a wide range of non-communicable diseases (NCDs) [2]. The ensuing global strategy on diet, physical activity and health noted that already 66% of deaths from NCDs occur in low income countries and this figure is projected to rise [63]. The modern emergence of NCDs as a major health threat in countries (like Nigeria) still battling with the unfinished agenda of infectious diseases and childhood malnutrition has been termed "the double burden of disease" [3, 63, 64]. The threat of HIV/AIDS, emergence of tuberculosis (TB) and malaria due to drug resistance brings the already struggling health services of many developing countries (including Nigeria) to their knees [63], as they strive to attain the MDGs [65, 66]. This may provide explanation for the low government policies in the prevention and management of obesity and other NCDs. Based on the ever-growing health and economic burdens of obesity, the government at all tiers should also play a pivotal role in curbing the epidemic since it influences the rise in the percentage of all deaths and of disability adjusted life years (DALYs) [61] in both developing and developed countries.

It is estimated that obesity cost the United States \$117 billion each year [21]; while in other 15 countries that were part of the European Union, before May 2004, the total direct and indirect annual cost of obesity reached £32.8billion in 2002, equivalent to 0.3% of the gross domestic product (GDP) [67]. The picture in developing countries may be worst as an un-estimated amount of money is lost due to loss in productivity and cost of treatment of obesity and obesity related problems.

The global availability of cheap vegetable oils and fats has resulted in greatly increased fats consumption among low income countries [43]. Technological breakthrough in the development of high yield oil seeds and in refining of high quality vegetable oils greatly reduced the cost of baking and frying fats, margarine, butter like spreads, salad, cooking oils in relation to animal based products [43, 68], hence, most low income countries prefer to import this cheap oils which may not be too cardiovascular system friendly since they are high cholesterol dense in lieu of good health vegetable oils produced locally. The government should create policies that will try to implement nutritional quality control on food/drinks imported into the country and also foods served at different service points even at fast foods and eateries. Food standard regulating agencies like NAFDAC (in Nigeria) and SON should try to ensure that foods produced within and especially those imported should not be off standard. Instead of imported

cheap vegetable oils, their Agricultural sectors can be revitalized to produce wholesome food, drinks and oils. NAFDAC, based on its mandate to rid the country of unwholesome and unprocessed or poorly processed foods, should checkmate the activities of the various food producing and processing industries. They should also sensitize the populace on the risk of unhealthy diet. In recent years, a huge range of highly energy dense products has emerge, providing appetizing, quick to cook and easy to eat foods which dominate supermarket shelves to the detriment of fresh products which requires a degree of purchasing knowledge and cooking skills to fashion meals of a comparable standard [69]. Therefore there is a need for regular situational quality standards assessment of these foods and oils.

Though some of these policies may be made, implementation is slow or either hampered as some individuals may prefer shady deals for dishonest gains in addition to political influence on importation and monitoring of certain food products leading to many necessary standard assessment protocols being bypassed. Government policies should encourage the initiatives by the food industry to reduce fat, sugar and salt content of processed foods and nutritious choice, and review of current marketing practices could accelerate health gains worldwide [3]. Countries like Nigeria could consider issuing taxes on foods such as fast foods, high fats snack foods and high calorie sodas that have been identified to contribute to the increased risk of unhealthy weight gain. Funds gathered from such taxation, along with additional national and international monies could then be invested in the efforts to produce and deliver cheap fresh fruits and vegetables to poor urbanized population.

In addition, public exercise programmes and free sporting activities should be made available to children and adults in poor urbanized areas [70] especially during holiday periods. The government agencies should promote public health education on the risk associated with obesity among all ages and gender groups.

3.2. The Role of Schools

The rise in childhood obesity worldwide is of great concern as it poses a significant health risks for those affected both during childhood and well into adulthood. Obese children are at an increased risk of developing hypertension and hypercholesterolemia, atherosclerosis and diabetes, conditions known to be predictive of coronary artery diseases [71-72]. Also, obesity has been found to affect school performance [23]. Furthermore, as childhood obesity increases, we will see increasing rates of chronic diseases in the population as it ages [70].

In most developing countries including Nigeria, a large percentage of the population attained primary, secondary or tertiary institutions especially with the implementation of the National Economic Empowerment and Development Strategy (NEEDS) program in 2004, national compulsory basic education for the nine years was introduced [73].

Schools play an integral role in the obesity epidemic prevalence in terms of proper education on lifestyles. Schools also play a vital role in providing the environment for physical activity for children and adolescents, but budget costs have resulted in less, but sometimes no physical activity, on school timetables [74,75] despite the knowledge that children adolescents who participate in team sport or exercise programmes are less likely to be overweight [76]. Aside from shaping a student's social, moral and cultural outlook, most importantly schools can help students adopt and maintain healthy and physical activity behaviors. The State Education Standard report [46] recommended what schools could do to make a difference: to address physical activity and nutrition through a coordinated school health programmes (CSHP). Hence the educational curriculum should imbibed less theory and more practical during the physical /health education and food nutrition studies at the primary and secondary tiers of education. Student at the early stage of development should be made to apprehend the need for proper health education and how the knowledge they acquire could better their lives and that of the society. The curricula should be focused on teaching students skills needed to adopt healthy behaviors, provide ample opportunities for them to practice those skills [46]. It is a statement of fact that majority of the non-communicable diseases globally, could either be prevented or managed through proper dieting and physical activity. Students too should be made to see the practicality of this statement. However, some challenges still abound; research in the physical and health education are still in its infant stage. In order for these professionals (physical/health educationists and nutritionists) to justify their rightful places in the field of academics, they should also be more heard and active. For instance, most of the norms we use in assessing the physical fitness are the physical fitness status of the developed countries despite the fact that there is ethnic/racial variation in physical fitness. This is because cultural differences in growth, fitness levels, eating habits and emotional behaviors, to mention a few, are known to exist [77] and could contribute to these variations.

