The Philippine Association for the Study of Overweight and Obesity (PASOO) *is a non-stock non-profit association of professionals from different disciplines all concerned with the problem of overweight and obesity in the Philippines. It was incorporated in 1993 with the mission of pioneering in the prevention and control of obesity and its complications through education, research and advocacy. The association's long-term vision is for an Obesity-risk Free Nation. To this end, PASOO organizes Annual Conventions, seminars, workshops, regional caravans and advocacy campaigns, and conducts and promotes scientific research on overweight and obesity. As a member of the International Association for the Study of Obesity (IASO), PASOO leads in the national celebration of the Obesity Prevention Week and participates in regional and international activities of IASO.*

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State of the Art of Obesity Research in the Philippines: 1981-2011

Philippine Association for the Study of Overweight and Obesity

Member - International Association for the Study of Obesity (IASO)

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Editor

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Preface

The WHO has declared obesity as a worldwide problem. The condition is now considered a disease, increasing rapidly in both developed and developing countries. In the Philippines, the Food and Nutrition Research Institute-DOST has shown in its national nutrition surveys that in the last two decades, overweight and obesity both among adults and children have alarmingly increased in prevalence.

At the same time, the deleterious effects of obesity on health and the economy are increasingly becoming recognized. Obesity is now considered not only as a disease in itself but as a major risk factor of numerous chronic disease conditions. Although obesity paints a dismal picture, the good news is that it is preventable and treatable.

Recognizing the value of country-specific research for national policy and program formulation, the Philippine Association for the Study of Overweight and Obesity (PASOO), the pioneer in this country in the prevention and control of obesity, has undertaken an exhaustive review of all existing researches on obesity in Filipinos between 1981 and 2011. The primary objectives of this review were to: 1) create a national registry for obesity researches among Filipinos conducted in the Philippines and internationally; 2) perform critical appraisal and systematic synthesis of all included articles; 3) determine knowledge and treatment gaps for obesity prevention and control of obesity in Filipinos; and finally, 4) provide a framework for recommendations for research agenda setting for future obesity research, intervention programs, and ultimately policy making. To fulfill its objectives, this review, now in the form of eight scientific papers, is printed in this document particularly for those who are concerned in one way or another in the control, management and treatment of the disease.

Chapter 1

Introduction

Cherrie Mae C. Sison, Aveline Sue Ann Lim, Joseph R. Bongon, in behalf of the PASOO Working Group on Obesity Research Registry

BACKGROUND

Obesity awareness has been on the rise both globally and nationally. As a forerunner of diabetes and cardiovascular diseases, the deleterious effects of obesity on health and the economy are increasingly becoming evident. In fact, obesity is now considered an epidemic in the Asian region, including the Philippines. Although obesity paints a dismal picture, the good news is that it is preventable and treatable.

The Philippine Association for the Study of Overweight and Obesity (PASOO) is a national organization with the mission to pioneer in the prevention and control of obesity and its complications through education, research and advocacy. PASOO envisions an obesity-risk free nation. Recognizing the value of country-specific research for national policy making, and in light of the lack of a comprehensive review of studies on obesity in Filipinos, PASOO has undertaken an exhaustive review of all existing researches on obesity in Filipinos. The primary objectives of this project are to: 1) create a national registry for obesity researches among Filipinos conducted in the Philippines and internationally; 2) perform critical appraisal and systematic synthesis of all included articles; 3) determine knowledge and treatment gaps for obesity prevention and control of obesity in Filipinos; and finally, 4) provide a framework for recommendations for research agenda setting for future obesity research, intervention programs, and ultimately policy making.

