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Strategy for the Prevention of Obesity - Malaysia

Malaysian Association for the Study of Obesity

Strategy for the Prevention of Obesity - Malaysia

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Foreword

Obesity has been a growing problem in most countries and corresponds to the steady decline in the prevalence of infectious diseases in the first half of the 20" century. The clinical relevance of obesity as well as its impact on public health became apparent in the 1950's when actuarial studies showed a close association between obesity and increased morbidity and mortality.

The increase in the standard of living in most countries is accompanied by increase in weight gain and obesity. Malaysia is no exception. Available data suggests that the prevalence of overweight and obesity in adults, adolescents and children in Malaysia is among the highest in the Asian region.

Many developed countries utilise sophisticated technology and highly specialised tertiary care to diagnose and manage the increasing number of obesity-related complications. Such services would require substantial costs. Similar demands in Malaysia will impose a huge burden on the human and financial resources in this country, all of which may complicate health care planning and healthcare priorities.

It is therefore imperative and strategic for us to intervene early before a typical dietary pattern associated with obesity becomes widespread. Similarly, we need to do much more to curb the sedentary lifestyle pattern and physical inactivity that is evident among Malaysians in all age groups. For us to be successful in combating the problem of obesity and obesity-related complications, we need to work with all stakeholders at all levels because obesity is often associated with multifactorial causes and therefore, to control it, we would require a multisectoral approach.

On behalf of the Ministry of Health Malaysia, I wish to congratulate the Malaysian Association for the Study of Obesity (MASO), and the members of the Technical Committee for their noble efforts. I would also like to thank all participants of the Consensus Workshop for their contributions towards the successful completion of this document.

DATUK DR. HJ. MOHD ISMAIL BIN MERICAN
Director-General of Health

8 December 2005

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Preface

Given the magnitude and complexity of the problem of obesity and its prevention, inter-sectoral collaboration and integration are crucial to the successful development and implementation of obesity prevention programmes. There is an urgent need to enhance the professional understanding of prevention principles and practices; to involve all relevant partners at national and local level to develop supportive public policies and create appropriate health promoting environments.

This document initiated by the Malaysian Association for the Study of Obesity (MASO) in collaboration with the Ministry of Health Malaysia, describes recommendations to help prevent normal weight individuals from becoming overweight or obese.

Members of the Technical Committee include representatives from Malaysian Association for the Study of Obesity, Ministry of Health Malaysia, Nutrition Society of Malaysia, Malaysian Dietitians' Association, Universiti Kebangsaan Malaysia and Specialist Teachers Training College. The Technical Committee will have continuing responsibility for the review and updating this document to be conducted once in every five years.

This document contains information on definition and classification of obesity, prevalence and trends, health consequences and economic cost. Factors that contribute to obesity and their prevention strategies as well as recommendations for future research are also discussed.

This document developed through a Consensus Workshop is useful for the healthcare providers, other related professionals as well as educators to help them educate specific target groups, particularly families and communities, schools, healthcare system, media and workplaces.

The information in this document is not only useful but timely in sensitizing stake-holders and policy makers on the importance of preventing obesity and most importantly, sufficient leadership be trained at national and local levels to assure that these preventive actions produce the desired goal of "Healthy Weight for All Malaysians".

I wish to thank the members of the Technical Committee for their effort and perseverance and all the participants of the Consensus Workshop for their contribution to the successful completion of this document. .

PROFESSOR DR. MOHD ISMAIL NOOR
Chairman, Technical Committee
Strategy for the Prevention of Obesity Malaysia (SPOM)

5 December 2005

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(Refer Appendix D)

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EXECUTIVE SUMMARY

Obesity has been described for some time as a clinically important condition that is a major contributor to many chronic diseases and disability in affected individuals; however it is only recently that it has been recognised as a population-wide problem that requires preventive action.

The Technical Committee comprising of experts in various fields and through an extensive review of the literature, has produce a document that examines the epidemiology of obesity, definition and classifications, environmental factors (including diet and physical activity), behavioural and socio-cultural factors in the aetiology of obesity.

The document discuss interventions across a range of key settings and in different population groups aimed at promoting healthy eating and increasing physical activity at a population level. It also describes potential opportunities for innovative approach of major stake-holders namely, the Government, related industries, family and communities and the media to combat the rising obesity epidemic in Malaysia.

The Technical Committee recognized that overweight and obesity represent a rapidly growing threat to the health of Malaysians irrespective of age, sex, ethnic and socio-economic status. The Technical Committee propose the following recommendations:

- Obesity is largely preventable through changes in lifestyle. There is an urgent need to prevent or reverse unhealthy trends in diet and physical activity pattern among Malaysians. Preventive measures should begin early in life.

- Obesity cannot be prevented or managed solely at the individual level. Communities, government, the media and the food industry need to work together to modify the environment so that it is less conducive to weight gain.

- A national action plan for the control and prevention of obesity is proposed to effectively combat the problem. This should be facilitated by the establishment of a National Steering Committee on obesity under the purview of the National Plan of Action for Nutrition.

- For meaningful comparison between population, the classification of overweight and obesity should be standardized on an international basis. The Technical Committee recommends retaining the WHO (1998) BMI classifications of ≥25.0 for overweight and ≥30.0 as obese.

- The Technical Committee recommends taking preventive actions at BMI 23.0 (representing increased risk) and at BMI 27.5 (at high risk) in line with WHO (2004) recommendation.

- A surveillance system should be established to track the problem of obesity in adults and children. This will enable timely and targeted intervention programmes to be implemented.

- Research should be supported particularly in relation to health consequences associated with overweight and obesity in all age-groups.

- The economic burden of overweight and obesity should be systematically evaluated.

1. INTRODUCTION

This document describes recommendations to affect a combined approach to prevent overweight and obesity. It was initiated by the Malaysian Association for the Study of Obesity (MASO) in collaboration with the Ministry of Health, Malaysia.

The terms of reference are as follows:

a. To provide a detailed overview of the problem of obesity including its definition, causes and consequences
b. To provide an overview of the severity of the problem of obesity in Malaysia
c. To recommend appropriate strategies for the prevention of obesity focussing on the whole population as well as specific target groups

This document is divided into nine sections, which cover different aspects of obesity.

- **Section 1** serve as an introduction which describes the term of reference of the technical committee, descriptions of each section and the major source of references used in drafting the document.

- **Section 2** provides a brief background on obesity. There is strong epidemiological evidence indicating that the prevalence of obesity in developing countries often increases in communities emerging from lifestyles of subsistence into affluence. Its public health implication impose a huge burden on the human and economic resources which we can ill-afford and the challenges that lies ahead for Malaysians has never been greater.

- **Section 3** examines the definition and classifications of obesity comparing WHO (1998, 2004) and WHO/IASO/IOTF (2000) reports. Defining and identifying the extent of the problem is a critical step in a coherent approach to its prevention and management strategy. The BMI classification issues were discussed together with the public health action points (WHO 2004). Waist circumference and waist/hip ratio as surrogate measures of co-morbidity are also discussed.

- **Section 4** covers aspects related to the prevalence of obesity in Malaysia and the Asia-Pacific region, and its health consequences ranging from an increased risk of premature death to several non-fatal debilitating complaints that impact on quality of life. The Committee also examined economic costs of obesity, which is known to impose a huge burden on the human and economic resources of the country. This section also discusses the health benefits of weight loss.

- **Section 5** describes what is known about this complex, multifactorial disease and identifies the major factors contributing to the development of obesity. Positive energy balance is known to be influenced by powerful societal and environmental forces which may overwhelm the physiological regulatory mechanisms that operate to keep weight stable. Dietary intake of Malaysians has changed markedly over the last three decades. Malaysians are reported to have lower energy expenditure, due to lower BMR and sedentary lifestyle. This section also describes examples of energy-saving activity pattern in modern societies and the psychosocial factors contributing to obesity.

- **Section 6** is devoted to childhood obesity encompassing its definition, classification, prevalence, aetiology and guidance for obesity prevention.

- **Section 7** provides recommendations for preventive strategies based on the principle of shared responsibility. Strategies for prevention of obesity involving different settings namely individuals, families and communities, schools, healthcare, media and communication and workplace have been recommended.

- **Section 8** describes research needs according to the different settings as mentioned in section 7.

- **Section 9** present appendices which allow readers to obtain detailed description of actions to be taken as stipulated in the respective sections.

The following publications served as useful references in the preparation of this document:

- Systematic review of relevant published literature as identified by computerized (CD-ROM) search

- Reports of other expert working parties in the same area as listed below:

  a. Report of a WHO Expert Consultation on appropriate BMI for Asian populations and its implications for policy and intervention strategies [WHO (2002) Singapore; Lancet (2004)]
  b. WHO Global Strategy on Diet, Physical Activity and Health : Western Pacific Regional Consultation Meeting Report (2003)
  c. WHO (2003) Diet, Nutrition and the Prevention of Chronic Diseases. Technical Report Series 916, Geneva
  d. The Surgeon General's Call to Action to Prevent and Decrease Overweight and Obesity (US DHHS 2001)
  e. The Asia-Pacific perspective: Redefining obesity and its treatment (2000)
  f. The Malaysian Dietary Guidelines (1999) – Ministry of Health, Kuala Lumpur
  g. Obesity – Preventing and Managing the Global Epidemic, WHO (1998)

h. Obesity in Scotland – Integrating Prevention with Weight Management (SIGN) Scottish Intercollegiate Guidelines Network (1996).
i. Recommended Nutrient Intakes for Malaysia. A report of the Technical Working Group on Nutritional Guidelines (NCCFN 2005)

This document was developed through a Consensus Workshop and input from relevant Ministries and selected professionals. It serves as a guidance to help healthcare providers, other related professionals as well as educators in educating specific target groups, particularly families and communities, schools, healthcare system, media and workplaces.

Users must keep in mind that new evidence could supersede recommendations in this document. The Technical Committee propose that this document be scheduled for review five years after publication, or when new evidence are available that require substantive changes to the recommendation.

2. BACKGROUND

In some communities even till today, weight gain and fat storage have been viewed as indications of good health and increasing wealth. As the standard of living continues to rise, weight gain and obesity has emerged as one of the most common and serious nutritional problems confronting many communities all over the world today. Obesity is a chronic disease, prevalent in both developed and developing countries, and affecting all age groups. Indeed, it is now so common that it is replacing the more traditional public health concerns, including undernutrition and infectious diseases, as one of the most significant contributors to ill health (WHO 1998). The problem may stem from the limited knowledge of the health impact of obesity compared with such fatal conditions as stroke and coronary heart disease.

Almost 30 years ago, we have been reminded by Professor Waterlow's statement in his report to the Department of Health and Social Security/Medical Research Council, United Kingdom in 1976, which still holds true up till today. He stated "We are unanimous in our belief that obesity is a hazard to health and a detriment to well-being. It is common enough to constitute one of the most important medical and public health problems of our time, whether we judge importance by a shorter expectation of life, increased morbidity, or cost to the community in terms of both money and anxiety" (Waterlow 1976).

Obesity is a condition of excess body fat and in most cases obese people are so because the energy intake in their diet has, over a period of time, exceeded their energy expenditure for metabolism, physical activity and growth. Obesity continues to be a prevalent public health problem in the developed countries, while there is strong epidemiological evidence indicating that the prevalence of obesity in developing countries often increases in communities emerging from lifestyles of subsistence into affluence.

One of the scientific curiosities of the human predicament is our limited ability to cope with excess supply of energy (calories). It has been known for many years that there is a range of acceptable body weight where present and future health is both optimal. This range is associated with a narrow range of energy supply. If the energy supply falls by 10%, 20% or perhaps 30%, then compensation through limiting physical activity can prevent disastrous weight loss. On the other hand, an increase in energy supply of even 10% above requirement for energy balance is enough to produce catastrophic weight gain. For most people there is no automatic compensatory increase in physical activity or other energy expenditure, which can match this rise (Lean 1996).

In developed countries, even with long experience in tackling the problem, they have failed to arrest the rise in the prevalence of obesity during the past few decades. The management of obesity is notoriously difficult for several reasons:

(i) the prolonged nature of the treatment,
(ii) the need to readjust dietary energy intakes and physical activity permanently to maintain a reduced weight and
(iii) the changes in metabolism and appetite which tend to minimize weight loss.

In most cases the result is a transient phase of weight loss followed by a rapid return to the obese condition. The hard fact therefore is that there is no immediate remedy, and a preventive policy seems to be the most appropriate solution.

Recent advances in human genetics and molecular biology have increased our understanding of the human genome. Scientists involved in the study of human obesity have become more optimistic about the possibility of identifying the genes associated with the predisposition to various types of obesity.

Obesity is a public health concern because of its association with a number of medical complications that lead to both increased morbidity and mortality. The most common complications are type 2 diabetes, hypertension, dyslipidaemia, cardiovascular disease (CVD), gallstones and cholecystitis, respiratory dysfunction and certain cancers (WHO 1998). These diseases represent far too great a burden for policy-makers, healthcare providers and researchers to ignore. The current trend in developed countries is the enormous cost of high technology and tertiary healthcare needed to diagnose and manage the high-incidence of obesity-related complications. Similar demands in Malaysia will impose a huge burden on the human and economic resources of the country and are liable to disturb priorities in the healthcare or other sectors. The question is "Can we afford it?" In this context, it is in Malaysia's best interest to intervene early before a typical dietary pattern associated with obesity becomes widespread and established within our population (Ismail 1998). Similarly, we need to curb the sedentary lifestyle pattern and physical inactivity that is evident among Malaysians in all age groups. Considerable advances have been made to treat obesity either through diet, exercise and behavioural modifications. However, despite this progress, prevalence of obesity has risen sharply over the last decade. Commercial weight loss products and programmes have gained popularity among Malaysians despite the fact that most of them have not been thoroughly evaluated for effectiveness and safety. The challenge to public health workers and scientists in this area has never been greater.

REFERENCES

Ismail MN. (1998). Obesity in Malaysia: prevalence and metabolic studies. In: Shetty PS, Gopalan C. Eds. Diet, *nutrition and chronic disease: An Asian perspective*. Smith-Gordon, London.

Lean MEJ. (1996). *Obesity*: *A clinical issue*. London: Science Press Ltd. p53.

Waterlow JC. (1976). In: *Research on obesity*: a report of the DHSS/MRC Group. James WPT (compiler). London: Her Majesty's Stationary Office. P94.

WHO. (1998). *Obesity: Preventing and managing the global epidemic*. Report of a WHO Consultation on Obesity. Geneva: World Health Organisation.

3. DEFINING OBESITY

Obesity is often defined simply as a condition of abnormal or excessive fat accumulation in adipose tissue, to the extent that health may be impaired. However, obese individuals differ not only according to the degree of excess fat, which they store, but also in the regional distribution of the fat within the body. Indeed, excess abdominal fat is as great a risk factor for disease as is excess body fat per se (WHO 1998).

3.1 Body Mass Index

One of the most commonly used indices of relative weight is the Body Mass Index (BMI), which is defined as body weight in kilogram divided by height, in meters squared. It was not originally intended as an index of obesity but is now commonly employed as such in epidemiological studies, to predict obesity-related morbidity and mortality in adults. A BMI of 30 kg/m^2 is considered the threshold of obesity. BMI however, does not distinguish between weight associated with muscle and weight associated with fat. BMI can be considered to provide the most useful, albeit crude, population-level measure of obesity. The classification of overweight and obesity in adults as proposed by WHO (1998) is shown in Table 1.

Table 1: Classification of weight status in adults according to Body Mass Index (BMI)

Classification	BMI (kg/m2)	Risk of co-morbidities
Underweight	< 18.5	Low (but risk of other clinical problems increased)
Normal range	18.5 – 24.9	Average
Overweight:	≥ 25	
Pre-obese	25 – 29.9	Increased
Obese class I	30.0 – 34.9	Moderate
Obese class II	35.0 – 39.9	Severe
Obese class III	≥40.0	Very severe

Source: WHO (1998)

The adequacy of the current international standard (WHO 1998) for informing policy and interventions in some populations has been questioned due mainly to substantial inter-population differences in the meaning of a given BMI (with respect to the level of body fatness, the associated level of health risk, or both) and in the range of BMI itself.

There has been two previous attempts to interpret the WHO BMI cut-offs in Asian and Pacific populations (WHO/IASO/IOTF 2000; James et al. 2002) A proposal has been made to redefine the classification of obesity using BMI for Asian population (Table 2) as there are now evidence that the increased risks of co-morbidities with obesity occurs at a lower BMIs in Asians (WHO/IASO/IOTF 2000). The recommendation is however based on two studies - in Hong Kong (Ko et al. 1999) and in Singapore (Deurenberg-Yap et al. 2000).

Table 2: Classification of weight status according to BMI in Asian Adults

Classification	BMI (kg/m2)	Risk of co-morbidities
Underweight	< 18.5	Low (but risk of other clinical problems increased)
Normal range	18.5 – 22.9	Average
Overweight:	> 23.0	
At Risk	23.0 – 24.9	Increased
Obese class I	25.0 – 29.9	Moderate
Obese class II	> 30.0	Severe

Source: WHO/IASO/IOTF (2000)

WHO convened another expert consultation in Singapore in 2002 to address the debate on interpretation of recommended BMI cut-off points for determining overweight and obesity in Asian populations.

The population level of BMI cut-off points is to identify risks of adverse health outcomes associated with different levels of body composition, so as to inform and trigger policy action, facilitate prevention programmes and to measure the impact of interventions. BMI cut-off points are also used for epidemiological purposes to help in determination of the aetiology of diseases. For clinical applications, population specific cut-off points will need to be determined by countries as most appropriate and should be used with an individual's clinical history and other clinical measurements (e.g. waist circumference and presence of other related factors). Ethnic-specific cut-off points may not be useful as it is likely to create great confusion in health promotion and disease prevention and management.

Rationale

- It has become increasingly clear that there is an emerging high prevalence of non-insulin dependent diabetes (NIDDM) and cardiovascular risk factors in parts of Asia below the cut-off points of less than 25 kg/m^2 for overweight and BMI less than 30.0 for obesity. (Ko et al. 1999; Deurenberg 2001; China Obesity Task Force 2002; Yajnik 2002; Zhou 2002)

- It is also known that relationship between BMI, and body fat percent and fat distribution, are less favourable in many Asian populations compared with Caucasian/European populations (Wang et al. 1994; Gurrici et al. 1998; Deurenberg-Yap et al. 2000; He et al. 2001).

- The BMI cut-off points for observed increased risk in different Asian populations varies from 22 to 25 kg/m^2 and for high risk varies from 26 to 31 kg/m^2 (Deurenberg & Deurenberg-Yap 2003)

If BMI cut-off values for overweight and obesity were to be lowered, it will automatically increase their prevalence rate overnight. This would then require adaptation in public health policies and clinical management guidelines. It would, however, also increase the governmental and public awareness and as such help to combat the increasing prevalence of obesity.

The WHO Expert Consultation (2004) made no attempt to redefine BMI cut-off points for each population based on the body composition data. Rather, the Consultation identified potential "public health action points" along the continuum of BMI. Reasons for this approach;

1) The relationship between BMI and risk curves are continuous, hence, all cut-off points based on risk slope are arbitrary.

2) Epidemiology "hard outcomes" such as defined disease were considered better than body composition and more meaningful to clinicians and policy makers.

3) BMI versus body composition varies substantially but the variation is not consistent across populations and within a given population under different social and lifestyle changes over time.

Recommendations (WHO Expert Consultation 2004)

1) The current WHO cut-off points of 18.5, 25, 30 and 40 kg/m^2 are retained. But the cut-off points of 23, 27.5, 32.5 and 37.5 kg/m^2 (Figure 1) are to be added as points for public health action.

2) For continuity, particularly in countries with concurrent problems of undernutrition and overnutrition, the distribution should continue to be presented as a continuum beginning with BMI less than 16 kg/m^2, through the BMI category of equal to or more than 40 kg/m^2. Above 18.5 kg/m^2 the categories are simply midway between the current cut-off points, except for the 18-24.9 kg/m^2 category. In this latter case, the intermediate cut-off point (23.0 kg/m^2) was chosen as a public health action point on the basis of the results of the meta-analysis from 9 countries in Asia and other published work.

3) For many Asian populations, additional trigger points for public health action were identified as 23 kg/m^2 or higher, representing increased risk, and 27.5 kg/m^2 or higher, as high risk. The suggested categories are as follows: less than 18.5 kg/m^2 underweight; 18.5-23 kg/m^2 increasing but acceptable risk; 23-27.5 kg/m^2 increased risk; and 27.5 kg/m^2 or higher, high risk.

Guidance should be provided to countries to identify public health action points that are most useful for the situation in each country. Countries should be aware that the increased risk is a continuum with increasing BMI, and that cut-off points are merely a convenience for public health and clinical use. Consequently, ranges were given (see Figure 1) but with the assumption that many Asian countries will use the ranges suggested. However global definition of overweight and obesity would remain as 25 kg/m^2 and above for overweight and 30 kg/m^2 and above for obesity.