Also the school setting offers multiple opportunities for students to enjoy physical activity outside physical education classes such as after school program, intramural sport program and physical activity clubs [46]. To advocate of the need for proper dieting/physical activity, school could form health promotions clubs such as the anti-obesity (healthy weight awareness) clubs, employing a peer-to-peer intervention strategy could promote and influence good students' health behaviors. In promoting healthy food preference and eating habits, cue could be taken from the Texas State Department of Agriculture [78] which issued a policy in 2004 that sets the nutritional standard for foods and beverage available on school campuses, regulate portion size and targeted the elimination of frying as a method of on-site food preparation. Many young ones should better

yet be encouraged to eat at home (The Eat at Home Policy) as skipping breakfast, eating at eateries and greater consumption of soft drinks have been associated with obesity [79-81]. Also, if the teachers keep a healthy eating behavior and body weight, they may serve as role models to the students. The school should encourage regular fruits eating than the eating of pastas, candies, and cookies at the canteens and for these to appeal to the students they should be cheap. Hence good health can be promoted by the eating of cheap, fresh fruits than candies.

Additionally, when assessing a student's academic performance, his/her psychomotor skills should be graded as cumulative grade points of his/her academic performance. This will also give a clear picture of the intellectual abilities in addition to his/her physical activity levels. Free regular body weight checking programs at schools should be implemented. As a matter of policy, each child should both know how to measure his/her height and weight periodically in order to keep pace with his/her BMI. Health care counselors should on the basis of these measurements follow up these students and encourage them on the gains of keeping a healthy weight even when some of them may be genetically predisposed to be obese. Also, when school resumes, during the first few weeks, the BMI of students could be taken to access the level of change during the sedentary period of holidays and follow-ups instituted if necessary. Annually, 8-12th October is observed as the International Walk to School Week (IWALK) [82] and it has help to promote walking to schools in 40 countries including the United Kingdom and United States except in developing countries including Nigeria. Though there may be some obstacles such as safety and distance to and from school, however, if safe routes to schools are created and the road safety personnel are up and doing, the "walk to school" strategy could promote health in our urban areas. Wang et al [83] indicates that school based obesity prevention programs are urgently needed in the urban, low socio-economic status communities. Since schooling could influence a student's psycho-motor and socio-behavioral make-up, hence addressing the issue of obesity at the level of the school could help prevent and manage the obesity epidemic worldwide.

3.3. *The Role of the Family*

The family environment is very instrumental to a child being obese. Ranging from genetic inheritance, acquisition of poor eating habits and food preference to family activities, body image perception and behavior, the family can be a cradle point of the developing of an "obesogenic society". Twins, adoption and family studies have established that obesity is highly heritable, and an individual's risk of obesity is increased when one of his relatives is obese [84]. Research showed that a child of two obese parents has about 80% chances of being obese, whereas the risk is 15% for the offspring of two parents of normal weight [85].

Family environment also plays an important role in the development of obesity. Lengthy periods of television viewing, lack of family meals at home, eating out at restaurants, childhood neglect, depression [86] and only child or last born child over pampering have been associated with obesity even among children [86]. Weight loss is more difficult to achieve and maintain at adulthood [87], prevention and treatment in childhood and adolescence is essential [1]. The primary point of healthy lifestyle education during childhood is the home and the sole responsibilities of the parents (especially the mothers). Parents (especially mothers) are responsible for the physical activity levels and dietary standards of their family. Most of the attitudes acquired from the home shape the socio-behavioral attitude of the child as he/she grows. Good nutrition education is vital, as it may influence eating habits. This is a useful form of prevention when focused on families as, not only could it change adult dietary preferences but also those of children. Food preference formed at childhood is mainly through parental food choice and affects childhood dietary intake. These preferences may be carried all through into adulthood and could cause adult health adverse effects [69, 88]. Most urban kids when taken to fast food points prefer white bread, savory snacks, cookies, chips, biscuits, other form of potatoes and chocolates [1], which are not part of the traditional recipes. If this trend is not reversed and the individuals educated, such young ones grows up with the notion that foods that taste sweet and oily is better.

Aside from educating the children on healthy lifestyles, the parents especially mothers should pay more attention to the nutritional status of their family. At the early stage of development, breastfeeding by mothers should be promoted not only as a measure of promoting child's immunity against diseases but also to prevent overweight/obesity). Infant feeding is important in the development of obesity, because children who are bottle-fed have higher rates of being obese than those who are breast-fed [38, 41, 89], but this relationship has been inconsistent in adults [39, 40], while in other studies it failed to be protective [90]. In our current environment many children, even when originally breast fed, start gaining excessive weight once they are 2-4 years of age by environmental factors means when they are exposed to very inappropriate foods and eating patterns [69].

Family meals at home, enjoying traditional foods than over dependence on western diet could boost the nutritional status of the family. Also, instead of buying a child candies, fruits are recommended.

With advances in technology, there has been a greatly reduced dependence on walking and cycling for transportation while more cars are now in use. These cars contribute to CO₂ emissions, traffic congestion, pollution caused by emissions and noise, and traffic accidents that is experienced. A replacement of car journeys by walking and cycling would assist in addressing many of these problems and could be part of the strategy to tackle global warming,

pollution and congestion. At the same time, there would be substantial public health benefit in terms of the reduction in disease risk, including obesity [74]. Household physical activity has likely decreased due to labor-serving devices [24] and longer duration of television watch. Based on these, it was recommended by the American Health Association [91] that: all children aged 2 and older should participate in at least 30 minutes of enjoyable moderate-intensity activities every day.