METHODOLOGY

An extensive and comprehensive search for available local data on obesity between 1981 to 2011 was conducted. Educational institutions, hospitals, professional medical organizations, libraries, government and private institutions were identified and contacted through mail. Published local and international journals, as well as unpublished researches and theses, were retrieved and the authors were contacted as necessary. Search engines were HERDIN for the PCHRD library, PIMEDICUS for UP Medical Library, iLib for the University of the Philippines, Philippine e-lib for the National Library of the Philippines, Google and Pubmed. Key terms were obesity, overweight, body mass index (BMI), waist circumference, and waist- hip ratio, Filipinos,

and Philippines. Papers on both adult and pediatric subjects, whether published or unpublished, were included in the review.

Educational Institutions

From the master list of schools and universities under the Commission on Higher Education (CHED), schools and universities offering courses in medicine, nursing, nutrition and public health were drawn out. Registered medical schools were traced through the Association of Philippine Medical Colleges (APMC). Finally, the list of schools offering courses in nutrition in the country was taken from the National Nutrition Council. Letters of request were mailed and emailed to the respective directors and deans of 127 schools/universities from Regions 1, 2, 5, 7, 9, 10, 11, and the National Capital Region (NCR). Twenty-nine out of 37 medical schools listed under APMC were contacted through emails and telephone calls. Seventy from 78 private universities listed under CHED were emailed. Only one medical school has responded to the emails sent but no articles were retrieved.

Hospitals

Three hundred seventeen hospitals in the country from Regions 1, 2, 4, 5, 7, 9, 10, 11, and NCR are sent letters of request. None of the hospitals responded to the mail. Researches were subsequently elicited from the four training institutions offering endocrine fellowship in the country --- the Philippine General Hospital (PGH), St. Luke's Medical Center (SLMC), University of Santo Tomas (UST), and the Makati Medical Center (MMC). There were 17 related research papers from the Section of Endocrinology, Diabetes, and Metabolism of PGH.

Medical Organizations

The Philippine College of Physicians (PCP), Philippine Medical Association (PMA), Philippine Society of Endocrinology and Metabolism (PSEM), Philippine Association for the Study of Overweight and Obesity (PASOO), Philippine Lipid and Atherosclerosis Society (PLAS), Philippine Heart Association (PHA), Philippine Association of Family Physicians (PAFP), and the Philippine College of Surgeons (PCS) were given letters of invitation to submit related research outputs of their members. The curriculum vitae of the organizations' Board of Directors, officers, and members were likewise reviewed for any relevant research output. In the Research Registry of the PSEM, which contained researches from 1960 to the current time, 23 articles were retrieved through file review and correspondence with authors. Twenty-two articles were retrieved from PASOO while 1 article was collected from PFAP. The rest of the organizations did not submit any related research.

Libraries

The National Library of the Philippines (NLP), the Food and Nutrition Research Institute of the Department of Science and Technology (FNRI-DOST), the Health Research and Development Information Network (HERDIN) of PCHRD, Philippine Pediatric Society Library, the University of the Philippines Manila Library, and the University of the Philippines College of Medicine FB Herrera Library were visited and searched for relevant articles. Libraries of schools under APMC and CHED private universities are sent emails and called by telephone. In addition, the Colleges and Universities Online Public Access Catalogs (OPAC) were accessed through the internet.

Personal correspondence with leading Philippine researchers both local and abroad

Known leaders in obesity research on Filipino adults and children were emailed and called. These included Maria Rosario Araneta, MD, PhD, Rodolfo Florentino, MD, PhD, and Sioksoan Chan-Cua, MD.

As agreed upon by the Technical Working Committee, the papers were classified into two major groups – adult obesity and pediatric obesity. Papers on adult obesity were further distributed into 5 categories --- 1) Epidemiology and Risk Factors, 2) Sociocultural Dimension, 3) Screening and Diagnosis, 4) Therapeutics and Prevention, and 5) Complications. Papers with data encompassing more than one group or category were shared among the respective working groups. Prevalence and associations were summarized and compared with foreign literature. Whenever possible, meta-analysis was done.