4) In considering BMIs of less than 21, it should be borne in mind that the lower range of BMI might reflect undernutrition in populations with current or recent widespread undernutrition.

5) Wherever possible, countries should use all categories for reporting purposes with a view to facilitating international comparisons (i.e. 18.5, 20, 23, 25, 27.5, 30, 32.5 kg/m^2, and in many populations, 35, 37.5 and 40 kg/m^2)

6) Where possible, in populations with a predisposition to central obesity and related increased risk of developing the metabolic syndrome, waist circumference should also be used to refine action levels based on the basis of BMI. For example, action levels based on BMI might be increased by one level if the waist circumference is above a specified action level.

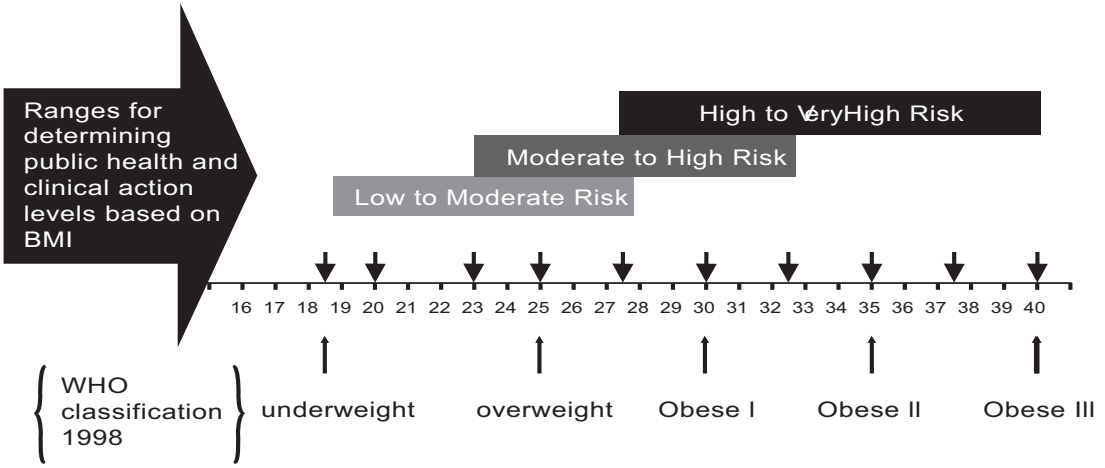


Figure 1: Suggested cut-off points (↓) for reporting population BMI distribution and specific action levels for population and individuals
Source: WHO (2004)

The recommendations above also suggests that the cut-off points for observed risks among Asians varies by three BMI points and made no attempt to redefine cut-off points. There is also lack of local data to support any changes to the BMI classification. The Committee recommends retaining the current WHO classification of BMI (WHO 1998) for adults (Table 1). However, the Committee acknowledges the need to have the public health action points as recommended by WHO Expert Consultation 2004 (Table 3).

Table 3 : Recommended BMI cut-off points for body weight classification and public health action for Malaysians

Body weight classification	BMI cut-off points for definition[1] (kg/m^2)	Comorbidities risk	BMI cut-off points for public health action[2] (kg/m^2)
Underweight	<18.5		<18.5
Normal range	18.5 to 24.9	Low	18.5 to 22.9
Overweight	≥ 25.0		23.0 to 27.4
Pre-obese	25.0 to 29.9	Moderate	27.5 to 32.4
Obese class I	30.0 to 34.9	High	32.5 to 37.4
Obese class II	35.0 to 39.9	Very high	≥ 37.5
Obese class III	≥ 40.0		

Source: [1]WHO (1998); [2]WHO Expert Consultation (2004)

3.2 Waist Circumference and Waist Hip Ratio

Excess abdominal fat is an independent predictor of risk factors and morbidity of obesity-related diseases such as type 2 diabetes, hypertension, dyslipidaemia and cardiovascular diseases. Waist circumference is positively correlated with abdominal fat. Hence, waist circumference is a valuable additional alternative method in identifying individuals at increased risk. Waist circumference (WC) is a convenient and simple measurement (Figure 2), which is unrelated to height and correlates closely with BMI and Waist-Hip Ratio (WHR). It is an approximate index of intra-abdominal fat mass.

Populations differ in the level of risk associated with a particular waist circumference, and so global cut-off points cannot be applied. For Caucasians, waist circumference of 94 cm and above in men and 80 cm and above in women denotes increased risk while waist circumference of 102 cm and above in men and 88 cm and above in women denotes substantially increased risk of metabolic complications (WHO 1998). WHO/IASO/IOTF (2000) report suggested cut off points of 90 cm and above in men and 80 cm and above in women.

However, it has become increasingly clear that there is a high prevalence of type 2 diabetes mellitus and cardiovascular risk factors in parts of Asia below these cut off points. Evidence from several Asian countries is now available including Hong Kong (Ko et al. 1999), Singapore (Deurenberg 2001) and China (China Obesity Task Force, 2002;

Zhou 2002; Jia et al. 2002). Thus based on the current evidence, the WHO/IASO/IOTF (2000) proposed waist circumference cut-off points are adopted (Table 4).

Table 4: Waist circumference cut-off points for increased risk to metabolic diseases

	Men	Women
WHO (1998)	≥94cm (37 inches)	≥80cm (32 inches)
WHO/IASO/IOTF (2000)	≥90cm (35 inches)	≥80cm (32 inches)

Over the last decade, a high WHR (WHR more than 1.0 in men and more than 0.85 in women) has become accepted as the clinical method of identifying patients with abdominal fat accumulation. However, recent advances suggest that waist circumference alone is a better and more practical measure.

Figure 2: Measuring Waist Circumference

REFERENCES

China Obesity Task Force. (2002). Predictive value of body mass index and waist circumference to risk factors of related diseases in Chinese adult population. *Clinical Journal of Epidemiology*. 23:5-10.

Deurenberg P. (2001). Universal cut-off BMI points for obesity are not appropriate. *British Journal of Nutrition*. 85:135-136.

Deurenberg P & Deurenberg-Yap M. (2003). Validity of body composition methods across ethnic population groups. In: Elmadfa I, Anklam E, Konig JS. Eds. Modern aspects of nutrition: present knowledge and future perspective. *Forum Nutr.* Basel Karger. 56:299-301

Deurenberg P, Deurenberg-Yap M, Wang J, Lin FP & Schmidt G. (1999). The impact of body build on the relationship between body mass index and body fat percent. *International Journal of Obesity*. 23:537-542

Deurenberg-Yap M, Schmidt G, Staveren WA & Deurenberg P. (2000). The paradox of low body mass index and high body fat percent among Chinese, Malays and Indians in Singapore. *International Journal of Obesity*. 24:1011-1017.

Gurrici S, Hartriyanti Y, Hautvast JG & Deurenberg P. (1998). Relationship between body fat and body mass index: differences between Indonesians and Dutch Caucasians. *European Journal of Clinical Nutrition*. 52(11):779-83.

He M, Tan KCB, Li ETS & Kung AWC. (2001). Body fat determinations by dual energy X-ray absorptiometry and its relation to body mass index and waist circumference in Hong Kong Chinese. *International Journal of Obesity*. 25:748-752.

James WPT, Chen C & Inoue S. (2002). Appropriate Asian body mass indices? *Obesity reviews*. 3(3):139

Jia WP, Xiang KS, Chen L, Lu JX & Wu YM. (2002). Epidemiological study on obesity and its comorbidities in urban Chinese older than 20 years of age in Shanghai, China. *Obesity Reviews*. 3(3):157-165.

Ko GTC, Chan JC, Cockram CS & Woo J. (1999). Prediction of hypertension, diabetes, dyslipidaemia or albuminuria using simple anthropometric indexes in Hong Kong Chinese. *International Journal of Obesity*. 23:1136-1142.

Wang J, Thornton JC, Russell M, Burastero S, Heymsfield SB & Pierson RN. (1994). Asians have lower BMI but higher percent body fat than do Whites: comparisons of anthropometric measurements. *American Journal of Clinical Nutrition*. 60:23-28.

WHO. (1998). *Obesity: Preventing and managing the global epidemic*. Report of a WHO Consultation on Obesity. Geneva: World Health Organisation.

WHO Expert Consultation. (2004). Appropriate body mass index for Asian populations and its implication for policy and intervention strategies. *Lancet*. 363:157-163

WHO/IOTF/IASO. (2000). *The Asia-Pacific perspective*: *Redefining Obesity and its Treatment*. Hong Kong: World Health Organization, International Obesity Task Force, International Association for the Study of Obesity.

Yajnik CS. (2002). The lifecycle effects of nutrition and body size on adult adiposity, diabetes and cardiovascular disease. *Obesity Reviews*. 3(3):217-224.

Zhou BF. (2002). Predictive values of body mass index and waist circumference for risk factors of certain related diseases in Chinese adults-study on optimal cut-off points of body mass index and waist circumference in Chinese adults. *Biomedical and Environmental Sciences*. 15:83-95.

4. WHY THE CONCERN?

4.1 Prevalence of Obesity

The global burden of overweight (BMI 25.0 – 29.9) and obesity (BMI≥30.0) is estimated at more than 1.1 billion. There is evidence that the risk of obesity related diseases among Asians rises from a lower BMI of 23.0 (James et al. 2002). If this were adopted as a new benchmark for overweight Asians, it would require a major revision of approaches in the Asian sub-regions, where a significant proportion of the 3.6 billion population already has a mean BMI of 23.4. In the Asia Pacific region, the prevalence of obesity in men is between less than 1% in China to about 58% in urban Samoa. In women, obesity prevalence is between less than 2% in China to about 77% in urban Samoa. Available local data on prevalence of obesity reveals that the problem faced in Malaysia is more serious than those reported in other Asian countries (Figure 3).

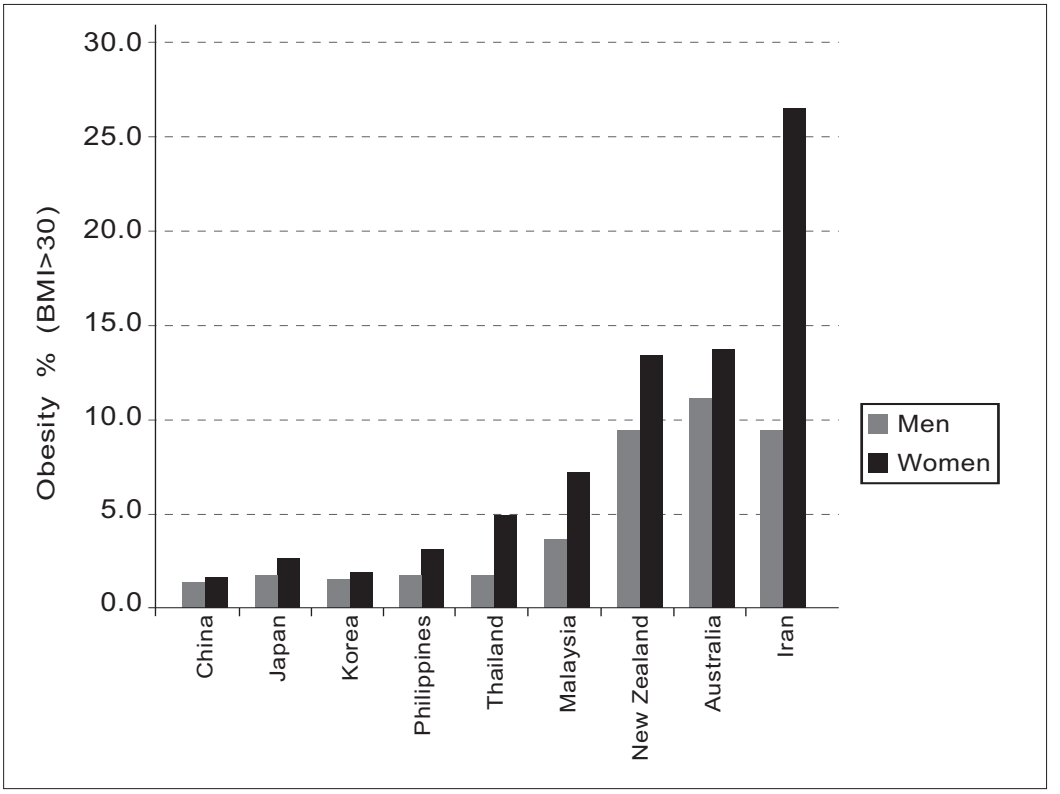


Figure 3: Prevalence of obesity in Asia Pacific region.

(Source: WHO/IASO/IOTF, 2000)

In adults, Ismail et al (1995) reported prevalence of overweight and obesity in men were 24.0% and 4.7% while in women were 18.1% and 7.7%, respectively. Among the Malaysian women, ethnic differences were evident, with Indians (16.5%), Malays (8.6%) and Chinese (4.3%). Rural-urban differences are also evident, 5.6% of urban men were obese as compared to 1.8% for rural men while 8.8% urban women were obese as compared to 2.6% of rural women. The National Health Morbidity Survey (1996) reported that in males, 20.1% were overweight and 4.0% obese while in females, 21.4% were overweight and 7.6% obese. It also reported that there is little difference between rural and urban populations and that there are more obese Malays and Indians as compared to Chinese (Lim et al. 2000).

Even among rural communities, the problem of overweight and obesity is also large. In a nationwide study of 4,600 rural villagers throughout Peninsular Malaysia, Khor et al (1999) reported a prevalence of 19.8% overweight amongst men and 28.0% amongst women. The prevalence of obesity was 4.2% amongst men and 11.1% amongst women.

Overweight and obesity are also a concern among the older populations in this country. In a study among 945 elderly people, mostly Malays, from major functional groups in Peninsular Malaysia (Zaitun et al. 1999), the prevalence of overweight was 18.2% and obesity was 4.3%. In a later study by Suzana et al. (2003) among 820 elderly Malays from four rural areas of Peninsular Malaysia, the prevalence of overweight and obesity were 24.7% and 11.4%, respectively.

4.2 Health Consequences of Obesity

The health consequences of obesity are many and varied, ranging from an increased risk of premature death to several non-fatal but debilitating complaints that impact on immediate quality of life. Obesity exacerbates numerous health problems, both independently and in association with other diseases (WHO 1998). In particular, it is associated with the development of diabetes mellitus, coronary heart disease, hypertension, obstructive sleep apnoea and osteoarthritis of large and small joints. In comparison, obese individuals showed an increased incidence of certain form of cancers such as gallbladder, biliary passages, breast (postmenopausal), uterus (cervix and endometrium), ovaries, rectal and prostate cancers (Table 5).

4.3 Economic Cost of Obesity

The economic costs of obesity are important issues to health care providers and policy makers alike. The economic costs of obesity have been assessed from several developed countries and range from 2% to 6% (Wolf & Colditz, 1994; Caterson & Broom, 2001) of total health care cost (Table 6). In the USA, the treatment of obesity and its primary co morbidities costs the US health-care system more than USD99 billion each year and consumers also spend in excess of USD33 billion annually on weight-reduction products and services. Moreover, obesity is associated with an increased prevalence of socioeconomic hardship due to a higher rate of disability, early retirement and widespread

discrimination. As a result of industrialisation, urbanisation and economic stability in Malaysia, significant changes in diet and lifestyle have occurred. This has had a dramatic impact on the health of the population as evidenced from the increased prevalence of obesity and chronic non-communicable diseases. Malaysia is thus entering a new era of public health where nutrition-related issues will become ever more prominent.

Table 5: Health risks associated with obesity

Greatly increased (RR > 3)	Moderately increased (RR 2-3)	Mildly increased (RR 1-2)
• Type 2 diabetes • Gallbladder diseases • Dyslipidaemia • Metabolic Syndrome • Breathlessness • Sleep apnoea	• Coronary heart disease • Cardiac failure • Hypertension • Osteoarthritis (knees and hips) • Hyperuricaemia and gout	• Cancer (breast cancer in postmenopausal women, endometrial cancer, colon cancer) • Reproductive hormone abnormalities • Polycystic ovarian syndrome • Impaired fertility • Low back pain • Increased anaesthetic risk • Foetal defects associated with maternal obesity

RR = Relative risk
Source: WHO 1998

Table 6: Economic costs of obesity

Country / Year	Direct	% Health care expenditure	Indirect
USA 1990* / 1998	$51.6 billion BMI > 29 kg/m^2	5.7%	$47.6 billion
Australia 1989/1990*	AUD 464 million BMI > 30 kg/m^2	>2%	n.a.
NZ 1996	$135million	2.5%	n.a.
France 1992*	FF12 billion BMI ≥ 27 kg/m^2	2%	FF0.57 billion
Netherlands 1981 - 1989*	DFL 1 billion BMI > 25 kg/m^2	4%	n.a.
Canada 1999	$1.8 billion BMI > 27 kg/m^2	2.4%	n.a.
UK 1994	GBP 30 million	n.a.	GBP 165 million
England 1999	GBP 130 million – overweight GBP 15 million – obese	n.a.	n.a.

n.a. not available
*Source: *Wolf & Colditz (1994); Caterson & Broom (2001)*

4.4 Health Benefits of Weight Loss

Overweight and obesity are known to be associated with an increased risk of disease and death (Allison et al. 1999; NIH, NHLBI 1998). Randomized controlled trials have shown that weight loss (as modest as 5 to 15% of excess total body weight) reduces the risk factors for at least some diseases, particularly cardiovascular disease, in the short term. Weight loss results in lower blood pressure, lower blood sugar and improved lipid levels (NIH, NHLBI 1998). The benefits of weight loss on health risks in obesity are shown in Table 7.

Table 7: Benefits of weight loss on health risks in obesity

Health Risk	Benefits of 10 kg weight loss in a 100 kg subject
Blood Pressure	• 10 mmHg reduction systolic BP • 20 mmHg reduction diastolic BP • Weight loss also reduces the need for medication in hypertensive patients
Lipids	• 10% reduction in total Cholesterol • 15% reduction in LDL-cholesterol • 30% reduction in triglycerides • 8% increase in HDL-cholesterol
Diabetes	• >50% reduction in risk of developing DM (Weight loss of 6.8 kg is associated with 58% reduction in incidence of diabetes, at 3 years in the Diabetes Prevention Programme) (Knowler et al. 2002) • 30-50% reduction in Fasting plasma glucose • 15% reduction in HbA1c
Osteoarthritis	• Decrease BMI > 2kg/m^2 associated with more than 50% decreased risk for developing osteoarthritis (Felson et al. 1992)
Mortality	• 20-25% reduction in all-cause mortality • 30-40% reduction in diabetes-related death • 40-50% reduction in obesity-related cancer death

Source: SIGN (1996); MASO/AMM/MEMS (2004)

REFERENCES

Allison DB, Fontaine KR, Manson JE, Stevens J & Van Itallie TB. (1999). Annual deaths attributable to obesity in the United States. *Journal of the American Medical Association*. 282(16):1530-1538.

Caterson ID & Broom J. (2001). *Obesity*. London: Harcourt Health Communications.

Felson DT, Zhang Y, Anthony JM, Naimark A & Anderson JJ. (1992). Weight loss reduces the risk for symptomatic knee osteoarthritis in women. The Framingham Study. *Annals of Internal Medicine*. 116(7):535-539.

Ismail MN, Zawiah H, Chee SS & Ng KK. (1995). Prevalence of obesity and chronic energy deficiency (CED) in adult Malaysians. *Malaysian Journal of Nutrition*. 1:1-9.

James WPT, Chen C & Inoue S. (2002). Appropriate Asian body mass indices? *Obesity Reviews*; 3(3):139.

Knowler WC, Barrett-Connor E, Fowler SE, Hamman RF, Lachin JM, Walker EA & Nathan DM. (2002). Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *New England Journal of Medicine*. 346(6):393-403.

Khor GL, Azmi MY, Tee ES, Kandiah M & Huang MSL. (1999). Prevalence of overweight among Malaysian adults from rural communities. *Asia Pacific Journal of Clinical Nutrition*. 8(4): 272-279.

Lim TO, Ding LM, Zaki M, Suleiman AB, Fatimah S, Siti S, Tahir A & Maimunah AH. (2000). Distribution of body weight, height and body mass index in a national sample of Malaysian adults. *Medical Journal of Malaysia*. 55(1):108-28.

MASO/AMM/MEMS. (2004). *Clinical practice guidelines on management of obesity.* Report of the Malaysian Association for the Study of Obesity, Academy of Medicine Malaysia and Malaysian Endocrine and Metabolic Society, Kuala Lumpur.

NIH, NHLBI. (1998). Clinical guidelines on the identification, evaluation and treatment of overweight and obesity in adults. HHS, PHS; pp. 12-19; 29 - 41.

SIGN. (1996). *Obesity in Scotland: Integrating prevention with weight management*. Edinburgh: Scottish Intercollegiate Guidelines Network.