Two primary mechanisms by which television viewing contributes to obesity have been suggested: reduced energy expenditure from displacement of physical activity and increased dietary intake, either during viewing or as a result of food advertising [92, 93]. Sleep duration is influenced in both adults and young ones by the duration of TV/video gaming/ social networking, night clubbing and job shift/demands and are associated with weight gain. Many individual who spend longer hours watching TV/playing video games tend to sleep less. Many children or adults who are in the habit of staying late at night watching a movie/playing games/ surfing the internet or clubbing tends to be involved in excessive night eating to sustain alertness. Parents could regulate the television/computer viewing periods of their children by also setting good examples. The parents should encourage their children to regularly exercise also through their examples in order to maintain a healthy weight. However, when the child is already obese due to genetic predisposition, educating the parents of these obese children has been shown to produce positive changes in the children's dietary intake [94]. Therefore the family environment is instrumental to the prevention and management of obesity.

3.4. The Role of Workplace Environment

In recent years, walking and cycling to work have reduced due to rapid urbanization and technological advancement. Many workers are transported to and from their duty post. For some, they remained immobile for these periods of time of work due to huge workload and some resort to fast foods which are sweetened and fattened to attract appeal and consumption. An extended period of sedentary posture may result in excessive weight gain and may results in obesity [95]. Just as obesity affects school performance in children [23], obesity also negatively affects physical functioning, vitality [96], and general quality of life [97]. It is also a possible cause for mortality and morbidity among the workforce. Like in other sectors of the society, work place environments, also plays a role in obesity epidemic. In order to curb the growing trend of obesity among workers, it is recommended that regular road walks and exercise should be encouraged among workers and incentives given to encourage participation and a day or week should always be set aside for that. Instead of the use of motorized lifts, workers should be encouraged to use the staircases except for high rising buildings. Occupational energy requirement have also dropped as mechanized labor

aids and labor saving devices have become available and in general, jobs have become more sedentary [24]. Except otherwise necessary physical tool handling should be encouraged.

Workers who walk night shift or shift work are prone to developing non communicable diseases such as obesity, diabetes and sleep disorders. These workers include nurses, doctors, waitresses, truck drivers, police officers, fire fighters etc. Researchers say that shift work alters the body's circadian rhythm which invariably may affect body metabolism [98-101]. There is a need for a time to time off duty for these workers.

In order to allay stress, some workers resort to night clubbing. Clubbing activities by workers should be discouraged or reduced; instead that time should be set aside to do other activities that could relieve stress like brisk walking, spending time with family and loved ones and sleeping.

The key policy regulators of the workplace should try to discourage an obesogenic environment at the workplace in order to preserve valuable man power. Also they should ensure that healthy foods are served at the canteens and sanctions placed on any defaulting party. Workers should be encouraged to attend medical checkups, checking their BMI status and imbibe a healthy eating behavior and food preferences. However while preserving an individual's dignity, obese workers should be encouraged to check their weight and those who have should be rewarded to encourage others to.

3.5. The Role of the Media

The media also plays a vital role in the promotion of the right messages for maintaining a healthy weight through a "keep fit and keep a healthy weight" philosophy. The media should reorient the populace's health habits through insightful programmes and advertisements. Aside from other health challenges such as polio, HIV, malaria, tuberculosis etc, over weight/ obesity should be given wide public enlightenment by the media. As the watch dog of the society, they should be selective of their adverts that could influence the dietary choice of the children and adults negatively. Instead of promoting the consumption of unhealthy foods and drinks, the media should advertise on the need for regular consumption of fruits, green vegetables and exclusive breast milk for infants which promotes overall cardiovascular health. In developing countries, there is a need for more public awareness on the effects of obesity on people, on health, on the economy, on work performance and even on family life through education and communication [62]. Also, in order to improve the knowledge regarding the risk of obesity, such public messages should be targeted at those with lower level of education [102] and should be done using the local dialect by the media, as has been used for HIV/malaria/TB prevention programmes. This is needed in order to reach larger audience and the message retained.

Reorienting the perception of weight gain by the average

individual is essential. In some African and Pacific communities being fat, being “big” remains a symbol of status, power and beauty despite the well-known problems associated with obesity [103,104]. No wonder most individuals (especially women) take the comment that they have gained more weight as a compliment. They see that being fat and big is beautiful. Fat and chubby children are perceived as healthy children [103]. Among some tribes in Nigeria and the Pacific communities, the cultural practice of fattening is common. Women are kept indoors to lighten their skin and fed foods that are fattening (along with reduced activity). Among the Efiks and Annang, the women taken through the fattening (*Nkuho*) room are prepared for their bridegroom. At the end of the fattening, the most “big” maiden is seen to be the most beautiful and a pride to her family [104,105].

According to the Bordieu concept of ‘habitus’ which states that the body (inclusive of appearance, style, behavior, affinities) is a social metaphor of a person’s status [106,107], no little wonder, the possession of “pot belly” or “beer belly” in men (accumulation of fats on the abdominal region-abdominal obesity) is seen as a sign of wealth, health, power and high socio-economic status, so that even men of low socio-economic status may desire it. The media should play a major role in reorienting the populace on the dangers of an unhealthy weight; however care should be taken not to stigmatize those who already are. The media also should be a medium by which government’s policies related to the epidemic could be aired. Programmes that encourage physical activity such as fitness/diet programmes should be aired and audience participation should be encouraged especially for those who cannot afford to go for gymnasiums and fitness clubs. The media should keep up to its responsibility of informing the society on the need to and why they should keep a healthy weight.