RESULTS

After 8 months of searching and collecting information, a total of 217 articles were retrieved. (Table 1.1) The largest number of articles came from personal correspondence, followed by UPCM Library, PCHRD and PSEM. Surprisingly, only a few articles were from the internet.

Table 1.2 shows the distribution between adult and pediatric papers. Published adult papers predominated over pediatric papers, whether full text or abstract only. However as many as 50 (24%) among the 217 papers were unpublished.

Table 1.3 shows the distribution of cited published and unpublished adult and pediatrict papers into various categories. The largest number of adult articles was on epidemiology, although 14% of the papers in this category were unpublished. Only as

minor percentage (14%) of the adult articles was on socio-economic dimension. Of the 74 pediatric articles on obesity, 36 were published with full text, while as many as 23 were unpublished. Most of the studies were cross-sectional surveys.

Table 1.1. Summary of Papers Retrieved

Source	Number of papers retrieved	Percentage of total
Personal correspondence	59	27
Internet (e.g., Google, Pubmed)	13	6
UPCM Library (FB Herrera)	37	17
UP Manila Library	21	10
National Library of the Philippines	4	2
FNRI	15	7
PCHRD	27	12
PSEM	23	11
CHED	18	8
TOTAL	217	100

Table 1.2. Sources of Articles

Papers	Published with full text	Published with abstract only	Unpublished	Total
Adult	90	26	27	143
Pediatrics	36*	15	23	74
TOTAL	126	41	50	217

*Two of the published pediatric papers can also be considered as adult papers

Table 1.3. Categorization of Retrieved Papers on Adult Obesity

Papers	Published with full text available	Published with abstract only	Unpublished	Total
Adult				
Epidemiology	46	5	10	61
Sociocultural dimension	4	0	7	11
Screening and diagnosis	21	7	8	36

Table 1.3. (Continued)

Papers	Published with full text available	Published with abstract only	Unpublished	Total
Therapeutics and prevention	36	1	4	41
Complications	21	16	4	41
Pediatric	36	15	23	74

CONCLUSION

A comprehensive synthesis covering various aspects of existing obesity research in the Philippines was done to serve as a framework for recommendations for research agenda setting and prioritization. Some of the critical questions that need answers include the following: Do Filipinos, as a specific Asian population, have particular traits that differently affect obesity as a disease and vice versa? What are the current knowledge and treatment gaps for obesity in Filipinos? The PASOO, through its linkages with national governmental and non-governmental agencies, can provide valuable resource through its registry, with its commitment for ongoing updates. As a result of the recognition of these gaps in research and planning for future research, it is hoped that we can minimize unnecessary duplication and utilize limited resources for projects that can provide more impact and a unified approach. It is further hoped that translation of these researches will provide the rationale for critical prevention and intervention programs in the country.

Chapter 2

Prevalence in Adults

Cherrie Mae C. Sison, Rodolfo F. Florentino

Key words: Prevalence of obesity; Philippines; Filipinos; body mass index; waist circumference; hip circumference; waist-to-hip ratio; android obesity; visceral obesity; diabetes mellitus; polycystic ovarian syndrome; non-alcoholic fatty liver disease.

INTRODUCTION

The World Health Organization (WHO) defines obesity as an abnormal or excessive fat accumulation that presents a risk to health. [1] Although there are several measures of adiposity, anthropometric measures such as the body mass index (BMI), waist circumference (WC) and the waist-hip ratio (WHR) remain the most feasible means of detecting and classifying overweight and obesity. This is especially true for the Philippines, where sophisticated equipment are not readily available in the clinics and are usually confined to research settings.

Prevalence rates differ depending on the anthropometric measure used and the criteria applied. It is beyond the scope of this section to discuss such controversies. Suffice it to say that in the Philippines, while many clinicians subscribe to ethnic-specific criteria (i.e., the Asia-Pacific guidelines), the use of WHO cut-off points for obesity remain popular especially for national nutrition surveys.