Suzana S, Zuriati I, Afaf Ruhi AF, Suriah AR, Noor Aini MY, Fatimah A & Zaitun Y. (2003). Penilaian multidimensi status pemakanan dan kesihatan di kalangan warga tua Melayu di kawasan luar Bandar. Prosiding Seminar IRPA RMK-7 (Jilid II), Pusat Pengurusan Penyelidikan, Universiti Kebangsaan Malaysia, ms: 169-173. Seminar IRPA RMK-7 held in Century Mahkota Melaka on 17 – 19 Januari 2003.

Wolf AM & Colditz GA. (1994). The cost of obesity: the US perspective. *Pharmacoeconomics* 5:34-37.

WHO. (1998). *Obesity: Preventing and managing the global epidemic*. Report of a WHO Consultation on Obesity. Geneva: World Health Organisation.

WHO/IOTF/IASO. (2000). *The Asia-Pacific perspective: Redefining obesity and its treatment*. Hong Kong: World Health Organization, International Obesity Task Force, International Association for the Study of Obesity.

Zaitun Y, Khor GL, Tee ES & Mirnalini K. (1999). Prevalence of obesity and other CVD risk factors among elderly in selected rural areas. Abstract in the Proceedings of the 3rd MASO Scientific Meeting on Obesity, 28-29 June 1999, Kuala Lumpur.

5. CAUSES OF OBESITY

5.1 Energy Balance in the Development of Obesity

Obesity can result from a minor energy imbalance, which lead to a gradual but persistent weight gain over a considerable period. Some researchers have hypothesized that energy imbalance is the result of inherited metabolic characteristics; whereas others believe it is caused by poor eating and lifestyle habits, that is "gluttony and sloth".

Positive energy balance occurs when energy intake is greater than energy expenditure and promotes weight gain (Figure 4). Conversely, negative energy balance promotes decrease in body fat stores and weight loss. Body weight is regulated by a series of physiological processes, which have the capacity to maintain weight within a relatively narrow range (stable weight). It is thought that the body exerts a stronger defence against undernutrition and weight loss than it does against over-consumption and weight gain.

Figure 4 also suggests that positive energy balance and weight gains are influenced by powerful societal and environmental forces which may overwhelm the physiological regulatory mechanisms that operate to keep weight stable. These include increasing automation, lack of recreational facilities and opportunities, increase in food variety and availability. Moreover, the susceptibility of individuals to these influences is affected by genetic and other biological factors such as sex, age and hormonal activities, over which they have little or no control (WHO 1998).

Dietary intake and physical activity are important contributing factors in the development of obesity. If calorie intake is in excess of requirement it will be stored mainly as body fat (Figure 4). If the stored body fat is not utilised over time, it will lead to overweight or obesity.

Inter-individual variations in energy intake, basal metabolic rate, spontaneous physical activity, the relative rates of carbohydrate-to-fat oxidation, and the degree of insulin sensitivity seem to be closely involved in energy balance and in determining body weight in some individuals (Ravussin 1993).

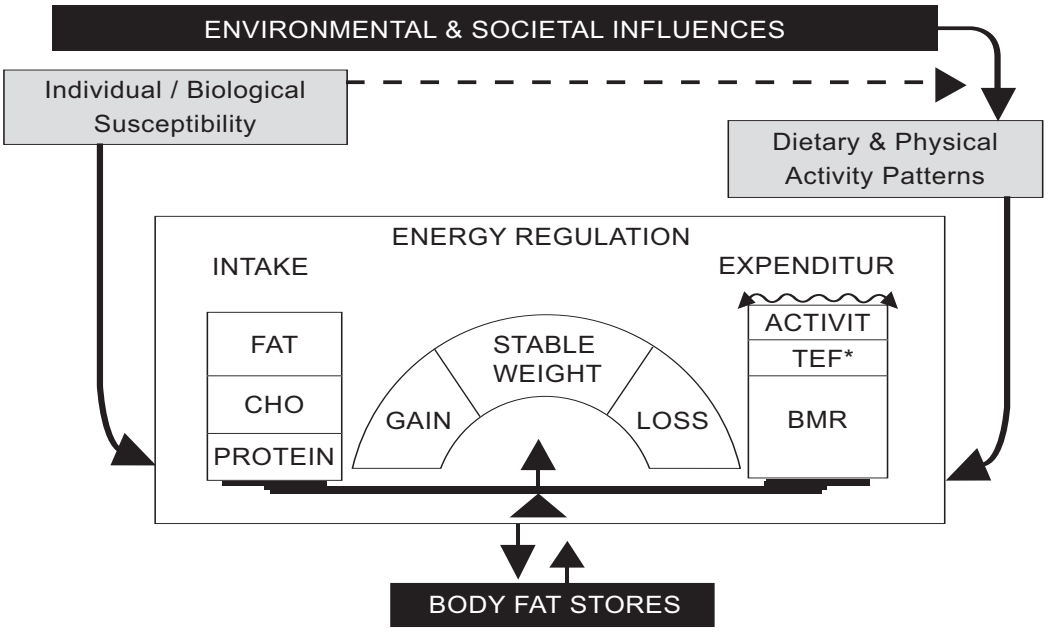


Figure 4: The fundamental principles of energy balance and regulation

* TEF = thermic effect of food; BMR = basal metabolic rate; CHO = carbohydrate.

Source: WHO (1998)

5.1.1 Factors that promote or protect against weight gain

WHO (2003) examined the various aetiological factors that could lead to unhealthy weight gain. These factors were categorised based on strength of evidence, namely convincing, probable, possible and insufficient as shown in Table 8.

Table 8: Summary of strength of evidence on factors that might promote or protect against weight gain and obesity

Evidence	Decreased risk	No relationship	Increased risk
Convincing	Regular physical activity. High dietary non-starch polysaccharide (fiber) intake	-	High intake of energy-dense nutrient-poor foods. Sedentary lifestyles
Probable	Home and school environments that support healthy food choices for children	-	Heavy marketing of energy-dense foods and fast-food outlets. Adverse social and economic condition (in developed countries, especially in women).
Possible	Low glycaemic index foods	Protein content of the diet	Sugar sweetened soft drinks and fruit juices. Large portion sizes. High proportion of food prepared outside the home (western countries) "Rigid restraint / periodic disinhibition" eating patterns
Insufficient	Increasing eating frequency	-	Alcohol

Source : WHO (2003)

5.2 Dietary Intake

5.2.1 Food consumption pattern

Dietary patterns of Malaysians have changed markedly, as evidenced from an analysis of food availability in the past four decades (1960s – 2000). Although these data should not be equated with consumption levels, food balance sheet data are useful in indicating probable trends in food consumption patterns. In the absence of regular food consumption surveys, these data do provide some useful information, within the recognized limitations of such data (Tee 1999).

FAO Food balance sheet data have shown that there has been a trend of increasing per capita availability of the major macronutrients calories, fat and protein, particularly the

former two nutrients (Figure 5). There was also a steady increase in the proportion of the calories from animal sources from 10% in the 1960s to 20% in the late 1990s. In the case of protein, proportion from animal sources also increased from 30% to almost 60% during the same time period. The increase in proportion of fat from animal sources was not so dramatic.

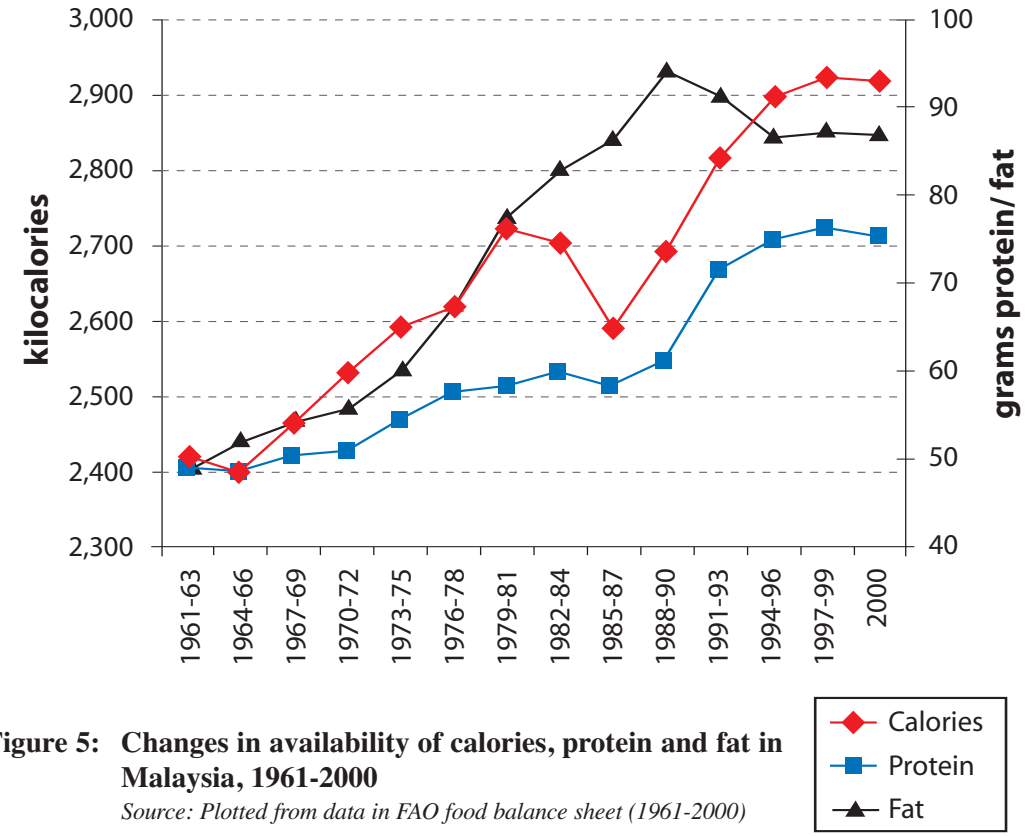


Figure 5: Changes in availability of calories, protein and fat in Malaysia, 1961-2000

Source: Plotted from data in FAO food balance sheet (1961-2000)

The changes in the sources of available calories are shown in Figure 6. A steady decline in calories from complex carbohydrates, notably cereals, is evident, from 60% in the 1960s to 40% in mid 1990s and appeared to have remained at that level. The availability of other fibre-rich foods, such as fruits and vegetables, has not increased over the years. There was a concomitant increase in the proportion of calories from oils and fats, sugars and meat, fish and eggs.

Similar changes in sources of available protein can be seen in Figure 7. The proportion of protein from cereals and from meat, fish and egg appeared to have levelled off in the late 1990s.

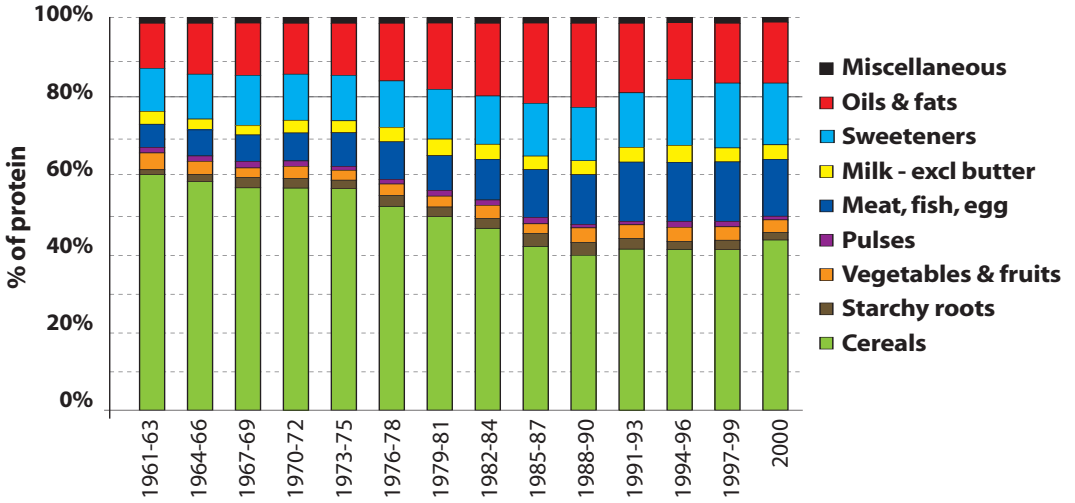


Figure 6: Changes in food sources of calories

Source: Plotted from data in FAO food balance sheet (1961-2000)

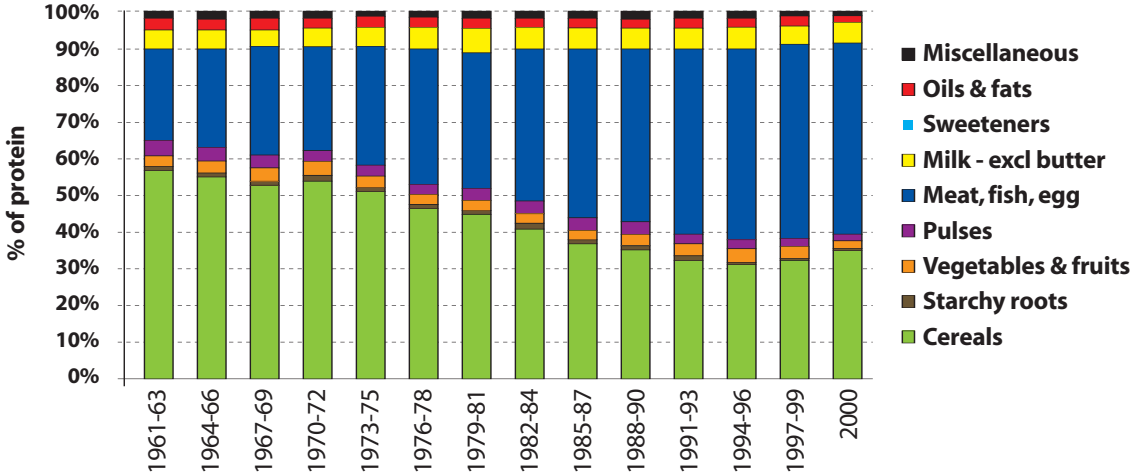


Figure 7: Changes in food sources of protein

Source: Plotted from data in FAO food balance sheet (1961-2000)

Figure 8 shows the percentage contribution of the three main nutrients namely carbohydrates, fat and protein to the total available energy over the past four decades. There has been a definite decline in the proportion of energy from carbohydrates, from about 73% in the 1960s to about 63% in 2000. At the same time, the percentage contribution of fat was observed to have increased from 18% to 27% .

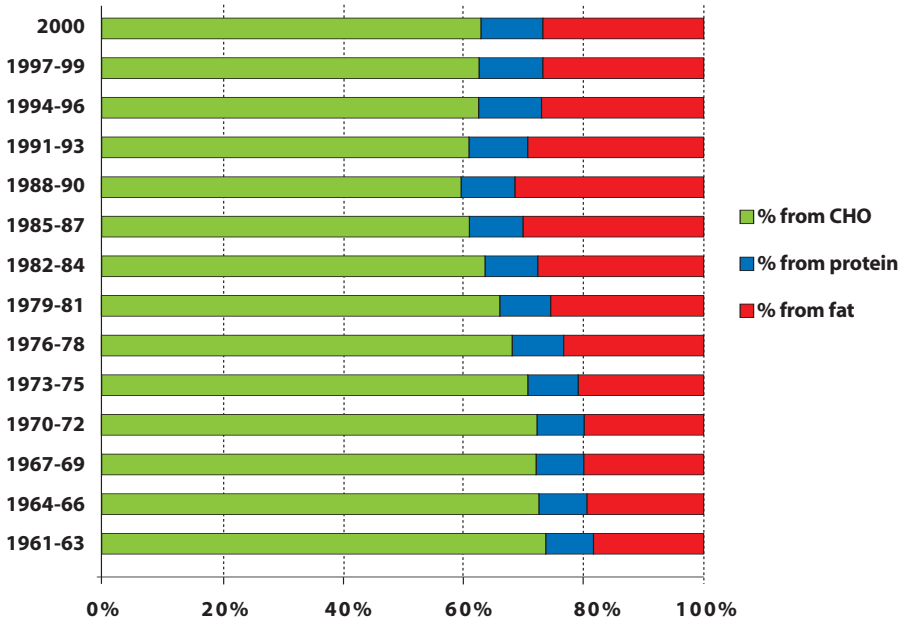


Figure 8: Changes in composition of calories from protein, fat and carbohydrates in Malaysia between 1961-2000

Source: plotted from data in FAO food balance sheet (1961-2000)

Local food consumption studies amongst different population showed that dietary energy intake varies widely. The contribution of fat ranges from 20 to 30 percent of total calories and tends to be higher among urban population. However, it should be borne in mind that dietary intake is not the only factor contributing to obesity.

5.2.2 Macronutrient composition of the diet

The association between energy intake and body weight relies on the ease with which excess macronutrients can be deposited as adipose tissue. The energy cost of nutrient storage is not identical for all macronutrients. The cost of fat storage from dietary fat is the lowest, followed by carbohydrate and protein (Flatt 1978). Macronutrients with a low storage capacity such as protein and carbohydrate will be preferentially oxidized when intakes exceeded requirements. Hence, excess dietary fat is more likely to be stored in the body and this capacity is unlimited (Astrup et al. 1994; Horton et al. 1995). The caloric content of fat is also more than twice that of protein or carbohydrate (Table 9).

Table 9: Energy content of macronutrients

Macronutrient	Energy contribution	
	kcal/g	kJ/g
Fat	9	37
Alcohol	7	29
Protein	4	17
Carbohydrate	4	16

Source: Paul & Southgate (1978)

Alcohol is not stored in the body thus all ingested alcohol is oxidized immediately. This response dominates oxidative pathways and suppresses the rates at which other fuels are oxidized. The obligatory disposal of alcohol will promote fat storage because it operates at the expense of fat oxidation (Suter et al. 1992).

In summary, after a meal the body has a specific order in which it burns up the fuels, that is, alcohol, followed by protein then carbohydrate and finally fat.

Table 10 highlights the main characteristics of the macronutrients of which fat seems to be the key macronutrient which undermines the body's weight regulatory systems since it is very poorly regulated at the level of both consumption and oxidation. As yet there is no consensus regarding the role of sugar intake on body weight regulation, but there is some concern that the over consumption of sweet-fat foods (such as chocolate bars, ice cream, cream puff) may be a problem in a subgroup of the population. Although high protein intakes may appear to be advantageous in controlling energy intake and contributing to good body weight regulation, high protein intakes (especially animal protein) have been associated with some adverse health consequences such as renal disease, cancer and cardiovascular diseases (WHO 1998). These probably due to the fact that some animal protein foods are also associated with high fat and cholesterol contents.

Table 10: Characteristics of macronutrients

	Protein	Carbohydrate	Fat
Ability to bring eating to an end	High	Intermediate	Low
Ability to suppress hunger	High	High	Low
Contribution to daily energy intake	Low	High	High
Energy density	Low	Low	High
Storage capacity in body	Low	Low	High
Metabolic pathway to transfer excess intake to another compartment	Yes	Yes	No
Autoregulation (ability to stimulate own oxidation on intake)	Excellent	Excellent	Poor

Source: WHO (1998)

5.2.3 High fat diets

Foods or meals that are high in fat are smaller in weight or volume than high-carbohydrate foods or meals of similar energy content (SIGN 1996). Dietary fat content is directly correlated with energy intake, produces only weak satiation in comparison with protein and carbohydrate, and is thought to be processed efficiently by the body. A number of studies found that individuals on a high-fat diet are more prone to become overweight (Popkin et al. 1995).

Drewnowski and Popkin (1997) reported that irrespective of income, fat availability has increased in Asia between the years 1975 to 1994 and more so in the affluent society (Figure 9).

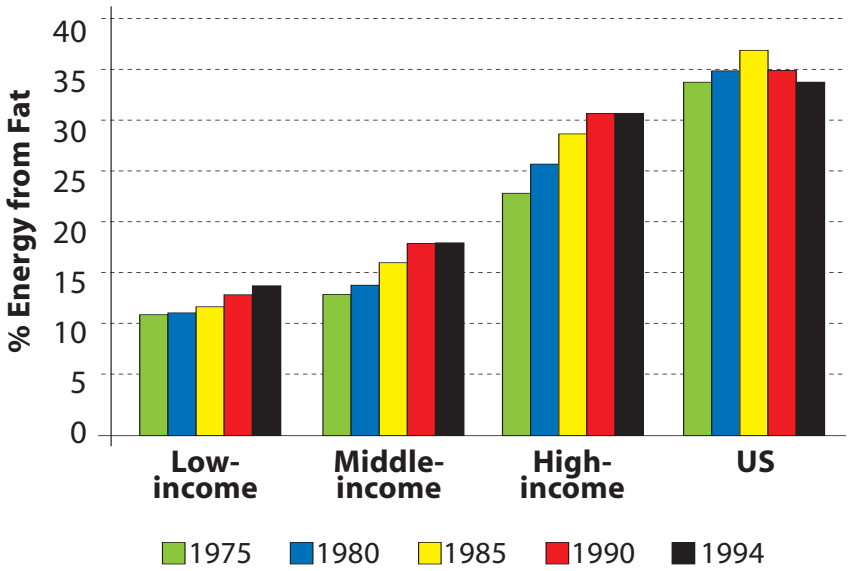


Figure 9: The relationship between availability of fat and GNP in Asia as compared to USA
Source : Drewnowski & Popkin (1997)

5.2.4 Energy dense foods and drinks

Consuming too much or too often high calorie foods and drinks may increase the total calories and thus result in obesity (SIGN 1996). Examples of commonly eaten high calorie Malaysian foods are given in Appendices A3 and A4. They are mostly deep-fried or cooked with *santan* (coconut milk).