3.6. The Role of Medical Practitioners

With the increasing prevalence of obesity in both developed and developing countries, the number of patients seeking advice for weight management in primary health care setting is increasing [108]. It is important for medical practitioners to have essential knowledge to manage obesity [109]. Health care practitioners should be equipped with necessary skills and knowledge to deal with the epidemic and to use any available opportunities to increase awareness and reduce the prevalence of overweight and obesity [110-111]. Obesity is every one’s responsibility [109]. The awareness of the risk associated with obesity should be intensified as a greater percentage of a population may be unaware of the associated risk behaviors for obesity [62]. Since various studies has identified that an average woman is more prone to be obese than an average man [53], at antenatal visits, more women can be reached by medical practitioners with the message of healthy weight management. Niert et al [112] found pre-pregnancy health check to

be an excellent opportunity for improving education of women regarding the risk of obesity prior to pregnancy. During these checks, their BMI should be assessed and based on the result, the recommendation to lose or maintain weight should be given by the health personnel [113] backed up with practical suggestions on what foods to eat, those to avoid and the need to be physical active within an allowed range they could bear. Most pregnant women become more and more sedentary especially as the gestational period advances and others engage in poor dieting due to their increased appetite during the pregnancy, a practice that should be strongly discouraged by medical practitioners. Given that a healthy baby is a highly valued outcome of pregnancy [114], increasing women’s knowledge about the impact of overweight and obesity on neonatal problems such as birth defects might encourage women to actively attempt to lose weight prior to pregnancy [112]. A meta-analysis of Leventhal’s common-sense model as a theoretical basis for intervention programmes identified moderate to strong relationship between knowledge of diseases, coping behaviors and outcomes [114]. This means that women should be told why they should not be obese, what it will cost them if they are and what they could do to prevent or manage their weight. Maternal education can be a powerful tool in managing or preventing childhood obesity or “family obesity”. During antenatal visit, women should be enlightened as to the protective actions of breastfeeding on obesity as against bottle feeding [38, 41].

For those already obese and are seeking remedies, the medical professionals should also give adequate information as to pharmacological treatment of overweight/obesity and its possible outcomes [116]. The medical personnel must create the awareness as to the difference between normal weight, overweight and obese weight.

3.7. The Role of Food Industries/Producers

Good health is wealth. Instead of putting wealth before consumer’s health, the producers of food and confectionaries should consider the benefits of a healthy society. Instead of the use of cheap, high cholesterol dense oils, natural healthy oils devoid of cholesterol should be used in the production of fast foods and confectionaries. Consumers should not be deceived into buying “bad” food for ‘good’ by making it cheap. Restaurants and grocery stores are the primary settings from which people obtain food. These settings are often designed to maximize sales of food by strategically placing and promoting items to encourage impulse purchases. The superficial characteristics of food products, including packaging and portion sizes, design, salience, health claims and labeling, strongly influence food choices and consumption in ways for which people generally lack insight [117]. In the light of this, the nutritional quality of food whether imported or locally made should be maintained by both food standard and manufac-

turing agencies and they should float sensitization campaigns on the need for proper dieting. The nutritionists who are versed as dieticians should do more research as to nutritional value of cheap healthy foods (even traditional foods) and make recommendations as to its incorporation into food manufacturing.

4. Conclusion: The Prospects for Preventing Obesity

There are prospects for preventing and managing the obesity epidemic in sub Saharan Africa and worldwide despite various challenges. It is projected therefore that the rate of mortality /morbidity due to obesity related complications could be reduced to half its occurrence hence; there is a need for multi-factorial, multidimensional, proactive approaches in order to prevent a higher trend of obesity in future. This approach should involve: early awareness, follow up and motivation for progress. Beginning from the traditional sector to the private sector, from the governmental sector to the non-government sector, all hands should be on deck. Action should begin now that we are experiencing a rapid change in lifestyles of the populace, rapid trend of urbanization to conform to the globalization of the food market and mechanized transportation. Such actions should be taken in the form of health policy drafting and implementation, lifestyle reorientation, environmental change, provision of clinical services, more consumption of healthy traditional foods, and reduction in body weight discrimination, etc. The campaign should be directed to the men, the women and the most especially our future— our children. The enlightenment should be done in the local language and involve reputable leaders such as: traditional, religious or peer group leaders. At school, the physical and health education and food nutrition curriculum should be imbued to be more practical and less theoretical and healthy weight awareness clubs be formed. Affected persons should be made to see the possibility of maintaining a healthy weight by increasing their physical activity levels and eating right. Since excessive body weight is the root cause of many non-communicable diseases, the fight against it should be a collective effort.

Acknowledgments

The authors acknowledge the management of Sifon Clinic Ltd, Uyo, Nigeria for providing the facilities used in compiling this review.