Where are we in the big picture?

Obesity has now reached epidemic proportions. According to the March 2011 WHO Fact Sheet [2] obesity has more than doubled since 1980, with more women afflicted than men. This increasing trend in obesity is found in both developing and developed countries. In 2008 alone, the WHO estimated that worldwide around 200 million adult men and nearly 300 million adult women are obese. If we are to include overweight individuals, the disease burden goes up to 1.5 billion adults globally. In the Western Pacific area, according to the 2010 WHO Global Infobase [3], prevalence rates of overweight and obesity (BMI $\geq$25) in subjects aged 15 to 100 years old range from 21.4% to 96.9% in males and 13.8% to 93% in females. Amongst Filipino men, this is 21.9% and in Filipino women, 33.6%. Due to differences in age range and BMI cut-offs used, direct comparison is not possible with our obesity prevalence rates from National Nutritional Health Surveys (NNHeS). Nonetheless, a 2008 WHO report on the Philippine obesity prevalence (WHO criteria) for those aged 20 years and above cited

a 4.5% for men (5.1% regional average) and 8.3% women (6.8% regional average). [4] In addition, our national surveys from 1987 to 2008 (Figure 2.1) mirror the rise in obesity prevalence seen in other countries.

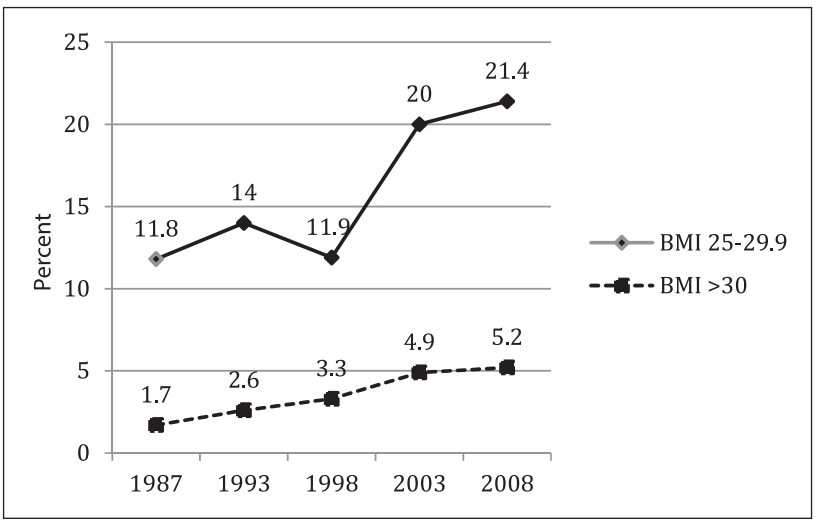
What do nationwide nutrition surveys tell us?

Nationwide nutrition surveys conducted by the Food and Nutrition Research Institute (FNRI) help define the burden of obesity among Filipinos. These surveys used weight-for-height to assess nutritional status of adults until 1987. This was replaced by BMI beginning 1993. Data obtained from the various surveys show that the prevalence of a BMI of 25 – 29.9 kg/m^2 in adults increased from 11.8% in 1987 to 21.4% in 2008. Similarly, the prevalence of a BMI ≥30 jumped from 1.7% in 1987 to 5.2% in 2008. Hence, a Filipino adult surveyed in 2008 was 10 times as likely to be overweight than someone seen in 1987; while the Filipino adult in 2008 was three and a half times more likely to be obese compared to 1987. [5,6] Overweight and obesity prevalence was highest in the middle age (40 – 59 years) group across survey periods. These surveys used a cut off BMI of 25 – 29.9 for overweight and BMI ≥30 for obesity. Clearly, if we were to apply the recently recommended BMI cut-offs for obesity in the Asia-Pacific Region, the cited prevalence data are underestimates of the national disease burden. Using the Asia Pacific criteria for obesity, overall prevalence rates would have been high at 20.2% in 1998, rising to 26.8% in 2008. [7]