The energy density of foods may be contributed by its macronutrient contents. A high fat food will often be labelled as energy-dense. However, sugars for example table sugar, honey, syrups also contribute to energy density. Extra sugars added to low fat

confectionaries, kuih, cakes or desserts will increase the calorie content of the food (Appendix A4). Low fat food products may also be high in calories and therefore should not be eaten in excess. Beverages containing substantial amounts of sugar or alcohol can also contribute to excessive calorie intake. Consumers are encouraged to read and compare food labels to make healthy choices (Appendix A5).

5.2.5 Fibre content in the diet

A diet with adequate amounts of fibre-containing foods is usually less energy dense. Its greater bulk has a short-term satiety effect, can help to prevent overeating and reduce risk of obesity (WHO 2003). The Malaysian Recommended Nutrient Intakes (NCCFN 2005) recommends an intake of 20 to 30 grams of dietary fibre per day. This can be achieved by including fruits, vegetables, whole grain cereals, pulses and legumes in the diet. Efforts to increase dietary fibre intake should be gradual to minimize discomfort such as bloating and flatulence. It is important to drink a lot of water when increasing fibre intake.

5.2.6 Food palatability

Palatability is defined as the momentary subjective orosensory pleasantness of a food, which indicates the sensory stimulation to eat. It is one of the most powerful influences in promoting calorie over-consumption (positive energy balance) by increasing both the rate of eating and the sense of hunger during and between meals. Perceived palatability of foods plays a major role in determining which foods are selected over others (Drewnowski & Popkin 1997). It has also been argued that palatability is associated with the energy density of foods. Foods that are energy dense are more palatable than those of lower energy density (Drewnowski 1998). Fat is associated with palatability and pleasurable mouth-feel that can induce behaviour which favours over-consumption (Blundell & King 1996) leading to obesity.

Sweetness is another powerful, easily recognized and pleasurable taste. Thus, many foods are sweetened in order to increase their palatability and consumption. However, consumption of sugars leads to a subsequent suppression of energy intake approximately equivalent to the amount provided by sugars (Mazlan 2001). Nevertheless, sweetened foods that have a high fat content are expected to be conducive to excess energy consumption since palatability is enhanced by both sweetness and mouth-feel, and fat has only a small suppression effect on appetite and intake. Both fat and sugar increase palatability of foods and thus help to promote overeating.

5.2.7. Unhealthy dietary practices

In Malaysia, a changing environment and increasing affluence have widened food options and changed eating habits. Groceries and supermarkets stock their shelves with a greater selection of foods. Fast foods and soft drinks which are high in calories, from either fat or sugar, are more accessible (Ismail 2002). It is also becoming a trend that more restaurants are extending their business hours to late night or to 24 hours

encouraging late night suppers. Malaysians may be eating more during a meal or snack because of larger portion sizes. People who frequently skip meals, especially breakfast, are more likely to overeat at other times. All of these are unhealthy dietary practices that would result in excessive energy intake and thus overweight problems.

Other unhealthy dietary practices that lead to obesity include binge eating, which if uncontrolled can escalate into binge eating disorder (BED). BED is defined as eating large amounts of food while feeling a loss of control over their eating behaviour. Among mildly obese people, 10 to 15 percent have binge eating disorder and this disorder is even more common among those with severe obesity (de Zwaan & Mitchell 1992).

5.3 Energy Expenditure

Total energy expenditure has three main components, namely, basal metabolic rate (BMR), thermogenesis or thermic effect of food (TEF) and physical activity (Figure 4).

Basal metabolic rate is the energy expended by a person who is fasting and at rest in the morning under comfortable ambient conditions. The BMR includes the cost of maintaining the integrated system of the body and in most sedentary adults; BMR constitutes about 60% to 70% of the daily energy expenditure. Although the BMR may vary intrinsically by ±25% between individuals of similar weight, within each individual it is tightly controlled (Dallosso & James 1984). Hence, the key variable of energy output in an individual is the degree of physical activity. In a dynamic phase, in which an individual gains weight as a result of energy intake exceeding energy expenditure over a prolonged period, BMR will increase due to the larger fat-free mass (including that of the expanded adipose tissue) as well as to an additional energy cost of activity imposed by the extra weight (Diaz et al. 1992).

The BMR of adult Malaysians were 10-13% lower than the BMR estimated using the FAO/WHO/UNU (1985) equations but only differed by 3% when compared with Henry & Rees (1991) equations for population in the tropics (Ismail et al. 1998). On the other hand, Poh et al. (1999) found that BMR values predicted from the FAO/WHO/UNU (1985) equations overestimated the BMR of Malaysian boys by 3% and that of girls by 5%, while the Henry & Rees (1991) equations for populations in the tropics underestimated BMR of boys and girls by 1% and 2%, respectively.

Thermogenesis is the increase in basal metabolic rate in response to stimuli such as food intake, cold or heat exposure, psychological influences such as fear or stress, or the administration of drugs or hormones. The thermic effect of food (the major form of thermogenesis) accounts for approximately 10% of the total daily energy expenditure.

Physical activity is the most variable component of daily energy expenditure, which may account for a significant number of calories in very active individuals. Sedentary adults however, exhibit a range of physical activity that still represents about 20% to 30% of the total calorie expenditure.

5.4 Physical Activity

Modern life is becoming increasingly sedentary and has been associated with an increased risk of obesity. Most modern jobs can be carried out with less physical effort due to technical progress, urbanization, transport and availability of a large range of domestic electrical appliances resulting in substantial decline in the energy spent in these activities. Recent studies (Table 11) in different age groups suggest that with the exception of armed forces and elite athletes, Malaysians are also leading a sedentary lifestyle (Ismail 2002). Physical activity level (PAL) values express daily energy expenditure as multiples of BMR.

Table 11: Basal metabolic rate (BMR, MJ/day), total daily energy expenditure (TDEE, MJ/day) and physical activity level (PAL)

Subjects	Age	Males			Females		
	(years)	BMR	TDEE	PAL	BMR	TDEE	PAL
Adolescents	12 -14	5.08	7.89	1.55	4.80	7.09	1.48
Adolescents	16 – 18	5.76	8.64	1.50	5.02	7.64	1.52
Young adults	18 – 30	5.85	9.40	1.61	4.77	7.58	1.59
Adults	30 – 60	5.66	9.53	1.68	4.79	8.17	1.70
Elderly	> 60	4.92	7.35	1.50	4.37	6.74	1.54
Armed forces	20 – 30	5.74	12.08	2.10	NA	NA	NA
Elite athletes	20 - 30	6.84	14.91	2.18	5.39	10.67	1.98

NA – not available, Moderately active – PAL=1.75 (WHO 1998)
Source: Ismail (2002)

There is convincing evidence that regular physical activity is protective against unhealthy weight gain whereas sedentary lifestyles, particularly sedentary occupations and inactive recreation such as watching television, promote it (WHO 1998).

5.4.1 Definition

The definition of physical activity and physical inactivity (sedentary behaviour) has been reported in the WHO 1998 Report.

Physical activity is defined as any bodily movement produced by skeletal muscles that result in a substantial increase over the resting energy expenditure (Bouchard et al. 1994). It has three main components:

(i) Occupational work - activities undertaken during the course of work
(ii) Household and other chores - activities undertaken as part of day-to-day living

(iii) Leisure-time physical activity - activities undertaken in the individual's discretionary or free time. Activity is selected on the basis of personal needs and interest. It includes exercise and sports.

a. Exercise - a planned and structured subset of leisure-time physical activity that is usually undertaken for the purpose of improving or maintaining physical fitness
b. Sports - its definition varies around the world. It implies a form of physical activity that involves competition and also embraces general exercise and a specific occupation.

Physical inactivity, or sedentary behaviour as it is otherwise known, can be defined as "a state when body movement is minimal and energy expenditure approximates resting metabolic rate" (Dietz 1996).

However:

- Physical inactivity represents more than an absence of activity; it refers also to participation in physically passive behaviours such as television viewing, reading, working at computer, talking with friends on the telephone, driving a car, meditating or eating (Ainsworth et al. 1993).

- Physical inactivity may contribute to weight gain through other means than reduction in energy expenditure. For example, recent studies in adolescents (Lytle et al. 1995) and adults (Simoes et al. 1995) have demonstrated significant relationships between inactivity and other adverse health practices, such as the consumption of less-healthy foods and an increased fat intake.

The decline in energy expenditure seen with modernization and other societal changes is associated with a more sedentary lifestyle in which motorized transport, mechanized equipment, and labour-saving devices both in the home and at work have replaced physically arduous tasks (Table 12).

5.4.2 Physical activity and the resting metabolic rate (RMR)

As explained in Section 5.3, basal metabolic rate (BMR) is the amount of energy the body needs to function while at rest. This energy is used to keep the heart beating, temperature regulated, and other organs functioning. Basal metabolic rate is measured under very restrictive circumstances. On the other hand, resting metabolic rate (RMR) is a more common and closely related measurement, measured under less strict conditions.

The effect of physical activity in increasing RMR has not been totally resolved. Several cross-sectional studies have found that highly trained runners have higher RMRs than untrained people of similar age and size. But other studies have not been able to confirm this (Poehlman 1989). Few longitudinal studies have showed that RMR might increase following training, but the data are not conclusive (Broeder et al. 1992). Because RMR

is closely related to the fat-free mass of the body (fat-free tissue is more metabolically active), interest has increased in the use of resistance training to increase fat-free mass in an attempt to increase RMR.

Table 12: Examples of energy-saving activity patterns in modern societies

Transport	The recent dramatic rise in motorised vehicles ownership means that many people now travel short distances by cars or motorcycles, rather than walking or cycling to their destination.
In the home	Energy expenditure is reduced through the use of cooking equipment and ready-prepared foods/ingredients during food preparation. The use of washing machines, vacuum cleaners and other electrical household appliances including remote control reduces energy expenditure even further. Over dependence on the domestic helper is another contributing factor.
In the workplace	Mechanization, robotics, computerization and control systems have markedly reduced the need for even moderate activity, and only a very small proportion of the population now engage in physically demanding manual work.
Public places	Elevators, escalators and automatic doors although essential to save substantial amounts of time and energy, are commonly abused.
Sedentary pursuits	Television viewing has been identified as a major cause of inactivity, especially in the obese. Computer and console games are increasingly more popular, especially among children and young adults. Traditional games that involve physical activity, such as galah panjang, hopscotch, konda-kondi, police and thief, are dying out.
Residential environment	In most residential areas, children, women and older people are dissuaded from going out either alone or at night because of fear for their personal security. Children also have difficulty in playing on local streets because cars use these to bypass areas of congestion. For active leisure pursuits, children and adults therefore usually travel by car to a sports facility or to the recreational park as a special outing, rather than taking exercise routinely as a part of their daily lives.

Modified from: WHO (1998)

5.4.3 Physical activity level (PAL)

PAL values express daily energy expenditure as multiples of BMR, thereby allowing approximate adjustment for individuals of different sizes. PAL is a universally accepted way of expressing energy expenditure and help to convey an easily understandable concept.

Individuals whose occupation involves regular physical activity are likely to be at PALs of 1.75 or more. Individuals whose lifestyle involves only light occupational and leisure

time activity are likely to have PAL of 1.55 – 1.60. Some individuals who engage in no activity whatsoever will have PAL below this range, at around 1.40.

In order to avoid obesity, populations should remain physically active throughout life at a PAL of 1.75 or more (Table 13).

Table 13: Actual and target physical activity level according to lifestyle

Lifestyle	Actual PAL	Target PAL
Sedentary	1.40	≥1.75
Limited activity	1.55 – 1.60	≥1.75
Physically active	≥1.75	≥1.75

Source: WHO (1998)

Table 14 shows some ways in which PAL can be raised from 1.55 – 1.60 up to 1.75 or more by the equivalent of an extra hour of moderate activity each day. More strenuous activities require less time than one hour per day to bring the overall average daily PAL up to 1.75.

Table 14: Equivalent of 1 hour's extra moderate physical activity daily

Duration	Activity ratio*	Activity
1 hour	4 – 5	Brisk walk (6 km/hr); canoeing (5 km/hr); cycling (12 km/hr); gardening; baseball; volleyball
45 mins	6 – 7	Cross-country hiking; cycling (15 km/hr); water skiing; dancing
30 mins	10 – 12	Any vigorous activity, e.g. soccer / football; hockey; running (13 km/hr); rugby; handball; basketball (competition)

*Activity ratio = multiple of BMR
Source: WHO (1998)

Long-term increases in population physical activity levels are more likely to be achieved through environmental changes. It is recommended to increase or maintain incidental daily activities and low-intensity leisure pursuits such as walking, climbing stairs and gardening rather than by encouraging occasional vigorous exercise.

For the prevention of unhealthy weight gain, recent recommendations (Saris et al. 2003) have suggested that current guidelines of 30 minutes of moderate activity, such as brisk walking and cycling, daily which is important for limiting health risks to chronic diseases is insufficient. In order to prevent weight gain or regain, compelling evidence suggest that 60 to 90 minutes of moderate activity are needed. In addition, it has also been suggested that to prevent transition to overweight and obesity, a PAL of 1.7, or approximately 45 to

60 minutes per day of moderate activity is necessary. For children even more time is recommended for physical activity.

5.4.4 Exercise and appetite

Woo & Pi-Sunyer (1982) showed that obese women did not compensate the higher energy expenditure induced by exercise with increased intake, and thereby obtained a significant negative energy balance on exercise. This suggests that those who have an excess amount of energy stored may particularly benefit from regular exercise. Hunger can be temporarily suppressed by intense exercise, and possibly by low-intensity exercise of long duration. Hence, there is no supporting evidence for the common perception that exercise stimulates appetite, leading to an increased food intake that even exceeds the energy cost of the preceding activities.

5.4.5 Health benefits of physical activity

Physical activity has been shown to improve the physiological aspects of our body system such as cardiovascular, respiratory, metabolic and weight control. There is convincing evidence that physical activity reduces risks of obesity, type 2 diabetes, CVD, certain cancers and osteoporosis.

Other benefits of physical activity includes becoming more energetic, improved self-esteem, increased resistance to stress, build stronger muscles and joints, increased fitness and flexibility, and living a healthier and longer independent life.

On the other hand, physical inactivity and sedentary lifestyle increase risk of obesity and type 2 diabetes (WHO 2003).

5.5 Psychosocial Factors contributing to Obesity

5.5.1 Introduction

Psychosocial factors take precedence in terms of contribution to obesity because genetic changes do not occur quick enough to warrant the increase of obesity cases around the world (Crawford & Ball 2002). Behaviour is governed by psychological aspects of human functioning, and is learnt through various experiences, including conditioning, reinforcements and modelling (Franken 1994). Calorie intake and use largely depend on behaviour, which are food-related and non-food related. The significance of behavioural factors in weight gain is that it can be modified more easily than genetics.

5.5.2 Hunger and appetite

Hunger is a physiological response to a need for food triggered by stimuli acting on the brain (Liebowitz 1995). It can be affected by a number of factors such as the size and

composition of preceding meal, habitual eating pattern, exercise, physical and mental states (Franken 1994). In a normal eating pattern hunger begins after four to six hours after eating, when food has left the stomach and much of it has been absorbed by the body. This pattern is highly influenced by psychophysiological factors such as smell, as well as environmental interactions (French et al. 2001).

Individuals who restrict food consumption at each meal may feel extra hungry for a few days, but then hunger diminishes for a time. However, at some point of food deprivation, hunger can be uncontrollable and lead to bouts of overeating that more than make up for the calories lost. The stomach capacity can also adapt to larger food quantities and until a normal meal size no longer feel satisfying.

Appetite or subjective hunger also initiates eating, but unlike hunger, appetite is learned. Appetite intensifies hunger but an individual can experience appetite without hunger (Franken 1994). A good example is the effect of seeing and smelling food after finishing a big meal – despite an already full stomach, appetite is still strong. Appetite can be affected by factors such as learned preferences, timings of meal, environmental cues and social interactions (Blundell 1995).

At some point during a meal, the brain receives stimuli from several sources that enough food has been eaten. This process is called satiation (Franken 1994). A lack of satiety between meals can lead to overeating when a mealtime arrives. In some cases this sets up a cycle of starvation and binging, which lead to overeating.

The choice of food may affect satiety – some foods seem to sustain satiety for longer period than others. In general foods high in protein and fibre sustain satiety longer than those high in fat or sugar.

5.5.3 Food-related behaviour

Humans have the ability to override signals of hunger and satiety and eat whenever they wish, especially when presented with circumstances that stimulate them to do so. Hence, overeating is a learnt process with regards to modelling, conditioning and habituation.

The main behavioural factors that contribute to obesity include:

- excessive energy intake, and diminished rate of physical activity or energy output,
- greater responsiveness to stimuli associated to food (especially energy dense food),
- large bites of food and rapid eating – rapid eating allows greater amount of food to be consumed before satiety signals are recognised.

According to learning theories, certain types of food can be associated with certain pleasures, (e.g. eating while watching favourite TV program); or sets of personal beliefs, (e.g. the impropriety of wasting food). Furthermore, certain situations and circumstances (i.e. time of the day, food court, mere presence of food, emotions/mood state) are

associated with certain foods or eating response, thus creating the craving for food. Therefore, such situations may lead to patterns of overeating.

Learning theories also state that an eating behaviour is reinforced or strengthened when it is followed immediately by a pleasurable activity or experience. These reinforcers can be in the form of the positive psychological and physiological experience of satiety, pleasant taste (e.g. foods high in fat, salt or sugar), social approval or acceptance, and distraction from negative events (e.g. relationship problems). In addition to inducing an individual to eat more, these reinforcers also change behaviour dynamics in eating, such as bigger bites, eating faster and piling on food on the plate.

On the opposite of reinforcement, there is punishment, which is an unpleasant experience. For example, hunger is a discomforting feeling and can be categorised as punishment for not eating. As such, continuous eating can be shaped so as not to experience hunger, thus leading to overeating.

Overeating behaviour can also be modelled after. It can be used as a coping mechanism to deal with daily stressors, or as part of an accepted behaviour (e.g. serving food during meetings). Effect of modelling or imitation is greater when the behaviour is reinforced (Franken 1994). For example, watching others being praised for finishing a large amount of food, or for finishing a whole plate of a meal regardless of satiety level.

5.5.4 Non-food-related behaviour

Non-food-related behaviour can also lead to obesity. These behaviours are sedentary behaviours such as sitting or sleeping for long hours, using lifts as compared to stair-walking, driving to places that are within walking distance.

In the modern world, mechanisms that reinforces sedentary behaviours include comfort in not moving much, discomfort when walking in hot and humid conditions, rewards for inactivity (e.g. being able to play computer games, having pleasant discussion, pleasant sleep), and punishment for over activity, especially in children. Many sedentary lifestyle-promoting factors such as the television, motorised transportation, computers and other labour-saving devices are increasingly available thus reducing the need for physical activity (French et al. 2001).

In today's working world, the opportunities for physical activity seem to be decreasing as the current lifestyle trends seem to be more geared towards daily career work. Moreover, there is little availability or accessibility in recreation spaces for people to participate in regular physical activities (French et al. 2001). Therefore, there is little behavioural reinforcement for physical activities, thus encouraging more sedentary behaviours.

5.5.5 Culture

Culture certainly has a big influence on behaviours leading to weight gain. The concepts of personal well being such health, affluence, beauty, strength and prosperity are modelled and learnt from society at large (Matsumoto 1994). As such, culture and society that accepts overweight as favourable, would lead to behaviours that reinforces weight gain. Behaviours that lead to weight gain are influenced at various social levels such as peer groups, parents, partners, friends and authority figures, or socio-economic environment.

Social influence can be a very strong factor in eating behaviour and weight management. It is usual that people tend to eat the foods that are eaten by their family and friends for reasons such as having a sense of acceptance and belonging, compliance to authority (i.e. parents, teachers, nutritionists, dietitians, etc.), as well as having consistencies in attitudes, beliefs and habits of diet and nutrition formed through learning within the community (Sobal 1995). Other social influence variables include gender roles (i.e. women tend to be fatter), life development (e.g. people tend to grow fatter as they age, and then decline), ethnicity, socio-economic status, parenthood (mothers tend to be heavier) and geographical location (Sobal 1995).