References

- [1] Skidmore PM, Yarnell JW. The obesity epidemic: prospects for prevention. *Q J M.* 2004; 97:817-825.
- [2] World Health Organization. Diet, Nutrition and Prevention of Chronic Diseases: Report of a joint WHO/FAO Expert Consultation, 28 January-1 February 2002, (WHO Technical Report Series 916). Geneva, Switzerland: World Health Organization, 2003.
- [3] World Health Organization. Obesity and overweight. Fact sheet No 311. World Health Organization Media Center. September 2006.
- [4] Bray GA, Bouchard C, James WT, (eds). Handbook of Obesity. Etiology and Pathophysiology. 2nd Edition. New York. Marcel Dekker, Inc, 2004.
- [5] Froguel P, Boutin P. Genetics of pathways regulating body weight in the development of obesity in humans. *Exp Biol Med (Maywood).* 2001; 226:991-996.
- [6] Rosenbaum M, Liabel HR, Hirsch J. Obesity. *N Engl Med.* 1997; 337:396-407.
- [7] Schwartz MW, Baskin DG, Kaiyala KJ, Woods SC. Model for the regulation of energy balance and adiposity by the central nervous system. *Am J Clin Nutr.* 1999; 69: 584-596.
- [8] Weber J. Energy balance in obesity. *Proc Nutr Soc.* 2003; 62:539-543.
- [9] Marti A, Moreno-Aliaga MJ, Hebebrand and Martinez JA. Genes, lifestyle and obesity. *Int J Obes Relat Metab Disord.* 2004, 28 Suppl 3: S29-S36.
- [10] Gordon-Larsen P. Obesity-related knowledge, attitudes and behaviors in obese and non-obese urban Philadelphia female adolescents. *Obes Res.* 2001; 9:112-118.
- [11] World Health Organization. Obesity: Preventing and Managing the Global Epidemic, Report of a WHO Consultation on Obesity, Geneva, 1997 June 3-5. Geneva, Switzerland: World Health Organization; 1998. Document no. WHO/NUT/NCD/98.1.whqlibdoc.who.int/hq/1998/WHO_NUT_NCD_98.1_(p1-158).pdf. Accessed October 12, 2012.
- [12] Sturm R. increase in morbid obesity in the USA: 2000-2005. *Public Health.* 2007; 121 (7): 492-496
- [13] Pi-Sunyer FX. Medical hazards of obesity. *Ann Intern Med.* 1993; 119:655-660.
- [14] Oral hCG Research Clinic. Obesity reviews-Estimating fat body content. <http://www.hcgoesity.org/research/obesity/obfatcnt.pdf>. 27/11/2004. Accessed 17 October 2012.
- [15] Larsson B, Svardsudd K, Welin L, Wilhelmsen L, Bjorntorp P, Tibbin G. Abdominal adipose tissue distribution, obesity and risk of cardiovascular disease and death: 13 year follow up of participants in the study of men born in 1913. *Br Med J.* 1984; 288:1401-1404.
- [16] Kaye SA, Folsom AR, Sprafka JM, Prineas RJ, Wallace RB. Increased incidence of diabetes mellitus in relation to abdominal adiposity in older women. *J Clin Epidemiol.* 1991; 44:329-334.
- [17] Lakka HM, Lakka TA, Tuomilehto J, Salonen JT. Abdominal obesity is associated with increased risk of acute coronary events in men. *Eur Heart J.* 2002; 23:706-713.
- [18] Hartz AJ, Rupley DC, Rimm AA. The association of girth measurement with disease in 32, 856 women. *Am J Epidemiol.* 1984; 119:71-80.