Android Obesity

The national surveys also looked into the prevalence of visceral or android obesity in Filipino adults beginning 1998. Both WC and WHR were measured and

Figure 2.1. Obesity prevalence rates by BMI according to FNRI National Nutrition Surveys



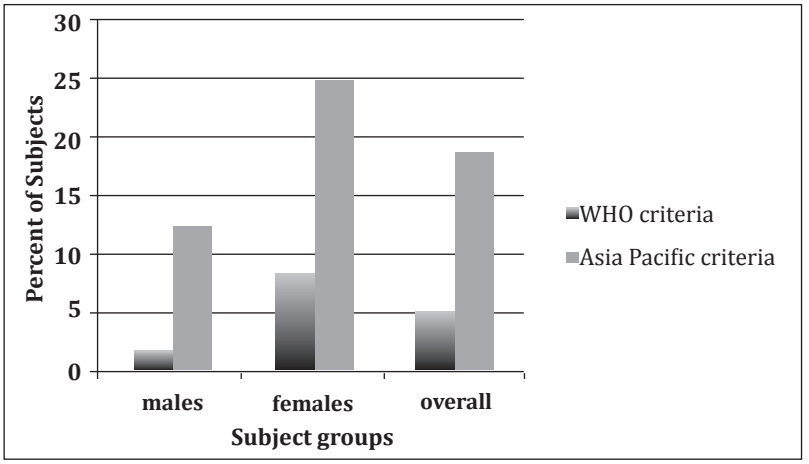
the WHO criteria were applied to define obesity. From 1998 to 2008 the mean WC of Filipinos fell within normal range according to both WHO and Asia Pacific criteria (Table 2.1). This is despite the 5.5% increase in mean WC in Filipino women over the past 10 years. On the other hand, while the mean WHR of Filipino men remained within normal, mean WHR for Filipino women reached obese levels beginning 2003. In the Fifth National Nutrition Survey done in 1998 [8], the mean WC and WHR for adult Filipinos were 79 cm, 0.90, respectively, for men, and 74 cm, 0.83, respectively, fo women, which were within normal levels.

However, using a WHO WC cut off, 2.7% of males and 10.7% of females were classified as obese in 1998. In a separate paper, Punzalan and colleagues [9] pointed out that if we were to use Asia-Pacific WC criteria , the obesity prevalence in the Fifth Nutrition Survey would be higher, i.e., 12.6% of males, 24.8% of females, and 18.8% overall (Figure 2.2). Using the cut-offs suggested for Asians, the prevalence rate for android obesity would have been high at 17.7% of men, 35.1% of women, 26.1% overall in the 2003 Nutrition Survey. [10] This phenomenon is similar to that observed for BMI.

Table 2.1. Mean waist circumference and waist-hip ratio, by year, according to FNRI National Nutrition Surveys (NNS)

Parameter	Sex	NNS 1989	NNS 2003	NNS 2008
Waist circumference	Males	79	79.2	79.4
	Females	74	76.9	78.1
Waist-hip ratio	Males	0.90	0.91	0.92
	Females	0.83	0.85	0.87

Figure 2.2. Obesity prevalence rate in the 1998 National Nutrition Survey according to WHO and Asia Pacific Region waist circumference criteria



Obesity by Sex

Whether the BMI or the WHR is used as a measure of obesity and whether one uses the WHO or the Asia Pacific criteria, prevalence rates are consistently and significantly higher in Filipino women compared to men (Figures 2.2-2.5). This is true for all age groups and survey periods. It mirrors the pattern found in other countries. BMI in Filipino men shows a continued but modest rise in prevalence from 1998 (3.2%) to 2008 (3.7%). In Filipino women, after an initial increase, the prevalence rate plateaued at 6.6% from 2003 to 2008 (Figure 2.3).