One such cultural influence with regards to socio-economic environment is eating out. Eating out has become popular as it is highly convenient for today's modern household. Eating out at restaurants and eating food prepared away from home has been found to be increasing in trend in the past 20 years (French et al. 2001). Local data shows similar trend not only in the urban but also in the rural area (Table 15). Moreover, food prepared away from home tend to be larger in portion, as well as higher in fat and energy. This change in nutritional quality is a cause for concern as there is increasing intake of higher than needed energy consumption. Mass media influence plays a large role in eating out behaviour by exposing messages that encourage food consumption, which leads to the increase of food availability (French et al. 2001).

Table 15: Percentage of household expenditure spent on meals outside home

	1980/82 survey	1993/94 survey	1998/99 survey
Malaysia	6.6	11.8	12.6
Urban	-	13.4	14.1
Rural	-	8.6	10.0

Source : Department of Statistics (1983, 1995, 2000).

5.5.6 Personality factors and cognitive style

Personality style as well as thinking patterns can help maintain behaviour that leads to obesity. Feelings of hopelessness can demotivate individuals from reducing and maintaining weight (Byrne 2002). On the contrary, individuals with high self-acceptance are unlikely to change themselves either.

Coping styles, determine how individuals cope with daily as well as acute life stressors. Irrational thinking styles and poor problem solving skills usually lead to negative coping mechanisms that may involve behaviour that promotes weight gain (Byrne 2002). These include seeking food for comfort and reduction in activity (e.g. overeating and/or oversleeping when distressed). As such, psychological disorders, especially binge eating disorder (BED) could also lead to obesity. Research shows that binge eaters tend to have other psychiatric comorbidities such as personality, anxiety and mood disorders, especially lifetime episodes of depression (Marcus 1995).

REFERENCES

Ainsworth BE, Haskell WL, Leon AS, Jacobs DR, Montoye HJ, Sallis JF & Paffenbarger RS. (1993). Compendium of Physical Activities: Classification of energy costs of Human Physical Activities. *Medicine and Science in Sports and Exercise;* 25: 71-80.

Astrup A, Buemann B, Christensen NJ & Toubro S. (1994). Failure to increase lipid oxidation in response to increasing dietary fat content in formerly obese women. *American Journal of Physiology*. 266:E592-E599.

Blundell JE. (1995). The psychobiological approach to appetite and weight control. In Brownell KD & Fairburn CG. (Eds.) *Eating disorders and obesity*: *a comprehensive handbook*. New York: Guilford Press. pp. 13-20.

Blundell JE & King NA. (1996). Overconsumption as a cause of weight gain: behavioural-physiological interactions in the control of food intake (appetite). In. *The origins and consequences of obesity*. (Ciba Foundation Symposium 2001). Chichester: Wiley.

Broeder CE, Burrhus KA, Svanevik LS & Wilmore JH. (1992). The effects of either high-intensity resistance or endurance training on resting metabolic rate. *American Journal of Clinical Nutrition*. 55(4):802-10.

Bouchard C, Shepard RJ & Stephens T. (1994). *Physical activity*, fitness and health: *International proceedings and consensus statement*. Champaign, Il: Human kinetics

Byrne SM. (2002). Psychological aspects of weight maintenance and relapse in obesity. *Journal of Psychosomatic Research*. 53:1029-1036.

Crawford D & Ball K. (2002). Behavioural determinants of the obesity epidemic. *Asia Pacific Journal of Clinical Nutrition*. 11(Suppl):S718-S721.

Dallosso HM & James WPT. (1984). The role of smoking in the regulation of energy balance. *International Journal of Obesity*. 8:365-375

Department of Statistics. (1983, 1995, 2000). Reports on household expenditure surveys for 1980/82, 1993/94 and 1998/99.

de Zwaan MD & Mitchell JE. (1992). Binge eating in the obese. *Annals of Medicine*. 24:303-308.

Diaz EO, Prentice AM, Goldberg GR, Murgatroyd PR & Coward WA. (1992). Metabolic response to experimental overfeeding in lean and overweight healthy volunteers. *American Journal of Clinical Nutrition*. 56:641-655.

Dietz WH. (1996). The role of lifestyle in health: the epidemiology and consequences of inactivity. *Proceedings of the Nutrition Society*. 55:829-840.

Drewnowski A. (1998). Energy density, palatability, and satiety: implications for weight control. *Nutrition Reviews*. 56:347-353.

Drewnowski A & Popkin BM. (1997). The nutrition transition: new trends in the global diet. *Nutrition Reviews*. 55(2):31-43.

FAO. (1961-2001). Food Balance Sheets. FAO website: http://apps.fao.org/faostat. Food and Agriculture Organization of the United Nations, Rome.

FAO/WHO/UNU. (1985). *Energy and protein requirements*. Technical Report Series 724. Geneva: World Health Organization.

Flatt JP. (1978). Biochemistry of energy expenditure. In: Bray G. Ed. *Recent advances in obesity research*. Westport: Techonomic.

Franken RE. (1994). *Human motivation*. 3rd Ed. Pacific Grove: California: Brooks/Cole.

French SA, Story M & Jeffery RW. (2001). Environmental influences on eating and physical activity. *Annual Review of Public Health*, 22, 309-335.

Henry CJK & Rees AG. (1991). New predictive equations for the estimation of basal metabolic rate in tropical people. *European Journal Clinical Nutrition*, 45:177-185.

Horton TJ, Drougas H, Brachey A, Reed GW, Peters JC & Hill JO. (1995). Fat and carbohydrate overfeeding in humans: different effects on energy storage. *American Journal of Clinical Nutrition*. 62:19–29.

Ismail MN, Ng KK, Chee SS, Roslee R & Zawiah H. (1998). Predictive equations for the estimation of basal metabolic rate in Malaysian adults. *Malaysian Journal of Nutrition*, 4:81-90.

Ismail MN. (2002). The nutrition and health transition in Malaysia. *Public Health Nutrition*; 5(1A): 191-195

Liebowitz SF. (1995). Central physiological determinants of eating behaviour and weight. In Brownell KD & Fairburn CG. (Eds.) *Eating disorders and obesity: a comprehensive handbook*. New York: Guilford Press. pp. 3-7.

Lytle LA, Kelder SH, Perry CL & Klepp K. (1995). Covariance of adolescent health behaviours: the class of 1989 study. *Health Education Research*. 10:133-146.

Marcus MD. (1995). Binge-eating and obesity. In Brownell KD & Fairburn CG. (Eds.) *Eating disorders and obesity: a comprehensive handbook*. New York: Guilford Press. pp. 441-444.

Matsumoto D. (1994). *People: Psychology from a cultural perspective*. Pacific Grove: Brooks/Cole Publishing Company.

Mazlan N, Horgan G & Stubbs RJ. (2001). Mandatory snacks rich in sugar, starch or fat: effect on energy and nutrient intake. *International Journal of Obesity*. 25(Suppl 2): S54.

NCCFN. (2005). Recommended Nutrient Intakes for Malaysia. A report of the Technical Working Group on Nutritional Guidelines. Putrajaya: National Coordinating Committee on Food and Nutrition, Ministry of Health Malaysia.

Paul AA & Southgate DAT. (1978). McCance and Widdowson's the composition of foods. 4th ed. London: Her Majesty's Stationery Office.

Poehlman ET. (1989). A review: exercise and its influence on resting energy metabolism in man. *Med Sci Sports Exercise*. 21:515-525.

Poh BK, Ismail MN, Zawiah H & Henry CJK. (1999). Predictive equations for the estimation of basal metabolic rate in Malaysia adolescents. *Malaysian Journal of Nutrition*. 5:1-14.

Popkin BM, Paeratakul S, Zhai F & Ge K. (1995). A review of dietary and environmental correlates of obesity with emphasis on developing countries. *Obesity Research*. 3(Suppl. 2):145s–153s.

Ravussin E. (1993). Energy-metabolism in obesity - studies in the Pima Indians. *Diabetes Care*. 16(1):232-238.

SIGN. (1996). *Obesity in Scotland: Integrating prevention with weight management*. Edinburgh: Scottish Intercollegiate Guidelines Network.

Saris WH, Blair SN, van Baak MA, Eaton SB, Davies PS, Di Pietro L, Fogelholm M, Rissanen A, Schoeller D, Swinburn B, Tremblay A, Westerterp KR & Wyatt H. (2003). How much physical activity is enough to prevent unhealthy weight gain? Outcome of the IASO 1st Stock Conference and consensus statement. *Obesity Reviews*. 4 (2):101-114.

Simoes EJ, Byers T, Coates RJ, Serdula MK, Mokdad AH & Heath GW. (1995). The association between leisure-time physical activity and dietary fat in American adults. *American Journal of Public Health*. 85: 240-244

Sobal J. (1995). Social influences on body weight. In Brownell KD & Fairburn CG. (Eds.) *Eating disorders and obesity: a comprehensive handbook*. New York: Guilford Press. pp. 73-77

Suter PM, Schutz Y & Jéquier E. (1992). The effect of ethanol on fat storage in healthy subjects. *New England Journal of Medicine*. 326: 983–987.

Tee ES (1999). Nutrition of Malaysians: where are we heading? *Malaysian Journal of Nutrition*. 5(1&2):87-109.

Woo R & Pi-Sunyer FX. (1982). Effect of increased physical activity on voluntary intake in lean women. *Metabolism*. 34:836-841.

WHO. (1998). *Obesity: Preventing and managing the global epidemic*. Report of a WHO Consultation on Obesity. Geneva: World Health Organisation.

WHO. (2003). *Diet, nutrition and the prevention of chronic diseases*. Report of a Joint WHO/FAO Expert Consultation. WHO Technical Report Series 916, Geneva: World Health Organisation.

6. CHILDHOOD OBESITY

The prevalence of child obesity is increasing rapidly worldwide (WHO 1998). It is associated with several risk factors for later heart disease and other chronic diseases including hyperlipidaemia, hyperinsulinaemia, hypertension and early artherosclerosis (Berenson et al. 1998). In view of its public health importance, the trends in child obesity should be closely monitored. Trends are, however, difficult to quantify or to compare locally and internationally, as a wide variety of definitions of child obesity are in use, and no commonly accepted standard has yet emerged (Cole et al. 2000).

Several reports show already high and increasing rates of overweight and obesity among preschool children living in developing countries (de Onis & Blassner 2000). Children become overweight for a variety of reasons. The most common causes are unhealthy eating patterns, lack of physical activity, genetic factors, or a combination of these factors. In rare cases, a medical problem, such as an endocrine disorder, may cause a child to become overweight.

Obesity is associated with significant health problems in childhood and adolescence, and is an important early risk factor for much of adult morbidity and mortality (Freedman et al. 1999). Medical problems are common in obese children and adolescents and can affect cardiovascular health (e.g. hypercholesterolemia, hypertension), the endocrine system (e.g. hyperinsulinaemia, insulin resistance, menstrual irregularity) and mental health (e.g. depression, low self-esteem).

Assessment of obesity in children and adolescents is important to prevent the progression of the condition and its related co morbidities into adulthood. Routine assessments of eating and activity patterns in children and recognition of excessive weight gain relative to linear growth are essential throughout childhood. At any age, an excessive rate of weight gain relative to linear growth should be recognized, and underlying predisposing factors should be addressed with parents and other caregivers (AAP 2003). Several factors to be addressed include:

- Genetic and hormonal causes of obesity warrant consideration, although rare,
- Prevention of psychosocial problems, e.g. low self-esteem,
- Instilling healthy lifestyle in children and their families throughout their life.

Factors determining persistence of obesity into adulthood include onset of obesity after the age of three, degree of obesity, and presence of obesity in at least one parent. The risk of obesity persisting into adulthood is higher among obese adolescents than among younger children (Whitaker et al. 1997).

6.1 Defining Childhood and Adolescent Obesity

Classifying obesity during childhood or adolescence had the added complication that height is still increasing and body composition is continually changing. WHO (1995) recommends that for children aged two to ten years, the NCHS Median +2SD reference weight-for-height may be used to determine overweight in boys and girls. For adolescents aged ten to eighteen years, values greater than 85th percentile BMI-for-age represents at risk of overweight (WHO 1995) (See Tables 16 and 17). These references may still be used for reporting overweight and obesity prevalence among children, along with new available standards.

Although BMI does not directly measure body fat, it provides a reasonable estimate of adiposity which, in turn, also predicts risks for current or future medical complications of obesity (Dietz & Robinson 1998). BMI in children is correlated not only with other measures of body fat but also with blood pressure (Gutin et al. 1990), lipid levels (Zwiauer et al. 1990), and insulin levels (Ronnemaa et al. 1991).

Table 16: BMI-for-age percentiles: adolescent boys, 10 - 18 years

Age	Percentiles				
(years)	5th	15th	50th	85th	95th
10	14.42	15.15	16.72	19.60	22.60
11	14.83	15.59	17.28	20.35	23.73
12	15.24	16.06	17.87	21.12	24.89
13	15.73	16.62	18.53	21.93	25.93
14	16.18	17.20	19.22	22.77	26.93
15	16.59	17.76	19.92	23.63	27.76
16	17.01	18.32	20.63	24.45	28.53
17	17.31	18.68	21.12	25.28	29.32
18	17.54	18.89	21.45	25.92	30.02

Source: WHO (1995)

Table 17: BMI-for-age percentiles: adolescent girls, 10 - 18 years

Age (years)	Percentiles				
	5th	15th	50th	85th	95th
10	14.23	15.09	17.00	20.19	23.20
11	14.60	15.53	17.67	21.18	24.59
12	14.98	15.98	18.35	22.17	25.95
13	15.36	16.43	18.95	23.08	27.07
14	15.67	16.79	19.32	23.88	27.97
15	16.01	17.16	19.69	24.29	28.51
16	16.37	17.54	20.09	24.74	29.10
17	16.59	17.81	20.36	25.23	29.72
18	16.71	17.99	20.57	25.56	30.22

Source: WHO (1995)

The Center for Disease Control and Prevention (CDC), USA released the BMI-for-age growth charts in year 2000 (Kuczmarski et al. 2000). The 85th and 95th percentiles of the body mass index reference had been proposed as cut-off points for "at risk of overweight" and "overweight", respectively (CDC 2000).

In the same year, a new definition of overweight and obesity in childhood had been proposed (Cole et al. 2000). This is based on pooled international data from Brazil, Great Britain, Hong Kong, the Netherlands, Singapore and United States for body mass index and linked to the widely used adult cut-off of >25 kg/m^2 and >30 kg/m^2, for overweight and obesity, respectively. The technical committee recommends adopting this international cut off points as shown in Table 18.

Table 18: BMI cut off points for 2-18 years

Age (yrs)	Overweight BMI		Obesity BMI	
	Males	Females	Males	Females
2.0	18.41	18.02	20.09	19.81
2.5	18.13	17.76	19.80	19.55
3.0	17.89	17.56	19.57	19.36
3.5	17.69	17.40	19.39	19.23
4.0	17.55	17.28	19.29	19.15
4.5	17.47	17.19	19.26	19.12
5.0	17.42	17.15	19.30	19.17
5.5	17.45	17.20	19.47	19.34
6.0	17.55	17.34	19.78	19.65
6.5	17.71	17.53	20.23	20.08
7.0	17.92	17.75	20.63	20.51
7.5	18.16	18.03	21.09	21.01
8.0	18.44	18.35	21.60	21.57
8.5	18.76	18.69	22.17	22.18
9.0	19.10	19.07	22.77	22.81
9.5	19.46	19.45	23.39	23.46
10.0	19.84	19.86	24.00	24.11
10.5	20.20	20.29	24.57	24.77
11.0	20.55	20.74	25.10	25.42
11.5	20.89	21.20	25.58	26.05
12.0	21.22	21.68	26.02	26.67
12.5	21.56	22.14	26.43	27.24
13.0	21.91	22.58	26.84	27.76
13.5	22.27	22.98	27.25	28.20
14.0	22.62	23.34	27.63	28.57
14.5	22.96	23.66	27.98	28.87
15.0	23.29	23.94	28.30	29.11
15.5	23.60	24.17	28.60	29.29
16.0	23.90	24.37	28.88	29.43
16.5	24.19	24.54	29.14	29.56
17.0	24.46	24.70	29.41	29.69
17.5	24.73	24.85	29.70	29.84
18.0	25	25	30	30

Source : Cole et al. (2000)

6.2 Prevalence of Childhood Obesity

In Malaysia, there is no known national survey carried out with the specific purpose of determining the prevalence of overweight and obesity amongst children and adolescents. However, many smaller scale studies have been reported.

Bong & Safurah (1996) reported a prevalence of 8% overweight among primary schoolchildren in Selangor. Ismail & Tan (1998) reported an obesity prevalence of 6.6% among 7-year-olds while a 13.8% prevalence was reported in 10-year-olds. Fatimah et al. (2001) reported 8.7% obesity in children residing in Kuala Lumpur as compared to 5.7% in Kota Bharu. In a recent survey of 11,500 schoolchildren aged between 6-12 years from four regions in Peninsular Malaysia, revealed a prevalence of 6% obesity in both sexes with small differences between urban and rural children (Ismail et al. 2003).

Tee et al. (2002) studying 5,995 children aged 7 to 10 years in all primary schools in Kuala Lumpur reported a prevalence of overweight of 9.7% among boys and 7.1% among girls (based on >95th percentile of the BMI-for-age), (WHO 1995). In marked contrast, Khor & Tee (1997) reported a prevalence of less than 2% among 3,000 rural children. It should be noted, however, that all the above studies were reported using different cut-offs / criteria for defining overweight. The findings are therefore not strictly comparable.

Two separate studies, in 1990 and 1997, carried out among adolescent boys studying in the same four schools in Klang Valley, reported an increase in prevalence of obesity from 1% in 1990 to 6% in 1997 (Ismail & Zulkifli 1996; Ismail & Vickneswary 1999). A more recent survey carried out among adolescents of both sexes aged 12 to 17 years in four regions of Peninsular Malaysia and the Miri region of Sarawak reported 19% of overweight using the WHO (1995) BMI-for-age cut-off of above 85th percentile (Poh et al. 2004).

6.3 Prevention of Childhood Obesity

Prevention is one of the hallmarks of paediatric practice and includes such diverse activities as newborn screenings, immunizations, and promotion of car safety seats and bicycle helmets (AAP 2003). Likewise, with the increase in prevalence of overweight and inactivity amongst children and adolescents, focus should be centred on preventive efforts in childhood obesity, with its associated co-morbid conditions in childhood and likelihood of persistence into adulthood.

6.3.1 Infants and toddlers

Babies and young children who are confined to strollers, play pens, and infant seats for long periods of time may be delayed in development, such as rolling over, crawling, walking and even cognitive development. Such restrictions may be the beginning of the path to sedentary preferences and childhood obesity. Although there is no data to show strong correlation between obesity in early childhood and adult obesity, promoting

positive behaviours and increasing physical activity in childhood may lead to persistence of these behaviours into adulthood, thus helping to alleviate the problem of obesity (NASPE 2002). The Bright Start Nutrition Advisory Panel also recommends encouraging physical activity for fitness and optimum development (BSN 2000).

Exclusive breastfeeding from birth until six months and continued breastfeeding up to two years should be encouraged (WHO 2003). Multiple studies in various populations have shown a weak but consistent protective effect of breastfeeding on the development of obesity after adjusting for appropriate possible confounders, including race and maternal education. Complementary foods should be started by six months.

Educating parents about how to introduce new foods and overcome the picky eating habits of toddlers can be valuable in encouraging them to eat healthily as they grow older. Involving toddlers in food preparation, for example washing and preparing vegetables; introducing new foods in familiar contexts, such as soups and porridges; and practicing patience and persistence will often help. Minimizing intake of sweet beverages (including 100% fruit juice) is appropriate, because intake of these drinks is often responsible for large amounts of excessive calories and replaces foods with more balanced macronutrient content (Hoppin 2004). Table 19 provides further details on lifestyle targets for obesity prevention.

Table 19 : Universal Anticipatory Guidance for Obesity Prevention

Age group	Lifestyle targets
Pregnancy	• Advocate good nutrition (including sufficient protein intake) and attaining appropriate maternal weight gain. • Advocate good glycaemic control, especially for gestational diabetes. • Encourage plans for breastfeeding.
Infants	• Encourage exclusive breastfeeding up to 6 months, and sustained breastfeeding up to two years. • Discourage early introduction of solid foods; complementary feeding should be started by 6 months. • Goal: moderate rates of weight gain, including in low-birth weight infants (throughout childhood). Rapid catch-up growth may be detrimental.
Toddlers	• Nutritional : - Continue to broaden diet, emphasize vegetables and fruits. - Minimize intake of juice and other sweetened beverages. - To establish regular meal pattern. - Parents should serve appropriate portion size. • Physical activity : - Establish habits of physical activity; encourage more physical playtime.