- [19] Katzel LI, Busby Whitehead MJ, Goldberg AP. Adverse effects of abdominal obesity on lipoprotein lipids in health older men. *Exp Gerontol.* 1993; 28:411-420.
- [20] Must A, Spadano J, Coakley EH, Field AE, Colditz G, Dietz WH. The disease burden associated with overweight and obesity. *JAMA.* 1999; 282: 1523-1529.
- [21] U.S Department of Health and Human Services. The surgeon General's call to action to prevent and decrease overweight and obesity. 2001. US Public Health Service. Office of the Surgeon General. Rockville, MD. <http://www.cdc.gov/nccdphp/dnpa/pdf/CalltoAction.pdf>. Accessed 12 October 2012.
- [22] Department of Health. Health check: on the state of public health. Annual Report of the Chief Medical Officer, 2002. London Department of Health. www.doh.gov.uk/cmo/annualreport2002 . 3 July 2003. Accessed 23 September 2012.
- [23] Taras H, Potts-Datema W. Obesity and Student performance at school. *J Sch Health.* 2005; 75 (8): 291-295.
- [24] Stein CJ, Colditz GA. The epidemic of obesity. *JCEM.* 2004; 89(6):2522-2525.
- [25] International Obesity Task Force and European Association for the Study of Obesity. 2002. "Obesity in Europe. The Case for Action." London: International Obesity Task Force and European Association for the Study of Obesity. http://www.iaso.org/site_media/uploads/Sep_2002_Obesity_in_Europe_Case_for_Action_2002.pdf . Accessed 06 October, 2012.
- [26] Hill JO, Wyatt HR, Melanson EL. Genetic and environmental contributions to obesity. *Med Clin North Am.* 2000; 84:333-346.
- [27] Hill JO, Wyatt HR, Reed GW, Peter JC. Obesity and the environments: where do we go here? *Science.* 2003; 299:853-855.
- [28] Commuzzie AG, Allison DB. The search for human obesity genes. *Science* 1998; 280 (5368): 1374-1377.
- [29] Dancott CM, Sack P, Shuldiner AR. The genetics of obesity. *Endocrinol Metab Clin North Am.* 2003; 32:761-786.
- [30] Martinez-Gonzalez MA, Martinez JA, Hu FB, Gibney MJ, Kearney J. Physical inactivity, sedentarism, lifestyle and obesity in the European Union. *Int J Obes Relat Metab Disord* 1999; 23: 1-10
- [31] Obesity preventing and managing the global epidemic. World Health Organization Consultation on Obesity. World Health Organization Technical Report 894: Geneva, 2000.
- [32] Swinburn BA, Caterson I, Seidell JC, James WR. Diet, nutrition and prevention of excess weight gain and obesity. *Public Health Nutr.* 2004; 7(1A):123-146.
- [33] Maffie C. Aetiology of overweight and obesity in children adolescents. *Eur J Pediatr.* 2000; 159:535-544.
- [34] Lustig RH. The neuroendocrinology of obesity. *Endocrinol Metab Clin North Am.* 2001; 30:765-785.
- [35] Whitaker RC, Deitz WH. Role of the prenatal environment in the development of obesity. *J Pediatr.* 1998; 132:768-776.
- [36] Vik T, Jacobson G, Vatten L, Bakketig LS. Pre and post-natal growth in children of women who smoked in pregnancy. *Early Hum Dev.* 1996; 45:245-255.
- [37] Wideroe M, Vik T, Jacobson G, Bakketig LS. Does maternal smoking during pregnancy causes childhood overweight. *Paediatr Perinat Epidemiol.* 2003; 17:171-179.
- [38] Gilman MW, Rifas-Stiman SL, Camargo CA, Jr, Berkey ES, Frazier AL, Rockett HR, Field AE, Colditz CA. Risk of overweight among adolescents who were breastfed as infants. *JAMA.* 2001; 285:2461-2467.
- [39] Parsons TJ, Power C, Manor O. Infant feeding and obesity through the life course. *Arch Dis Child.* 2003; 88:793-794.
- [40] Ravelli AC, Van der Meulen JH, Osmond C, Barker DJ, Bleker OP. Infant feeding and adult glucose tolerance, lipid profile, blood pressure and obesity. *Arch Dis Child.* 2000; 82:248-252.
- [41] Toschke AM, Vignerova J, Lhotska L, Osancova K, Koletzko B, Von Kries R. Overweight and obesity in 6 to 14 years old Czech children in 1991: protective effect of breast feeding. *J Pediatr.* 2002; 141:764-769.
- [42] Serdula MK, Ivery D, Coates RJ, Freedman DS, Williamson DF, Byers T. Do obese children become obese adults? A review of the literature. *Prev Med.* 1993; 22:167-177.
- [43] Drewnowski A, Popkin BM. The nutrition transition: new trends in the global diet. *Nutr Rev.* 1997; 55(2):31-43.
- [44] Popkin BM. Urbanization and nutrition transition. Achieving urban food and nutrition security in the developing world. A 2020 Vision for Food, Agriculture, and the Environment, Focus 3. Brief 7 of 10, Washington DC: International Food Policy Research Institute (IFPRI), August 2000. Available at http://www.ucl.ac.uk/dpup/projects/drivers_urb_change/urb_society/pdf/liveli_vulnera/ifpri_garett_food_security.pdf . Accessed 13 October 2012.
- [45] Stubbs CO, Lee AJ. The obesity epidemic: both energy intake and physical activity contribute. *Med J Aust.* 2004; 181(9):489-491.
- [46] National Association of State Boards of Education. The role of schools in preventing childhood obesity. The State Education Standard. December 2004, pp1-12. http://www.cdc.gov/healthyyouth/physicalactivity/pdf/roleof_schools_obesity.pdf . Accessed 22 September 2012.
- [47] Crawford D. Population strategies to prevent obesity. *Br Med J.* 2002; 325:728-729.
- [48] Noel PH, Pugh JA. Management of overweight and obese adults. *Br Med J.* 2002; 325: 757-761.
- [49] Ekezie J, Anyanwu EG, Danborno B, Anthony U. Impact of urbanization on obesity, anthropometric profile and blood pressure in the Igbos of Nigeria. *N Am J Med Sci.* 2011; 3(5): 242-246.
- [50] Akinpelu AO, Oyewole OO, Oritogun KS. Overweight and obesity: does it occur in Nigerian adolescents in an urban community? *Int J Biomed Hlth Sci.* 2008; 4 (1): 11-17.
- [51] Ogunjimi LO, Ikorok MM, Oluyinka OY. Prevalence of obesity among Nigerian nurses: the Akwa Ibom State expe-

rience. *Int NGO J*. 2010; 5 (2): 45-49.