On the other hand, obesity prevalence by WHR in Filipino men dipped from 12.1% to 11.1% from 2003 to 2008. This is in contrast to the dramatic rise in android obesity in women (Figure 2.4). Beginning 2003, over half of Filipino women appear to have visceral obesity. Moreover, it is clear from Figure 2.5 that android obesity is more prevalent in Filipino women. Using a WHR of ≥1 for men and ≥0.85 in women to measure obesity will yield a higher prevalence rate compared to using BMI alone. Nonetheless, regardless of the anthropometric measure used, it is evident that obesity in Filipinos is on the rise particularly in Filipino women.

Obesity by Region

Regional differences in obesity prevalence were also demonstrated in the 1998 National Nutritional Survey. The highest prevalence for a high WC in males is seen in Region III or Central Luzon (10.1%) followed by the Caraga Region (6.8%), then by

Figures 2.3. BMI > 30 according to gender, FNRI National Nutrition Surveys

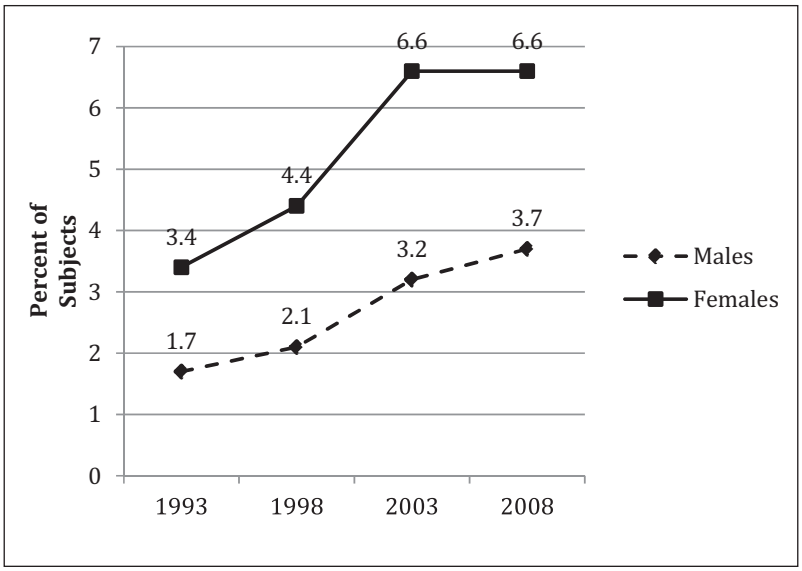


Figure 2.4. Obesity Prevalence Using Waist Hip Ratio, FNRI National Nutrition Surveys