	- Establish healthy television habits (less than one hour a day; not at meals; minimise the number of television in a household). • Behavioural : - Emphasize family-based meals, avoid cooking special meals for kids. - Do not use food as a reward or punishment. - Do not encourage overeating. - Provide parental modelling of healthy diet, physical activity, and minimal television viewing. - Offer positive reinforcement for healthy choices, avoid criticism.
School-age children	All of the above plus: • Physical activity : - Investigate local opportunities for adding organized sports to lifestyle (community and school programmes). - Offer options, including individual sports if team sports not practical or enjoyed by child (for example: martial arts, dance). - Participate in physical activities with children: recreational sports, outdoor play, walking , or bicycling. • Behavioural : - Support healthy body image, emphasizing strength and health rather than weight and appearance.
Adolescents	Watch out for and discourage: • Nutritional : - Excessive take-out or restaurant meals. - Meal skipping or inadequate meals (which often lead to out-of control eating later in the day). - "Grazing" rather than meal-based eating habits. - Withdrawing from sports or other physical activity.

Modified from: Hoppin (2004)

Moderate rates of weight gain are probably ideal, particularly in infants of low birth weight, because rapid catch-up growth is associated with higher rates of the metabolic syndrome (Vanhala et al. 1998).

To establish an appreciation of physical activity, families are encouraged to spend time together in active play, which is easily accomplished with frequent visits to the playground. Toddlerhood is an important time to establish firm limits on television viewing, before it becomes a habit. Snacking during television watching should also be discouraged as television often distracts from natural signals of hunger and satiety.

Families should be encouraged to establish regular mealtimes and to eat together whenever possible. Mealtimes should also be an enjoyable family experience (BSN 2000).

6.3.2 Children and adolescents

Teaching healthy behaviours at a young age is important since change becomes more difficult with age. Behaviours involving physical activity and nutrition are the cornerstone of preventing obesity in children and adolescents. For school-aged children and adolescents, families and schools are the two most critical links in providing the foundation for those behaviours. Parents are the most important role models for children (Fowler-Brown & Kahwati 2004). Parents should not underestimate the health risk of excess weight to their children, and the difficulty in achieving and maintaining behavioural changes associated with obesity prevention.

Parents should understand the importance of regular physical activity for their children and encourage active outdoor as well as active indoor play. For example, children can be encouraged to enrol in a structured activity such as tennis, gymnastics, martial arts, etc. or to join a sports team at school or in the community. Time spent inactively watching television or playing computer games should be limited.

Besides creating an active environment, parents should also create a healthy eating environment for their children and adolescents. The same healthy diet that is rich in fruits, vegetables and grains should be implemented for the whole family and not just select individuals. Large portion sizes should be avoided.

Outside of the home, children and adolescents spend the majority of their time in school. So, it makes sense that schools provide an environment that promotes healthy nutrition and physical activity habits. Foods served during break time at school should be contain less fats and oils, sugar, and salt; while fruits and vegetables as well as healthy snacks should be promoted. Schools should also provide physical and social environments that encourage and enable young people to engage in safe and enjoyable physical activity. Physical education periods should also not be neglected in favour of more revision or studying time (Hoelscher et al. 2004).

REFERENCES

AAP. (2003). Prevention of pediatric overweight and obesity. Policy Statement of the American Academy of Pediatrics. *Pediatrics*. 112(2):424-430.

Berenson GS, Srinivasan SR, Bao W, Newman WP, Tracy RE & Wattigney WA. (1998). Association between multiple cardiovascular risk factors and atherosclerosis in children and young adults. The Bogalusa Heart Study. *New England Journal of Medicine*. 338:1650-1656.

Bong ASL & Safurah J. (1996). Obesity among years 1 and 6 primary school children in Selangor Darul Ehsan. *Malaysian Journal of Nutrition*. 2:21-27.

BSN. (2000). Prime messages of the Bright Start Nutrition toddler and preschooler nutrition education programme. Bright Start Nutrition Advisory Panel. Kuala Lumpur: Bright Start Nutrition. http://www.brightstartnutrition.info

Cole TJ, Bellizzi MC, Flegal KM & Dietz WH. (2000). Establishing a standard definition for child overweight and obesity worldwide: international survey. *British Medical Journal*. 320:1240-1243.

de Onis M & Blassner M. (2000). Prevalence and trends of overweight among preschool children in developing countries. *American Journal of Clinical Nutrition*. 72: 1032-1039.

Dietz WH & Robinson TN. (1998). Use of the body mass index (BMI) as a measure of overweight in children and adolescents. *Journal of Pediatrics*. 132:191-193.

Dreon DM, Frey-Hewitt B, Ellsworth N, Williams PT, Terry RB &Wood PD. (1988). Associations of diet and obesity in middle-aged men. *American Journal of Clinical Nutrition*. 47: 995-1000.

Drewnowski A & Popkin BM. (1997). The nutrition transition: trends in the global diet. *Nutrition Reviews*. 55(2): 31-43.

Fatimah A, Wan Asma WI, Md Idris MN, Wan Manan WM, Ruzita AT, Roslee R, Mazlan N, Fuziah MZ, Norizan AM, Noor Afizah I, Hatta S & Fauziah S. (2001). The effectiveness of childhood obesity intervention program and the psychosocial factors involved in maintaining weight changes in urban areas. Prosiding *Persidangan Kebangsaan Penyelidikan dan Pembangunan Institusi Pengajian Tinggi Awam 2001*. Kuala Lumpur, 25 – 26 October 2001: 654-659.

Fowler-Brown A & Kahwati LC. (2004). Prevention and treatment of overweight in children and adolescents. *American Family Physician*. 69(11): 2591-2598.

Freedman DS, Dietz WH, Srinivasan SR & Berenson GW. (1999). The relation of overweight to cardiovascular risk factors among children and adolescents: the Bogalusa heart study. *Pediatrics*. 103:1175-1182.

Gutin B, Basch C, Shea S, Contento I, DeLozier M, Rips J, Irigoyen M & Zybert P. (1990). Blood pressure, fitness, and fatness in 5- and 6-year old children. *Journal of the American Medical Association*. 264:1123-1127.

Hoelscher DM, Feldman HA, Johnson CC, Lytle LA, Osganian SK, Parcel GS, Kelder SH, Stone EJ & Nader PR. (2004). School-based health education programs can be maintained over time: results from the CATCH Institutionalization Study. *Preventive Medicine*. 38(5):594-606.

Hoppin AG. (2004). Assessment and management of childhood and adolescent obesity. http://www.medscape.com/viewarticle/481633

Ismail MN & Tan CL (1998). Prevalence of obesity in Malaysia. Country report at the Regional Advisory Board meeting on obesity, Manila, Phillipines.

Ismail MN & Vickneswary EN. (1999). Prevalence of obesity in Malaysia. Data from three ethnic populations. Country report at the Asian BMI/Obesity Workshop, Milan, Italy.

Ismail MN & Zulkifli MAH. (1996). A study on obesity among male adolescents in National Conference on "Adolescent: Challenges of the 21st Century", Kuala Lumpur.

Ismail MN, Norimah AK, Ruzita AT, Mazlan N, Poh BK, Nik Shanita S, Nur Zakiah MS & Roslee R. (2003). Nutritional status and dietary habits of primary school children in Peninsular Malaysia. Final report for UKM-Nestle Research Project. Kuala Lumpur: Department of Nutrition & Dietetics, Faculty of Allied Health Sciences, Universiti Kebangsaan Malaysia.

Khor GL & Tee ES. (1997). Nutritional assessment of rural villages and estates in Peninsular Malaysia. II. Nutritional status of children aged 18 years and below. *Mal J Nutr*, 3:21-47.

Kuczmarski RJ, Ogden CL, Grummer-Strawn LM, Flegal KM, Guo SS, Wei R, Mei Z, Curtin LR, Roche AF & Johnson CF. (2000). *CDC growth charts: United States. Advance data from vital and health statistics; No. 314*. National Center for Health Statistics.

NASPE. (2002). NASPE Early childhood physical activity guidelines. Washington D.C.: National Association for Sport and Physical Education.

Poh BK, Ismail MN, Ong HF, Norimah AK, Safiah MY & Zafrullah S. (2004). *Energy Requirements of Malaysian Adolescents*. Final Report for IRPA 06-02-02-0096 Research Project. Kuala Lumpur: Department of Nutrition & Dietetics, Faculty of Allied Health Sciences, Universiti Kebangsaan Malaysia.

Ronnemaa T, Knip M, Lautala P, Viikari J, Uhari M, Leino A, Kaprio EA, Salo MK, Dahl M, Nuutinen EM, Pesonen E, Pietikainen M & Akerblom HK. (1991). Serum insulin and other cardiovascular risk indicators in children, adolescents and young adults. *Ann Intern Med*. 23: 67-72.

Tee ES, Khor SC, Ooi HE, Young SI, Omar Z & Hamzah Z. (2002). Regional study of weight and height of urban primary school children: 3. Kuala Lumpur, Malaysia. *Food and Nutrition Bulletin* 23(1): 41-47.

Vanhala M, Vanhala P, Kumpusalo E, Halonen P & Takal J. (1998). Relation between obesity from childhood and the metabolic syndrome: population-based study. *British Medical Bulletin*. 317:319.

Whitaker RC, Wright JA, Pepe MS, Seidel KD & Dietz WH. (1997). Predicting obesity in young adulthood from childhood and parental obesity. *New England Journal of Medicine*. 337:869-873.

WHO. (1995). Physical status: The use and interpretation of anthropometry. Report of a WHO Expert Committee. Geneva: World Health Organisation.

WHO. (1998). Obesity: Preventing and Managing the Global Epidemic. Report of a WHO Consultation on Obesity. Geneva: World Health Organisation.

WHO. (2003). Global Strategy for Infant and Young Child Feeding. Geneva: World Health Organisation.

Zwiauer K, Widhalm K & Kerbl B. (1990). Relationship between body fat distribution and blood lipids in obese adolescents. *International Journal of Obesity Related Metabolic Disorders*. 14:271-277.

7. RECOMMENDED PREVENTION STRATEGIES

Greater attention should be given to strategies aimed at preventing weight gain and obesity. These are likely to be more cost effective and have a greater positive impact on the long- term control of body weight than strategies designed to deal with obesity once it has fully developed.

The Committee adapted relevant strategies recommended by WHO (1998) and the Surgeon General's Report (US DHHS 2001) for this section.

7.1 Shared Responsibility

Control and prevention of obesity focus on the promotion of healthy diets or increasing levels of physical activity, or both, and should be a shared responsibility (Figure 10). They cannot be seen as the sole responsibility of any one sector. To be effective, strategies should be multisectoral, with the coordinated participation of the health, educational and agricultural sectors. Active participation should be sought from governments, the food industry, the media and the individual consumers. The support of professional bodies, non-governmental organizations and international agencies dealing with obesity and related non-communicable diseases (NCD) is essential. The prevention and management of overweight, obesity and associated co-morbidities require the synergism of national health policies on nutrition and NCD control as well as in relation to sports, housing environment, urban planning as well as transportation.

We must collectively build on existing programs in both the public and private sectors, identify current gaps in action, and develop and initiate actions to fill those gaps. Public-private working groups should be formed around key themes or around the major settings in which obesity prevention and treatment efforts need to take place. The design of successful interventions and actions for prevention and management of overweight and obesity will require the careful attention of many individuals and organizations working together through multiple spheres of influence.

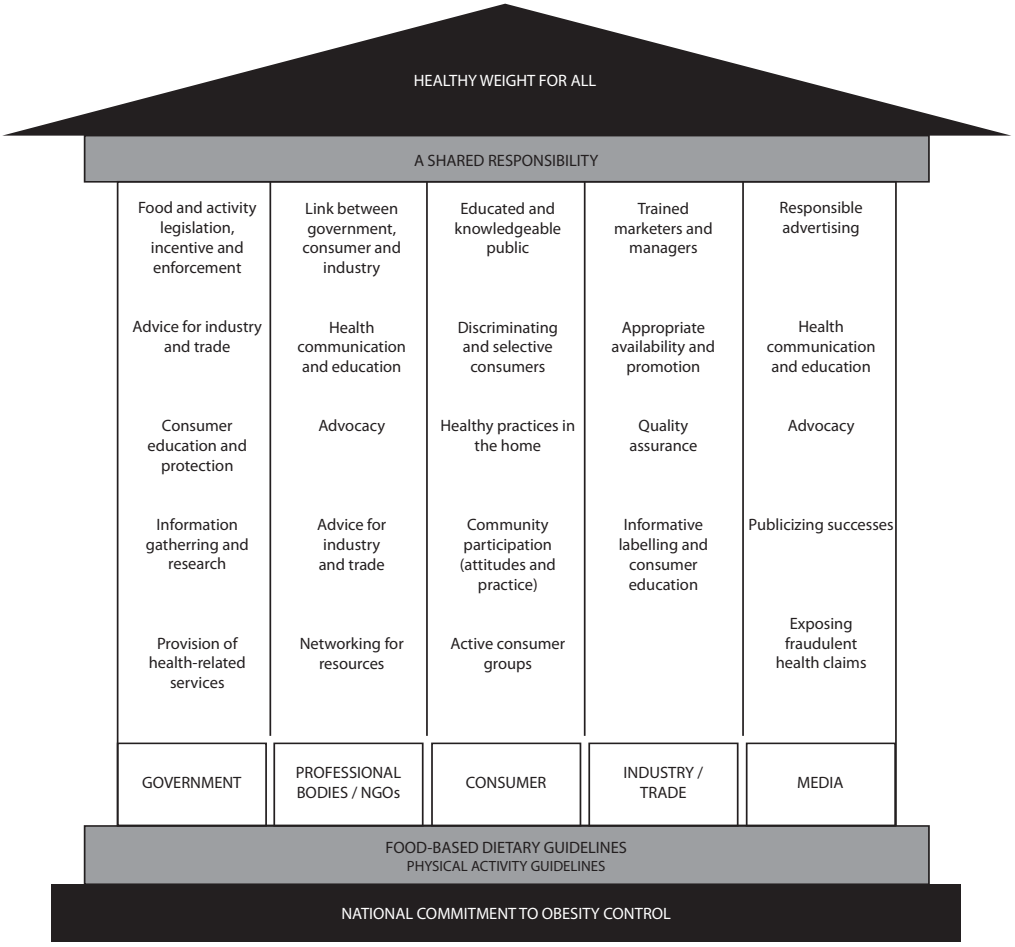


Figure 10 : Healthy weight for all – a shared responsibility
Modified from : WHO (1998)

7.1.1 Government

Government should play a leading role in the prevention of obesity by creating and implementing policies that promote an environment in which healthy dietary and physical activity options are readily accessible. Government can provide support for public education, and public awareness campaigns. It should be willing to work together in partnership with the key players involved in the prevention and control of obesity identified in this section. Governments should provide funding for research on the effects of interventions on overweight and obesity prevalence, prevention, and treatment, and on trends in diet and exercise among at-risk populations.

State governments can form task forces, steering committees, or advisory committees and can also develop State strategic plans for the prevention of obesity. Local authorities should work together with organisations and communities to facilitate goals for reducing overweight and obesity. This includes providing facilities to increase physical activity and promote healthy food choices.

7.1.2 Industry

The industries have a vital role in the prevention of overweight and obesity. They should continue to support government policies in relation to promotion of healthy lifestyle. They should also allocate resources to carry out action plans as part of their social responsibility. The food industry should pay greater attention to the nutritional value of products and should be encouraged to produce and market nutritious food products and healthier alternatives at an affordable price.

Other industries (for example health, fitness and housing developers) may influence the extent of physical activity in which we engage.

The industry, therefore, has the potential and responsibility to create and sustain an environment that encourages individuals to achieve and maintain a healthy or healthier body weight. The industry should adhere to regulations governing the marketing, advertising and labelling of their products and services.

7.1.3 Professional bodies

These organizations can play vital and effective roles in reinforcing and enhancing programmes and activities of the government departments and the industry. The relevant professional bodies can provide the expertise required and often serve as the link between the government or industry and the community. Such organizations may have an advantage in implementing various intervention programmes for the communities. They must, nevertheless, have the necessary checks and balances within the organisations and play an unbiased role in the programme.

7.1.4 Non-governmental organizations

Organisations can initiate discussions on obesity and overweight within their membership and can establish weight and lifestyle goals. Programs can be developed to educate members on healthy food choices and appropriate levels of physical activity and to put these healthy habits into practice. Through networking, organisations can influence the wider community to conduct similar programs and thus serve as a useful public resource.

7.1.5 Communities

A forum should be provided in which all community members can discuss the scope of the problem of overweight and obesity within the community. The nature and adequacy of available resources for public education and treatment must be addressed. Policies and programs to reduce the burden of overweight and obesity within the community should be strengthened.

7.1.6 Individuals

Individuals lie at the foundation of the solution to the problems of overweight and obesity. Individuals can share their own knowledge and habits regarding a healthy diet and physical activity with their children, other family members, friends, and co-workers. Through open discussions regarding the methods, challenges, and benefits of adopting a healthy lifestyle, individuals can be empowered to take responsibility in the prevention of obesity.

7.2 National Plan of Action

The prevention of obesity requires a range of long-term strategies. They should be part of an integrated, multi-sectoral, population-based approach, which includes environmental support for promoting a healthy life style, particularly healthy diets and regular physical activity. A national action plan for the control and prevention of obesity is thus proposed to effectively combat the problem. This Plan should complement and support National Plan of Action of Nutrition that is already established in the country and is in line with the Food and Nutrition Policy of Malaysia.

As emphasized above, in order to establish a sustainable action plan and for that plan to be effectively implemented, there must be committed government support, and smart partnerships between the public and private sectors and productive collaborations between organizations, industries, communities, schools, families and individuals.

7.2.1 National Steering Committee for the Prevention of Obesity

It is proposed that a National Steering Committee for the Prevention of Obesity be established. The key functions of this Committee would include: planning and developing action plans and programmes for the control and prevention of obesity,

monitoring and implementation of these plans and evaluating the outcomes.

The Committee should be led by the Ministry of Health and should involve the key players in the smart partnership mentioned above, namely the Ministry of Education, other relevant government agencies, industries, professional bodies, and NGO's. This partnership will provide a strong central leadership with a multi-disciplinary approach.

The multi-sectoral component of the National Steering Committee will foster learning, sharing of resources, division of labour, and consistency in the message to the public. Additionally they lend credibility to policies, and programmes in addressing the problem of obesity.

7.2.2 Formation of Working Groups

It is recommended that Working Groups should be formed around settings, such as in communities, schools, health care facilities and workplaces. These working groups will be charged with the responsibility of implementing the recommended programmes and activities identified by the Steering Committee. The formation of Working Groups would optimise the talents and resources available at the local level, and dedicated to operationalise the plan of action for obesity prevention. Each Working Group should preferably involve the media to facilitate communication and promotion in the various settings.

It is important that there should be regular interactions among the various Working Groups to establish networking, share resources, as well as exchange ideas and experiences in the implementation of the action plan. Successful intervention programmes can be identified through this system and used as a model for other similar settings. The National Steering Committee should play the role of facilitating and ensuring that such interactions take place.

7.2.3 Monitoring and evaluation

Systematic assessment and evaluation should be a routine part of all interventions aimed at preventing and managing overweight and obesity. The effectiveness of policies, programmes and activities in the prevention and management of obesity must be evaluated at regular intervals. Sound experimental design and statistical principles should be used to critically evaluate the impact of each proposed intervention programme. Monitoring should include gathering new information on obesity as well as reporting on the status of current programmes and activities. Monitoring will allow the national steering committee to gauge the success or failure of any action plans.

A surveillance system should be established to track the problem of obesity. Monitoring and surveillance will form part of an evaluation system to monitor outcomes of action plans. This type of information is important for revision and expansion of these action plans. The nutrition surveillance system conducted by the MOH among infant and toddlers in government health centres should be continued and extended to kindergartens.

The current weight and height measurements of school children needs to be improved and data collected should be analysed. This activity should be extended to secondary schools. It is proposed that a periodic national nutrition survey to be conducted to monitor trends in body weight and lifestyle habits such as food habits and physical activity pattern.

7.3 Strategies for Prevention of Obesity

The development of effective strategies for the prevention of overweight and obesity requires action at three levels (Figure 11):

- Public health prevention (directed at everyone in the population)
- Selective prevention (directed at subgroups of the population with an above average risk of developing obesity).
- Targeted prevention (directed at high-risk individuals with existing weight problems but who are not yet obese).

Figure 11:Levels of prevention measures
Source: WHO (1998)

The key components of the strategies are education and action. Education involves providing information and tools to motivate and empower decision makers at the governmental, organisational, community, family, and individual levels who will create change toward the prevention and decrease of overweight and obesity. Action refers to interventions and activities that assist decision makers in preventing and decreasing overweight and obesity, individually or collectively.

The strategies are centred on activities and interventions in five key settings: families and communities, schools, health care, media and communications, and workplace. The key actions discussed are presented for each of these settings. Many of these actions can be applied in several or all settings.

Within each key settings, the Committee has recommended specific guidelines for the prevention of overweight and obesity. Please refer to Appendix A (dietary practice), Appendix B (physical activity), and Appendix C (psycho-behavioural aspects).