- [52] Omigbodun OO, Adediran KI, Akinyemi JO, Omigbodun AO, Adedokun BO, Esan O. Gender and rural-urban differences in the nutritional status of in-school adolescents in South Western Nigeria. *J Biosoc Sci*. 2010; 42 (5): 653-676.
- [53] Chigbu CO, Aja LO. Obesity in pregnancy in Southeast Nigeria. *Ann Med Health Sci Res*. 2011; 1:135-140.
- [54] Ekpenyong CE, Akpan UP, Ibu JO. Relationship of physical activity and gender to incidence of overweight and obesity among civil servants in South Eastern Nigeria. *African J Med Sci*. 2011;4(1):129-134
- [55] World Bank/Department for international development(UK). Country Partnership Strategy for the Federal Republic of Nigeria: Report No. 32412-NG, June 2, 2005. http://siteresources.worldbank.org/INTLICUS/Resources/Nigeria_CPS.pdf. Accessed 10 October 2012.
- [56] GAVI Alliance. Country Fact Sheet: Nigeria, 2008. http://www.gathroughalliance.org/resources/Nigeria_GAVI-Alliance-country-fact-sheet-June-2008-eng.pdf. Accessed 20 May 2009
- [57] United Nations & AIDS. Epidemiological fact sheet on HIV and AIDS:core data on epidemiology and response. Nigeria, 2008. UNAIDS/WHO/UNDP. http://apps.who.int/globalatlas/predefinedReports/EFS2008/full/EFS2008_NG.pdf. Accessed 12 October 2012.
- [58] World Health Organization. WHO Country Cooperation Strategy: Federal Republic of Nigeria, 2002-2007. WHO Regional Office for Africa, Brazzaville, 2002. http://www.who.int/countries/en/cooperation_strategy_nga_en.pdf. Accessed 12 October 2012.
- [59] Agunwamba A, Bloom D, Friedman A, et al. Nigeria: the Next Generation Project- Literature Review. Harvard School of Public Health, British Council, 2009: pp1-78.
- [60] Popkin D, Gordon-Larsen P. The nutrition transition: worldwide obesity dynamics and their determinants. *Int J Obes Relat Metab Disord*. 2004; 28 Suppl 3: S2-S9.
- [61] Ezzati M, Hoorms V, Lawes CM, et al. Rethinking the “diseases of affluence” paradigm: global patterns of nutritional risk in relation to economic development. *PLOS Med*. 2005; 2(5): e 133.
- [62] Nyaruhucha CN, Achen JH, Msuya JM, Shayo NB, Kulwa K. Prevalence and awareness of obesity among people of different age groups in educational institutions in Morogoro, Tanzania. *East Afr Med J*. 2003; 80 (2):68-72.
- [63] Prentice AM. The emerging epidemic of obesity in developing countries. *Int J Epidemiol*. 2006; 35:93-99.
- [64] Ekpenyong CE, Udokang NE, Akpan EE, Samson TK. Double burden, non-communicable diseases and risk factors evaluation in sub-Saharan Africa. The Nigerian experience. *EJSD*. 2012; 1(2):249-270.
- [65] United Nations General Assembly. United Nations Millennium Declaration. Resolution 55/2. September 08, 2000. <http://www.un.org/millennium/declaration/ares552e.htm>. Accessed 10 October 2012.
- [66] Enabudoso EJ, Gharoro EP, Ikena GO, Abhulimhen-Iyoha, B. Health and the millennium development goals. The Nigerian perspective. *BJPM*. 2006; 8(1):1-7.
- [67] Fry J, Finley W. The prevalence and costs of obesity in the EU. *Proc Nutr Soc*. 2005; 64: 359–362.
- [68] Williams GW. Development and future direction of the world soybean market. *Q J Intl Agr*. 1984; 23:319-337.
- [69] James WP. The epidemiology of obesity: the size of the problem. *J Intern Med*. 2008;263:336-357.
- [70] Brody J. The global epidemic of childhood obesity: poverty, urbanization and the nutrition transition. *Nutr Bytes*. 2002; 8(2):1-7.
- [71] Berenson GS, Srinivasan SR, Nicklas TA. Atherosclerosis: A nutritional disease of childhood. *Am J Cardiol*. 1998; 26:22T-29T.
- [72] Schnieder D. International trends in adolescent nutrition. *Soc Sci Med*. 2000; 15: 955-957.
- [73] International Monetary Fund. Nigeria: Poverty Reduction Strategy Paper-Progress Report. IMF Country Report 07/270, June 13 2007. www.imf.org/external/ns/. Accessed 12 October 2012.
- [74] Fox KR, Riddoch CJ. Changing the physical activity patterns of contemporary children and adolescents. *Proc Nutr Soc*. 2000; 59: 497-504.
- [75] Grant Makers in Health. Weighing in obesity. American’s growing health epidemic. Issue briefs no 11. Washington DC, Grant Makers in Health, 2001. Accessed 12 October 2012 from www.gih.org/files/usrdoc/Obesity.pdf.
- [76] Pate RR, Trost SG, Levin S, Dowda M. Sport Participation and health related behaviors among US youth. *Arch Pediatr Adolesc Med*. 2000; 154: 904-911.
- [77] Emiola L. Physical fitness: Definition and measurement. In: Amusa, L.O, Udoh CO. (eds). Dynamics of physical fitness. Osogbo. Adebara Pub. Ltd, 1982.
- [78] Texas Department of Agriculture, Texas Public School Nutrition Policy, 2004. www.agr.state.tx.us/foodnutrition/policy/food_nutrition_policy.pdf. Accessed 15 October 2012
- [79] Binkley JK, Eales J, Jekanowski M. the relation between dietary change and rising obesity. *Int J Obesity Relat Metab Disord*. 2000; 24: 1032-1039.
- [80] Smiciklas-Wright H, Mitchell DC, Mickel SJ, Glodman JD, Cook A. food commonly eaten in the United States, 1989-1991 and 1994-1996; are the portion size changing? *J Am Diet Assoc*. 2003; 103:41-47.
- [81] French SA, Lin BH, Guthrie JF. National trends in soft drink consumption among children and adolescents age 6 to 17 years. Prevalence amounts and sources, 1977/1987 to 1994/1998. *J Am Diet Assoc*. 2003; 103: 1326-1331.
- [82] The International Walk to School Project. www.iwalktoschool.org. Accessed 27 September 2012.
- [83] Wang YL, Tussing A, Odoms-Young C, et al. Obesity prevention in low socio-economic status urban African American adolescent: study design and preliminary findings of the HEALTH-KIDS Study. *Eur J Clin Nutr*. 2006; 60