7.3.1 Setting 1: Individuals, families and communities

Individual behavioural change lies at the core of all strategies to reduce overweight and obesity. Successful efforts, however, must focus not only on individual behavioural change, but also on group influences and supportive environment with accessible and affordable healthy food choices and opportunities for regular physical activity. Other lifestyle habits such as getting enough rest, avoidance of unhealthy habits, including smoking and alcohol consumption, should also be given attention. Family members can share their own knowledge and habits regarding a healthy diet and physical activity with their children, friends, and other community members. Emphasis should be placed on family and community opportunities for communication, education, and peer support surrounding the maintenance of healthy dietary choices, physical activity patterns and behavioural changes.

7.3.1.1 Education

a. Educate policy makers of the need to develop social and environmental policy that would help communities and families consume a healthier diet and be more physically active.
b. Inform community leaders (for example Jawatankuasa Keselamatan Kampung (JKKK), Penghulu, political leaders) about the importance of developing healthy communities and highlight programs that support healthy lifestyle.
c. Educate individuals, families, and communities about healthy lifestyle based on the guidelines given in Appendix A and B. They should be educated and encouraged to demand food product of high nutritional quality and safe clean food.
d. Educate parents about the need to serve as good role models by practising healthy eating habits and engaging in regular physical activity in order to inculcate lifelong healthy behaviours in their children.
e. Educate expectant parents and other community members about the potentially protective effect of breastfeeding against the development of obesity.

f. Obesity prevention and management interventions should be carefully designed so that they do not cause undue fear of fatness and precipitate eating disorders especially in adolescent girls. Interventions should also discourage other unhealthy behaviours, for example cigarette smoking, that may be adopted in the belief that this habit will prevent weight gain.

7.3.1.2 Action

a. Resident associations should support the development of increased facilities for leisure time physical activity and to encourage local food outlets to increase availability of healthier food choices in their vicinities.
b. Encourage the food industry to provide reasonable food and beverage portion sizes.
c. Increase availability of nutrition information for food products and foods served in eating establishments.
d. Create more community-based obesity prevention and treatment programs for children and adults.
e. Empower families to manage weight and health through skill building in parenting, meal planning, and behavioural management (Appendix C).
f. Expand efforts to encourage healthy eating patterns, consistent with the guidelines provided in Appendix A.
g. Place more nutritionists at community level to conduct nutrition education programs.
h. Create community supports and provide facilities that promote and support breastfeeding.
i. Encourage outdoor activities among families and minimise time spent watching television and in similar sedentary behaviours.
j. Provide and maintain more safe and accessible recreational facilities such as playgrounds and parks for the public.
k. Create and implement public policy related to the provision of safe and accessible sidewalks, walking and bicycle paths so as to encourage and facilitate more frequent daily outdoor activities.

7.3.2 Setting 2: Schools

Schools are identified as a key setting for public health strategies to prevent and decrease the prevalence of overweight and obesity. Malaysian children spend a fairly large portion of time in school. Schools are in the position to provide opportunities to educate children in healthy eating and physical activity. These healthy practices can be reinforced in school settings. Public health measures should extend beyond health and physical education to include improvement in physical and social environment in school, and links with families and communities.

7.3.2.1 Education

a. Increase awareness among teachers, canteen operators and parents-teachers associations (PTA / PIBG) about the contribution of good nutrition and physical activity to the maintenance of healthy weight.
b. Educate teachers to be role models for children, to adopt healthy eating and regular physical activity.
c. Educate staff to be sensitive to the problems encountered by the overweight child.
d. Educate schoolchildren, teachers and parents about unhealthy body size perceptions and inappropriate weight control practices.

7.3.2.2 Action

a. Include healthy living education into the school curriculum, emphasising on healthy eating and physical activity.
b. Review the School Canteen Guidelines and reinforce its implementation in all schools. Adopt policies ensuring that healthy food choices are made available in schools.
c. Schools should organise regular programmes on healthy eating by incorporating talks by nutritionists, interactive sessions such as games, quizzes and debates. Adopt existing nutrition educational packages that are age-appropriate and culturally sensitive.
d. Vending machines should not be encouraged in schools. However, if these are available, schools should ensure that healthy snacks, food and drinks are provided in these machines.
e. Provide all children, from pre-school through secondary schools, with dedicated time for physical education with qualified teachers to help develop the knowledge, attitudes, skills, behaviours, and confidence needed to be physically active for life.
f. Provide more co-curricular physical activity programs, and encourage the use of facilities offered by the school and/or community-based organisations outside of school hours.
g. Provide incentive to children with overweight problem for participation in physical activities.

7.3.3 Setting 3: Health care

The health care system provides a powerful setting for interventions aimed at reducing the prevalence of overweight and obesity and their consequences. Nutrition education given by health care providers can influence dietary choices and physical activity patterns. In collaboration with schools and workplace, health care providers and institutions can reinforce the adoption and maintenance of healthy lifestyle behaviours. Health care providers also can serve as effective public policy advocates and further catalyse intervention efforts in the family and the community and in the media communications settings.

7.3.3.1 Education

a. Sensitise health care providers and administrators of the burden of overweight and obesity on the health care system in terms of mortality, morbidity and cost.
b. Emphasize to the health care community about the importance of being role models for public on healthy eating and regular physical activity.
c. Educate health care providers and administrators to identify and promote opportunities for public to have access to effective nutrition and physical activity programs.
d. Inform and educate the health care community about assessment of weight status and the risk of inappropriate weight change.
e. Educate health care providers on effective ways to promote and support breastfeeding.

7.3.3.2 Action

a. Train health profession students and provide continuous professional development for health care providers in effective prevention and treatment techniques for overweight and obesity.
b. Encourage partnerships between health care providers, schools, religious groups, and other community organisations in prevention efforts targeted at social and environmental causes of overweight and obesity.
c. Explore mechanisms in health insurance policies that will partially or fully cover reimbursement for health care services associated with weight management, including nutrition education and physical activity programs.
d. Intensify effective nutrition and physical activity programmes targeting at the prevention of obesity.

7.3.4 Setting 4: Media and communications

Public health efforts to promote healthy lifestyle must be carried out in close collaboration with the media. Continuous public education using relevant mass media on the rising problem of obesity will increase awareness and encourage the community to take steps to prevent and manage the problem. The mass media can play an effective role in communicating intervention measures for dietary improvement and promotion of physical activity to the community.

7.3.4.1 Education

a. Educate media professionals that the primary concern of overweight and obesity is one of health rather than physical appearance.
b. Emphasise to media professionals that the burden of overweight and obesity is similar in rural-urban populations and among ethnic groups. However, there is a need for culturally appropriate health messages.
c. Communicate the importance of prevention of overweight through balancing food

intake with physical activity at all ages.
d. Educate the media professionals about the health implication of undesirable weight change.
e. Build awareness of the importance of social and environmental influences on appropriate diet and physical activity choices.
f. Educate media professionals on policy areas related to diet and physical activity.
g. Emphasise to media professionals the need to develop uniform health messages about diet and physical activity that are consistent with the guidelines (Appendix A and B).
h. Emphasise the role of media in promoting behavioural changes in the population.

7.3.4.2 Action

a. Collaborate with the media in conducting national public awareness campaigns on the health benefits of regular physical activity, healthy dietary choices, and maintaining a healthy weight, consistent with the Malaysian Dietary Guidelines.
b. Media should promote healthy and realistic goals for weight loss programmes as well as scientifically substantiated claims on weight management products.
c. Media should incorporate messages about healthy eating and regular physical activity consistent with the Malaysian Dietary Guidelines, more frequently.
d. Media to help train health professionals in advocacy skills to effectively disseminate their knowledge to a broad audience.
e. Media to conduct advertising campaigns to counter messages that promote consumption of excess calories generated by food industries, and physical inactivity by industries that promote sedentary behaviours.
f. Media, in collaboration with health professionals, should utilise celebrities' influences as role models to demonstrate healthy eating and physical activity for health rather than for appearance.

7.3.5 Setting 5: Workplace

The workplace has the potential to provide opportunities to reinforce the adoption and maintenance of healthy lifestyle behaviours. Public health measures should extend beyond health education and awareness to improve physical and social environment in the workplace.

7.3.5.1 Education

a. Employers should be informed on direct and indirect costs of obesity.
b. Communicate to employers the return-on-investment (ROI) for obesity prevention and treatment programmes.

7.3.5.2 Action

a. Adopt flexible working hours to create opportunities for regular physical activity during working days.
b. Observe 'dedicated' lunch time for employees.
c. Promote healthy eating by ensuring healthy food options are made available at staff cafeteria / canteen.
d. Promote physical activity by providing exercise and changing facilities, or subsidise cost of employees to join local fitness centres
e. Employers should ensure that health insurance contract for employees include weight management and counselling.
f. Create work environments that promote and support breastfeeding.
g. Government workplaces should promote healthy eating and physical activity that will set examples for others.
h. Employer to provide programmes to help employee with weight problem
i. Tax reduction/rebate for enrolment in fitness club

REFERENCES

WHO. (1998). Obesity: *Preventing and managing the global epidemic*. Report of a WHO Consultation on Obesity. Geneva: World Health Organisation.

US DHHS. (2001). The Surgeon General's call to action to prevent and decrease overweight and obesity. Rockville, MD: U.S. Department of Health and Human Services, Public Health Service, Office of the Surgeon General.

8. RESEARCH NEEDS

The research needs in relation to the prevention of overweight and obesity were discussed in the context of the local situation. Besides that, the Committee also adapted some relevant research strategies from WHO (1998) and the Surgeon General's Report (US DHHS 2001).

8.1 Setting 1: Individuals, Families and Communities

a. Conduct research to develop cost-effective community-directed strategies to prevent the onset of overweight and obesity.
b. Determine the contributing factors such as environmental, behavioural, social and ecological factors leading to obesity and how such forces vary by ethnicity, gender, and socio-economic status.
c. Assess the economic burden of overweight and obesity in the population.
d. Develop and evaluate preventive interventions that target infants, children and adolescents especially those who are at high risk of becoming obese.
e. Coordinate research activities to refine risk assessment of overweight and obesity.
f. Conduct behavioural research to identify culturally appropriate techniques to motivate people to increase and maintain physical activity and make healthier food choices.
g. Conduct research on the influence of marketing practices in food industry and food outlets.
h. Study the cost-effectiveness of community-directed strategies designed to prevent the onset of overweight and obesity.
i. Assess community insights in relation to their understanding, perceptions, and expectations on weight maintenance.

8.2 Setting 2: Schools

a. Assess the effectiveness of existing nutrition and physical activity curriculum and co-curricular programs in schools.
b. Investigate the effect of dietary practices and physical activity on schoolchildren's physical, mental and social health.
c. Develop and evaluate school-based behavioural intervention programmes for the prevention of overweight in children.
d. Develop, implement and assess effectiveness of appropriate obesity intervention programmes in schools.

8.3 Setting 3: Health Care

a. Develop and evaluate the cost-effectiveness of obesity prevention and weight management programmes.
b. Promote research on effective means of maintenance of weight loss.
c. Promote research on breastfeeding and the prevention of obesity.

8.4 Setting 4: Media and Communications

a. Develop media campaigns to prevent obesity and evaluate its impact.
b. Conduct consumer research to determine whether media messages are positive, realistic, relevant, consistent, and achievable.
c. Study the effects of popular media images of ideal body types and their potential health impact, particularly on young women.

8.5 Setting 5: Workplaces

a. Evaluate best practices in workplace for obesity prevention and treatment efforts, and disseminate results widely.
b. Evaluate the cost effectiveness of obesity prevention and treatment efforts at workplaces.
c. Conduct controlled studies on the impact of overweight and obesity management programmes on worker productivity and absenteeism.
d. Explore and evaluate the feasibility of providing incentives to employees that support healthy eating habits and active lifestyle.

REFERENCES

WHO. (1998). *Obesity: Preventing and managing the global epidemic*. Report of a WHO Consultation on Obesity. Geneva: World Health Organisation.

US DHHS. 2001. The Surgeon General's call to action to prevent and decrease overweight and obesity. Rockville, MD: U.S. Department of Health and Human Services, Public Health Service, Office of the Surgeon General.

APPENDIX A1: Dietary Guidelines for the Prevention of Obesity

Practising sensible and healthy dietary habits is the key to the prevention of excessive weight gain. The committee recommends the following dietary strategies for prevention of obesity among Malaysians:-

1. Maintain healthy body weight by balancing food intake with regular physical activity

The first step to achieve healthy body weight is to practice healthy eating and be physically active. In most cases, overweight or obesity is a result of excess intake of calories and lack of physical activity over a period of time. The amount of energy needed to maintain a healthy body weight depends on an individual's age, sex, physiological condition and physical activity level.

2. Eat a balance diet by enjoying a variety of foods

The body needs foods as the source of energy and nutrients to grow, move, work, play, think and learn. However, no single food can supply all the nutrients in the amounts the body needs. Therefore, the best way to ensure that we meet the nutrients requirements is to eat a variety of foods within the recommended amounts according to the Malaysian Food Pyramid (Appendix A2).

3. Minimize fat in food preparation and choose foods that are low in fat

Dietary fat is the major determinant of the energy density of diets. It imparts taste and flavour to foods enhancing their palatability, as well as promotes the absorption of fat-soluble vitamins. Despite its importance, excessive consumption of dietary fat can have adverse effects on health such as obesity and other non-communicable diseases. In the Malaysian diet, the main source of dietary fat is reported to be cooking oil used in food preparation. Here are some tips to reduce dietary fat intake:

- Adopt alternative cooking methods such as grilling, microwave or steaming in preference to frying in oil or deep frying.
- Use only a little cooking oil.
- Choose lean cuts of meat, discarding the skin where applicable (e.g. chicken).
- Use small amounts of visible fats such as margarine, butter, salad oils, cream, mayonnaise and coconut milk.
- Choose low fat or fat free products (e.g. skimmed milk, low fat milk, low fat yogurt, and low fat cheese). (Note: low fat products are not recommended for children below 2 years, whilst skimmed milk products are not recommended for children below 5 years).
- Cut down on high fat foods that contains hidden fats (e.g. traditional *kuih*, pastry and cake).

4. Reduce sugar intake and choose foods low in sugar

Sugar is considered as simple carbohydrate that lacks in other nutrients (empty calories) and tends to displace other more nutritious foods. Excessive intake of sugar can have an adverse effect on health including problems of overweight. Here are some tips to reduce sugar intake:

- Encourage gradual sugar reduction in foods while taste adapts to the change. Use 1/2 or 3/4 of usual amount in cakes or in drinks.
- Cut down on confectionery and sugary food items.
- Use fresh fruit instead of canned fruits.
- Drink plain water, low calorie or sugar free drinks.
- Spices such as cinnamon or nutmeg can enhance the natural flavour without added sugar.

5. Adhere to a regular mealtime

Skipping meals can lead to overeating during the next mealtime and often results in overweight and obesity. Avoid unhealthy habit of skipping breakfast, little or no lunch and a huge dinner. A sensible dietary habit includes a regular breakfast, lunch and dinner. Snacking between meals can help curb hunger, but it should not replace a main meal. Low calorie and high fibre snacks are preferable for maintaining healthy body weight.

6. Choose healthier food and smaller portion size when eating out

Snacks and meals eaten away from home provide a large part of daily calories for many people. Therefore, when eating out, choose smaller portions of foods and cut down on serving size of foods. Appendix A7 provides a guide when eating out according to place of eating.

7. Promote and practice breastfeeding

The increased initiation and duration of breastfeeding may provide low-cost, readily available strategy to help prevent obesity in childhood (Hediger et al. 2001) and adolescent (Gillman et al. 2001). However, the maternal weight change associated with breastfeeding is minimal among normal weight women, and for overweight women the weight gained during pregnancy is not reduced by breastfeeding (Sichieri et al. 2003). Therefore, after childbirth, in addition to breastfeed their babies for at least 6 months, women are encouraged to adopt a healthy lifestyle, including diet and exercise to prevent postpartum weight gain.

8. Alcohol intake

Avoid drinking alcohol. Regular consumption of alcohol is not recommended because of its high calorie content. Alcohol provides 7 kcal per gram, which is less than that provided by fat (9 kcal per gram) but more than that contributed by either carbohydrates (4 kcal per gram) or protein (4 kcal per gram).

If you drink alcoholic beverages, do so in moderation (not more than one drink for women and two drinks for men daily). A standard drink is one 12 ounce beer, one 5 ounce glass of wine, or one 1.5 ounce shot of distilled spirits. Each of these drinks contains about half an ounce of alcohol.

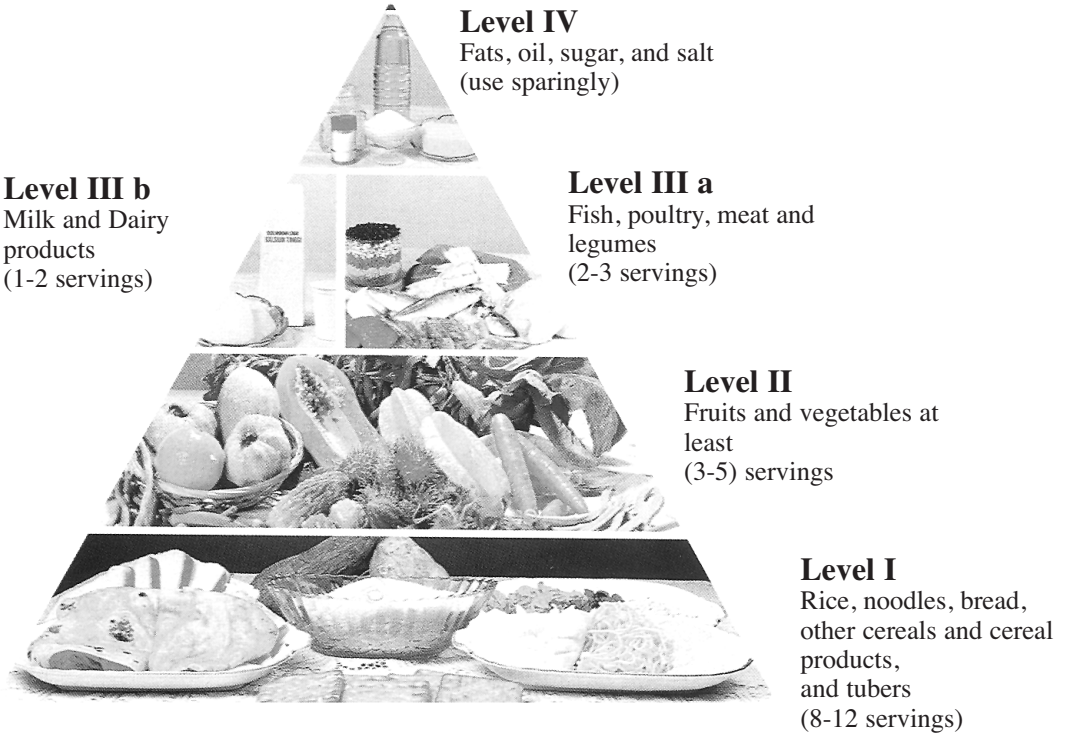
9. Building good food habits from childhood

Prevention of obesity should begin in childhood. This includes learning healthy eating and activity habits from an early age.

These are some guidelines for parents to instil good eating habits in their children.

- Set good examples as parents because children tend to imitate what they see.
- Eat a variety of foods so you and your children will be less likely to develop nutrient deficiencies or excesses.
- Keep your child busy because he or she may eat out of boredom instead of hunger.
- Serve small portions on individual plates.
- Help your child eat more slowly. Eating too fast can result in overeating.
- Encourage your child to participate in planning, shopping, and cooking meals.
- Have low-calorie nutritious snacks available.
- Encourage adequate fruit and vegetable intakes.

APPENDIX A2 : Malaysian Food Pyramid



Source: MOH (1999)

Level I: Eat adequate amount of rice, cereal products and tubers

Eating adequate amount of rice, cereal products such as noodles, bread, pasta, chapatti, thosai, oats, barley and other products and tubers such as potato, tapioca and sweet potato, is a key to a healthy diet. These foods known as complex carbohydrates also provide vitamins, minerals and fibre. A daily diet should comprise of 8 to 12 servings of these food groups. Generally, they are low in fat if cook without using too much cooking oil, coconut milk, butter and ghee.

Level II: Eat more of fruits and vegetables

Most fruits and vegetables are excellent sources of vitamins and minerals. They are also low in fat and high in fibre that helps to maintain a healthy body weight. It is recommended to include 3 to 5 servings of these foods daily. Fibre may help to fill up the stomach and thus reduce food intake.

Level IIIa: Eat fish, meat, poultry and legumes in moderation

Fish, meat, poultry and legumes are good sources of protein, some vitamins and minerals. However, meat and poultry also contain a significant amount of fat, unless the visible fat is trimmed. The number of serving recommended for this group is 2 to 3 servings daily.

Level IIIb: Consume milk and dairy products in moderation

Milk and dairy products such as cheese, yoghurt, yoghurt drinks, lassi are essential sources of calcium and protein. This group, however, does not include condensed milk, butter and cream. Adults are recommended to take 1 to 2 servings daily. Lower fat alternatives are preferable.

Level IV: Consume least fats, oils, sugar and salt

Fats, oils, sugar and salt are placed at the tip of the pyramid because they are required in small amounts. Therefore, use these foods sparingly.

APPENDIX A3. Calorie content of local dishes and franchised fast foods

Type of food *	Portion size	Weight	Calories
High calories (>600 kcal/ serving)			
Western fast food set comprise of 2 pieces fried chicken, 1 bun, 1 mash potato, 2 potato wedges and 1 glass of carbonated drink	1 set	-	762
Nasi biryani with chicken curry and yellow dhall gravy	1 set	385	632
Medium calories (400 – 600 kcal / serving)			
Beef burger with fries and carbonated drink	1 set	-	422
Chicken soto	1 bowl	493	528
Nasi kerabu with one small fried fish, fish cracker and coconut sauce	1 set	300	535
Chicken rice	1 set	300	565
Nasi lemak with fried chilli paste, $\frac{1}{2}$ boiled egg, fried anchovies and fried groundnuts	1 set	282	480
Low calories (<400 kcal / serving)			
Beef burger	1 piece	100	234
Idli with dhall gravy and coconut chutney	1 set	197	236
Chicken satay 5 pieces, 8 small cubes compressed rice and 1 small bowl coconut sauce)	1 set	200	258
Chapatti with yellow dhall gravy, and coconut chutney	1 set	179	322
Mee soup	1 bowl	522	35

* Criteria for high/moderate/low calories based on Buku Resepi Sihat, Pilihan Bijak (NSM 2002)
Source: Suzana et al. (2002); Tee et al. (1997)

APPENDIX A4: Calorie content in selected local *kuih* and western pastries

Type of food *	Portion size	Weight	Calories
High Calories (>200 kcal/serving)			
Lepat pisang	1 piece	116	238
Cheese cake	1 piece	116	281
Medium Calories (100-200 kcal / serving)			
Plain cake	1 piece	23	100
Kuih kastard jagung	1 piece	93	108
Popiah goreng	1 piece	50	113
Pisang goreng	3 small pieces	66	131
Vadai	1 piece	44	143
Kuih lapis	1 piece	100	152
Kuih talam ubi kayu	1 piece	96	156
Kuih seri muka	1 piece	99	192
Yau-car-kue	1 piece	46	192
Plain doughnut	1 piece	54	193
Low Calories (<100 kcal / serving)			
Tapai pulut (Fermented glutinous rice)	1 pack	30	50
Popiah basah	1 piece	40	74
Kuih apam	3 small pieces	40	77

* Criteria for high/moderate/low calories based on Buku Resepi Sihat, Pilihan Bijak (NSM 2002)
Source: Suzana et al. (2002); Tee et al. (1997)

APPENDIX A5: A guide to reading food labels when shopping

Consumers should have adequate knowledge in nutrition to make healthy choices when shopping for food. Food labels provide information which will assist in making good food choices. The information to look for on food labels includes ingredients, expiry date, nett weight and storage instruction. Labels also provide specific nutrition information on Calories, carbohydrates, protein and fat content of the food. Compare the nutrient content among products and choose the one that suits your health needs.

A sample format for the labelling of mandatory nutrients is shown below:

Nutrition Information[1]		
Serving size: 200 ml **Servings per package: 5**		
	Per 100 ml	**Per Serving (200 ml) (or per package[2])**
Energy	100 kcal (420 kJ)[3]	200 kcal (840 kJ)
Carbohydrate	23.8 g	47.6 g
Total Sugars[4]	11.5 g	23.0 g
Protein	1.1 g	2.2 g
Fat	0 g	0 g

Source: MOH (2003)
Footnotes:
1 This is the recommended title for nutrition labels.
2 If the package contains only a single portion.
3 1 kcal = 4.2 kJ
4 Only for ready-to-drink beverages. Total sugars refer to all monosaccharides and disaccharides contained in the beverage.

APPENDIX A6: Nutrient content claims

Nutrition content claims on food labels such as low calorie, low fat, sugar free can help consumers to make healthier food choices. Conditions for making claims of 'low in' or 'free of' are shown below:-

Component	Claim	Not More Than
Energy	Low	40 kcal (170 kJ) per 100g (solids) or 20 kcal (80kJ) per 100 ml (liquids)
	Free	4 kcal per 100 g (100 ml)
Fat	Low	3 g per 100 g (solids) or 1.5 g per 100 ml (liquids)
	Free	0.15 g per 100 g (100 ml)
Saturated Fat	Low	1.5 g per 100g (solids) or 0.75 g per 100 ml (liquids) and 10% of total energy of the food
	Free	0.1 g per 100 g (solids) or 0.1 g per 100 ml (liquids)
Cholesterol	Low	0.02 g per 100g (solids) or 0.01 g per 100 ml (liquids)
	Free	0.005 g per 100 g (solids) or 0.005 g per 100 ml (liquids)
TFA	Low	1.5 g per 100g (solids) or 0.75 g per 100 ml (liquids) and 10% of total energy of the food
	Free	0.1 g per 100 g (solids) or 0.1 g per 100 ml (liquids)
Sugars	Free	0.5 g per 100 g (or 100 ml)
Sodium	Low	0.12 g per 100 g
	Very Low	0.04 g per 100 g
	Free	0.005 g per 100 g

Source: MOH (2003)

APPENDIX A7: Food choices when eating out

Place of eating	Healthier food choices	Foods to be reduced
Malay restaurants or food stalls	• *Laksa asam, mee soup, mee tomyam or mee hailam*. • Plain rice with dishes such as grilled or baked fish/ chicken/ lean meat, *tomyam, soup, asam pedas* and *ulam* or *'sayur air*' • *Rojak buah, pecal, acar* • *Popiah basah, apam*	• *Nasi lemak, nasi minyak, nasi beryani* and *nasi tomato* • Fried dishes such as fried mee • Santan dishes such as *'ayam masak lemak cili api'* or *'sayur lemak'* • Fried 'kuih' such as banana fritters, currypuff • Traditional 'kuih' cooked with coconut milk and sugar such as 'kuih talam'
Chinese restaurants or food stalls	• Clear soup, noodle soup • Porridge • Chicken rice (remove the skin) • Steamed dim sum and dishes • Steam boat with non-fried items • Tofu dishes • Grilled or barbequed meat • Stir fried vegetables with little oil • Plain dessert or jelly, such as almond jelly	• Concentrated soup, eg. shark fin soup, corn soup • Fried dishes such as fried noodles, kuey teow, fried fish or sweet and sour dishes • *Bak kut teh* with internal organ • Egg dishes • Stir fried vegetables with excessive oil
Indian restaurants/ food stalls	• Capati, nan bread, idli, tosai, putu mayam • Chicken or fish tandoori • Dhall dishes • Curry without coconut milk • Vegetables fried with little oil	• Puri, roti canai, murtabak • Fried mee • Curry dishes using coconut milk • *Rojak mamak* • Additional yoghurt or tairu • Laddu
Western restaurants	• Sandwiches with low fat fillings such as salad, tuna or chicken without mayonnaise • Deep pan pizza with chicken or vegetables topping • Mash or bake potatoes • Barbequed or grilled fish, seafood or meat • Fish fillet • Clear soup • Salad with lemon or vinaigrette dressing • Corn on the cob (without margarine) • Low fat yoghurt / dairy products	• Mayonnaise and high fat salad dressing • Crispy pizza with pepperoni, meat, sausage and extra cheese • Deep fried dishes, eg. french fries and battered fish • Casserole dishes • Bolognaise with meat sauce and extra cheese • Pastries, creamed soup and pies
Beverages	• Mineral / plain water • Chinese tea • Plain tea / coffee • Barley drinks, lai chee kang • Soya drinks • Fresh unsweetened fruit juice • Low fat / skimmed milk products • Plain ice cream / jelly with fruit flavours	• Carbonated drinks • High calories drinks, eg. Cendol, air batu campur, the tarik, lassi • Ice cream

Note: Consumers should ask for less sugar, salt, oil when eating out.

REFERENCES FOR APPENDICES A1 – A7

Gillman MW, Rifas-Shiman SL, Camargo CA, Berkey CS, Frazier AL, Rockett HRH, Field AE & Colditz GA. (2001). Risk of overweight among adolescents who were breastfed as infants. *Journal of the American Medical Association*. 285(19):2461-7.

Hediger ML, Overpeck MD, Kuczmarski RJ & Ruan WJ. (2001). Association between infant breastfeeding and overweight in young children. *Journal of the American Medical Association*. 285(19): 2453-2460.

MOH. (1999). *Malaysian dietary guidelines*. Kuala Lumpur: Jawatankuasa Penyelaras Makanan dan Pemakanan Kebangsaan (NCCFN), Ministry of Health.

MOH. (2003). *Guide to nutrition labelling and claims*. Kuala Lumpur: Food Quality Control Division, Ministry of Health.

NSM. (2002). *Resipi sihat, pilihan bijak*. Volume 2. Kuala Lumpur: Nutrition Society of Malaysia.

Sichieri R, Field AE, Rich-Edwards JR & Willet WC. (2003). Prospective assessment of exclusive breastfeeding in relation to weight change in women. *International Journal of Obesity*. 27: 815-820.

Suzana S, Rafidah G, Noor Aini MY, Nik Shanita S, Zahara AM & Shahrul Azman MN. (2002). *Atlas of food exchanges and portion sizes*. Kuala Lumpur: MDC Publisher.

Tee ES, Ismail MN, Nasir MA & Katijah I. (1997). *Nutrient composition of Malaysian foods*. 4th Ed. Kuala Lumpur: Institute for Medical Research.

APPENDIX B: Physical Activity Guidelines for the Prevention of Obesity

Interventions aimed at increasing levels of physical activity in the community are an important approach to promote reductions of body weight of the whole population. Such interventions need to take into account the following points:

- Increasing the levels of physical activity of community has numerous potential benefits for population health in addition to preventing further increases in average BMI, e.g. reduction risk of Type 2 diabetes, coronary heart disease and certain cancers.
- Physical activity should always be encouraged, but it should not be presented as requiring excessive physical bouts involving boring routines or requiring expensive equipment.
- Physical activity should be fun in order to encourage regular participation and to discourage sedentary behaviour.

There is some evidence that physically active children remain active in adult life, so the promotion of a variety of general activities in young children may be especially important.

The public health perspective views that an increase in the physical activity level of the general population is likely to bring about health and economic benefits to the nation. The guidelines refer to the minimum level required to maintain healthy body weight and not meant for high level fitness or sports training (DHAC 1999). These guidelines are suitable for Malaysians of all ages and aims to instil values that physical activity is good for health and healthy people are more productive.

Approaches to enhance physical activities:
1. Being active is an opportunity
2. Be active every day in as many ways as possible
3. Do light to moderate intensity activity for at least 30 minutes preferably everyday
4. Where possible, enjoy some regular vigorous activity.

1. Being active is an opportunity

Change your mind set. Moving around should not be seen as troublesome but as a chance to burn off extra calories. Reinforce movement – increase opportunities for reinforcement. Think small but regular and fun. Think prevention is better than cure.

This approach emphasizes the importance of all forms of activity, ranging from simple movement, low to moderate intensity physical activity to more vigorous activity.

2. Be active every day as many ways as possible

With the availability of labour saving devices, people tend to become sedentary. Malaysians should be encouraged to walk or cycle to the local shop instead of driving, use stairs instead of lifts or escalators, park their car some distance away from their destination and enjoy outdoor family activities.

3. Do light to moderate intensity activity for at least 30 minutes preferably everyday

Previously, exercise was thought to be more beneficial when done vigorously 3 to 4 days a week for a minimum of 30 minutes. However, current evidence shows that shorter period of moderate intensity activities amounting to 30 minutes or more daily (eg – 3 sessions of 10 minutes each) or doing 30 minutes continuously will improve blood pressure, blood cholesterol levels and maintain body weight.

However, for preventing weight gain or regain in formerly obese individuals, 60 – 90 minutes of moderate intensity activity or lesser amounts of vigorous intensity activity is required (Saris et al. 2003). To prevent the transition to overweight or obesity, moderate intensity activity of approximately 45 – 60 minutes per day is needed. For children, even more activity time is recommended.

4. Where possible, enjoy some regular vigorous activity.

This guideline adds an extra level to the above three recommendations for those adults who are able and wish to achieve greater health and fitness benefits. Children and teenagers under the age of 18 should follow this guideline routinely.

APPENDIX B1: Types and levels of physical activities recommended for prevention of obesity

Mild or Moderate	Vigorous
• Fast walking on flat surface • Cycling on level surface • Light gardening • House cleaning chores • Golf: walking and pulling or carrying clubs • Ballroom / line dancing • Light or moderate strength–developing exercise • Volleyball • Snorkelling • Badminton • Aerobics • Roller-blading • Bowling	• Jogging • Cycling up the hill • Moving heavy furniture • Heavy gardening (eg – use cangkul) • Swimming • Football / Futsal • Basketball • Squash • Tennis

APPENDIX B2: How to become physically active ?

B2.1 Office workers

Urban male office workers:	Urban female office workers:
• Wake up 10 minutes earlier than your usual time, and do some light stretching exercises. • If you have to take bus or taxi walk briskly to the bus or taxi stand. • Walk up the stairs instead of the lift if your office is within the first five floors. If you have to take the lift, stop five floors below your office and walk the rest of the way up. Initially you may feel breathless but after a few months of daily walking up the stairs you will be more energetic in completing the task of walking up the stairs). • While in the office, take 5 to 10 minutes break to brisk walk in the office. • Try to do some physical activities while in the office. • Take a walk after dinner. • Be physically active even while watching television. • While at home help your spouse to do some of the household chores. • During weekends, wash your own car. • If you go to the market or night market park your car further away from the market. • Carry your own shopping goods without using the trolley to the car. • If you have young children, play actively with your children. • Try to find time to take up games on a regular basis.	• Wake up 10 minutes earlier than your usual time and do some light stretching exercises. • If you have to take bus or taxi walk briskly to the bus or taxi stand. • Walk up the stairs instead of the lift if your office is within the first five floors. If you have to take the lift, stop five floors below and walk the rest of the way up. Initially you may feel breathless but after a few months daily walking up the stairs you will be more energetic in competing the task. • While working in the office, take 5 to 10 minutes break to brisk walk in the office. • Try to do some physical activities while in the office. • Take a walk after dinner. • If you want to go for a walk after dinner walk with your husband or a friend. • If it is not possible to go for a walk after dinner try vacuuming or cleaning the house. • Keep active after dinner till it is time for bed. • During weekends, go for family outings in the park and play with the children. • If you have young children, play actively with your children. • Wear a comfortable T-shirt and pants and a pair of suitable shoes. • While watching television do rope skipping or stationary cycling. • Join a neighbourhood sports club and take up regular game.

B2.2 Housewives

Urban Housewives:	**Rural housewives:**
• Wake up 10 minutes earlier than your usual time and do some light stretching exercises. • Move or walk faster whenever you do your housework. • Try to be on your feet all day. • Spend less time sitting down. • Avoid sitting down in front of the television for a long stretch. • If you live in a high-rise building, walk-up stairs to the first 5 floors, and take the lift the rest of the way up. • Do rope skipping or stationary cycling 15 to 20 minutes everyday, at any time of the day. • Be more vigorous in doing your house hold work for example vacuuming, mopping, scrubbing or cleaning the windows. • Organize evening walks with your neighbours. • Walk to the market or shops if within walking distance. • Carry your own shopping bags, do not use the trolley. • At weekends take your family to the park, play actively with your children.	• Grow your own vegetables around the house. • Walk to the mosque, surau, temple, shops, every day. • Avoid sitting down in front of the television for a long stretch. • Do light stretching exercises.

B2.3 Pensioners

Urban male pensioners:	**Urban female pensioners**
• Brisk walking in the morning around your place of living for at least 30 minutes, 4 to 5 times a week. • Walk briskly to the mosque or surau or shops regularly. • Stationary cycling while watching television. • Grow your own vegetables if possible. • Swim once or twice a week. • Play badminton once or twice a week. • Avoid sitting too long in front of the television. • For Muslim men perform more sunat prayers.	• Brisk walk in the morning or in the evening around your home area for at least 30 minutes, 4 to 5 times per week. • Walk briskly to the mosque or surau or shops regularly. • Stationary cycling while watching television. • Grow your own vegetables if possible. • Avoid sitting too long in front of the television. • For Muslim women perform more sunat prayers. • Organize swimming for women only once or twice a week. • Be more vigorous in doing your household chores.

B2.4 Others

Rural adult men:	**Children and teenagers**
• Wake up 10 minutes earlier than your usual time and do some light stretching exercises. • Walk briskly to the mosque or surau or shops. • Cycle to places if they are too far to walk. • Clean your house compound three times a week. • Grown your own vegetables. • Avoid sitting ideally for too long. • Get involved in gotong-royong activities e.g. cleaning the surau or mosque or school compound. • For Muslim men perform more sunat prayers.	Aim for at least 60 minutes activities per day: • Walk, cycle skip or run. • Take part actively in physical education. activity classes during school. • Play actively during school recess. • Join after-school or community physical activity programs. • Spend less time watching television or playing video games. • Take part in school sports activities. • Join school outdoor activities such as camping, canoeing, mountain climbing, snorkelling, orienteering and repelling. • If possible walk or cycle to school. • Help your parents in the daily household chores.

REFERENCES FOR APPENDICES B – B2:

DHAC. (1999). National physical activity guidelines for adults. Canberra, Australia: Department of Health and Aged Care.

Saris WH, Blair SN, van Baak MA, Eaton SB, Davies PS, Di Pietro L, Fogelholm M, Rissanen A, Schoeller D, Swinburn B, Tremblay A, Westerterp KR & Wyatt H. (2003). How much physical activity is enough to prevent unhealthy weight gain? Outcome of the IASO 1st Stock Conference and consensus statement. *Obesity Reviews*. 4 (2):101-114.

Appendix C: Psycho-behavioural Guidelines for Prevention of Obesity

Psycho-behavioural management can help prevent unnecessary indulgence of food and overeating. Therefore, modification of behaviour using psychological approaches is an important strategy in preventing obesity. Some of these techniques include:

1. Restrict exposures to external cues such as environment conducive to overeating:
   - Avoid route with plenty of food stalls – reinforce use of alternative routes where there are less cues.
   - Eat before you go for grocery shopping.
   - Stick to your shopping list when buying foodstuff.
   - Learn to cope with stress without resorting to food, drinks and/or alcohol.
   - During buffet or functions, use small plate and take small portions.

2. Encourage and reinforce physical activity:
   - Encourage active lifestyle; discourage sedentary behaviour.
   - Make physical activity fun and rewarding so as to reduce sedentary activities.
   - Encourage active family- or community-based recreational activities for more social support.
   - Reduce time spent watching television and playing computer or other sedentary games.

3. Discourage unhealthy eating behaviour as reward:
   - Use alternative non-food reward such as giving books or sports equipment and opportunities for fun physical activities.
   - Avoid associating unhealthy foods with happy occasions such as parties having pizza, fries, fried finger foods and alcohol by replacing with healthier foods for example fruits, low calorie and non-alcoholic drinks.

4. Encourage health-seeking behaviour:
   - Reinforce health-seeking behaviour by participating in health screenings and campaigns.
   - Reward health seeking behaviour with tangible and social rewards.
   - Encourage medical supervision for weight management.

5. Promote positive attitude to health and weight management:
   - Enhance self-esteem and body image acceptance.
   - Promote positive self image and self respect.
   - Improve quality of life by promoting healthy lifestyle attitudes (“Health is Wealth”).
   - Rectify distorted perceptions on the importance and methods of managing excess weight.
   - Monitor food intake and exercise.

Appendix D: Consensus Workshop Participants 16 December 2004, Kuala Lumpur

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Hayati Mohd Yusuf, KUSTEM
Hazreen Abdul Majid, UM
Kamarul Faridah Kamarul Zaman, LPPKN
Mahenderan Appukutty, UITM
Mastari Mohamad, IJN
Mirnalini Kandiah, UPM
Mohd Anuar b Abdul Hamid, MOE
Mohd Ismail Noor, UKM
Mohd Nasir Mohd Taib, UPM
Mohd Nordin Mohd Som, Nestle
Molly Cheah, PCDOM
Nik Mazlan Mamat, UIA
Norimah A. Karim, UKM
Pauline Low Hwee Hong, WMIC
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Razali Mohamed Salleh @ Zainal, UPM
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Rusidah Selamat, MOH
Ruzana Abdullah, HUKM
Siti Fatimah Mohd Shakaff, UMMC
Suzana Shahar, UKM
Syaridah bt Yusoff, FMM
Tan Yoke Hwa, HKL
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