- (1):92-103.
- [84] Yang W, Kelly T, He J. Genetic epidemiology of obesity. *Epidemiol Rev.* 2007; 29:49-61.
- [85] Andreoli TE, Carpenter CJ, Griggs RC, Loscalzo J. Cecil Essential of Medicine. 6th edition. Philadelphia. WB Saunders. 2004, pp 551-555.
- [86] Ebbeling CB, Pawlak DB, Ludwig DS. Childhood Obesity: public-health crisis, common sense cure. *Lancet.* 2002; 360:473-482.
- [87] National Institutes of Health. The practical guide: Identification, Evaluation and Treatment of Overweight and Obesity in Adults. Bethesda, MD: North American Association for the study of obesity, National Heart, Lung and Blood Institute 2000. NIH Publication 00-4048. <http://www.nhlbi.nih.gov/guidelines/obesity/practgde.htm>. Accessed 18 October 2012.
- [88] Power C, Moynihan C. Social class and changes in weight for height between childhood and early adulthood. *Int J Obes.* 1988; 12:445-53.
- [89] Padez G, Mourao I, Moreida P, Rosado Vitor. Prevalence and risk factors for overweight and obesity in Portuguese children. *Acta Paediatrica.* 2005; 94:1550-1557.
- [90] Arenz S, Ruckerl R, Koletzko B, Von Kries R. Breast-feeding and childhood obesity-a systematic review. *Int J Obes Relat Metab Disord.* 2004; 28:1247-1256.
- [91] American Heart Association. Exercise (Physical Activity) and Children. http://www.heart.org/heartorg/gettinghealthy/physical-activity-and-children_ucm_304053_article.jsp. Accessed 5 October 2012
- [92] Bergmann KE, Begmann RL, von Kries R, et al. Early determinants of childhood overweight and adiposity in a birth cohort study: role of breast-feeding. *Int J Obes Relat Metab Disord.* 2003; 27:162-172.
- [93] Robinson TN. Reducing children's television viewing to prevent obesity. A randomized controlled trail. *JAMA.* 1999; 282:1561-1567.
- [94] Golan M, Fainaru M, Weizman A. role of behavior modification in the treatment of childhood obesity with the parents as the exclusive agents of change. *Int J Obes Relat Metab Disord.* 1998; 22:1217-24.
- [95] Choi B, Schnall PL, Yang H, Dobson M, Landsbergis P, Israel L, Karasek R Baker D. Sedentary work, low physical job demand and obesity in US workers. *Am J Ind Med.* 2010; 53 (11):1088-101.
- [96] Coakley EH, Kawachi I, Manson JE, Speizer FE, Willet WC, Colditz GA. Lower levels of physical functioning are associated with higher body weight among middle-aged and older women. *Int J. Obes Relat Metab Disord.* 1998; 22:958-965.
- [97] Fine JT, Colditz GA, Coakley EH, Moseley G, Manson JE, Willet WC, Kawachi I. A prospective study of weight change and health-related quality of life in women. *JAMA.* 1999; 282:2136-2142.
- [98] Sleep deprivation doubles risks of obesity in both children and adults. *Science Daily,* July 13, 2006. <http://www.sciencedaily.com/releases/2006/07/060713081140.htm>. Accessed 1 October 2012.
- [99] Taheri S. The link between short sleep duration and obesity: we should recommend more sleep to prevent obesity. *Arch Dis Child.* 2006; 91(11): 881-884.
- [100] Kristen LK, Spiegel K, Penev P, Van Cauter E. Metabolic consequences of sleep deprivation. *Sleep Med Rev.* 2007; 11(3): 163-178.
- [101] Knutson KL. Does inadequate sleep play a role in vulnerability to obesity? *Am J Hum Biol.* 2012; 24(3):361-371.
- [102] Nitert MD, Foxcroft KF, Lust K, Fagermo N, Lawlor DA, O'Callaghan M, McIntyre and Callaway LK. Overweight and obesity knowledge prior to pregnancy: a survey study. *BMC Pregnancy Childbirth.* 2011; 11:96.
- [103] World Health Organization Report: Workshop on obesity prevention and control strategies in the Pacific Apia, Samoa; 26-29 September 2000. World Health Organization Regional Office for the Western Pacific, Manila, Philippines, 2002.
- [104] BBC News. The fattening rooms of Calabar, 19th July 2007. <http://news.bbc.co.uk/2/hi/6904640.stm>. Accessed 12 October 2012.
- [105] Brinks PJ. The fattening room among the Annangs of Nigeria. *Med Anthropology.* 1989; 12 (1):131-143.
- [106] Bourdieu P. Distinction: a social critique of judgment of taste. London, United Kingdom, Routledge and Kegan Paul Ltd, 1984.
- [107] Power EM. An introduction to Pierre Bourdieu's key theoretical concepts. *J Study Food Soc.* 1999; 3:48-52.
- [108] Campbell K, Engel H, Timperio A, Catherine C, Crawford D. Obesity management: Australian General Practitioners' attitude and practices. *Obes Res.* 2000; 8:459-466.
- [109] Ojwang AA. Aspects of knowledge, attitude and practices of medical practitioners on obesity and weight management in three urban centers in Kenya. Thesis: Department of Human Nutrition of the University of Stellenbosch, 2005.
- [110] Schwartz JS, Lewis CE, Clancy C, Kinoshian MS, Radany MH, Koplan JP. Internist' practices in health promotion and diseases. A survey. *Ann Intern Med.* 1991; 114:46-53.
- [111] Jean LK, Robert AH. Physicians' attitudes towards managing obesity: differences among six specialty group. *Prev Med.* 1997; 26:542-549.
- [112] Nitert MD, Foxcroft KF, Lust K, Fagermo N, Lawlor DA, O'Callaghan M, McIntyre HD, Callaway LK. Overweight and obesity knowledge prior to pregnancy: a survey study. *BMC Pregnancy Childbirth.* 2011; 11: 96.
- [113] Education and Training Experience. Queensland, Australia, 2005 (cat No. 6278.0). Australian Bureau of Statistics, 2005. www.ausstats.abs.gov.au/ausstats/abs@archive.nsf/.../62780_qld.xls. Accessed 10 October 2012.
- [114] Luo ZC, Wilkins R, and Kramer MS. Effect of neighborhood income and maternal education on birth outcomes: a population based study. *CMAJ.* 2006; 174(10):1415-1420.

- [115] Hagger MS, Orbell S. A meta-analytic review of the common-sense model of illness representations. *Psychol Health*. 2003; 18(2):141-184.
- [116] Reaven G, Segal K, Hauptman J, Boldrin M, et al. Effect of Orlistat-assisted weight loss in decreasing coronary heart disease risk in patients with syndrome X. *Am J Cardiol*. 2001; 87:827-831.
- [117] Cohen DA, Babey SH. Contextual influences on eating behaviors: heuristic processing and dietary choices. *Obes Rev*. 2012; 13(9): 766–779.