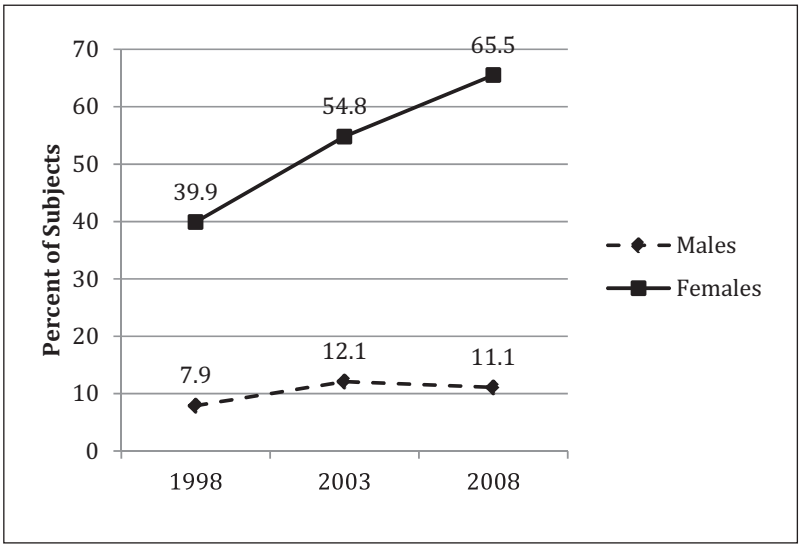
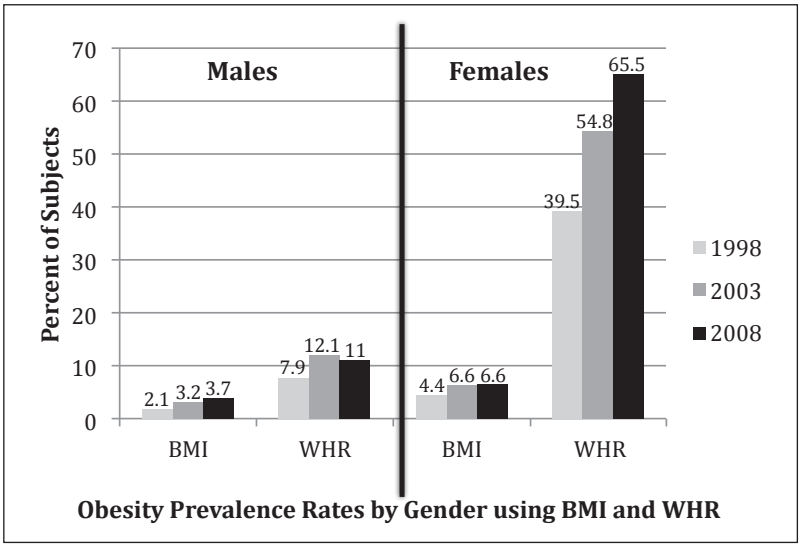


Figure 2.5. Comparison of obesity prevalence rates using BMI and WHR, FNRI National Nutrition Surveys



highly urbanized cities (6.7%). Among females, the high WC is most prevalent in the National Capital Region (NCR) (23.3%). On the other hand, a high WHR is found most frequently in Region IX (60%) for females and in NCR (15.3%) for males. Sandoval, MA et. al., studied365 adults from 12 barangays in San Juan, Batangas reporting a mean BMI in the overweight range by Asia Pacific criteria for males (23.29 kg/m^2),

females (23.91 kg/m^2), and both (23.74 kg/m^2). Although mean WC are within normal for all categories, the mean WHR crossed the Asia Pacific cut-off for obesity (0.91 males, 0.86 females). This community has a 43% overall prevalence of obesity by WC, with more females (51%) affected than males (22%). [Sandoval MA, Pacheco EP, Ardena GJR, Ang FLA, Paterno E, Juban N. Prevalence of diabetes, prediabetes, and metabolic syndrome in a selected sector of a rural community in the Philippines: Phase II of the community-based diabetes self-management education (DSME) program in San Juan, Batangas, Philippines, [unpublished data, 2010]. It is not clear what causes the regional differences in prevalence rates. However, what is evident is that across regions more Filipino women than men are overweight or obese.

Obesity by Socioeconomic Factors

A Report to the WHO Regional Office for the Western Pacific [11] concluded that across sexes, generalized and android obesity increases with age (Table 2.2). Educational levels confer marginal differences in prevalence. On the other hand, increasing income, especially among women, is associated with an increased prevalence of both types of obesity. In a 16-year prospective cohort of 1,943 women from randomly selected urban and rural communities of Metro Cebu, the prevalence of a BMI $\geq$ 25 increased nearly 6-fold (6% to 35%) from 1983 to 1999. For this group of Filipinos women, the highest weight gain occurred between 1986 and 1991 in all age groups, paralleling the rapid economic change at that time leading to higher household incomes and ownership of consumer goods, higher fat diets, more sedentary jobs, and reduced work burden. Overweight and obesity was more prevalent among women with more education, higher socioeconomic status, sedentary occupations, and increased dietary energy intake. Inverse associations were noted from 1984 to 1991 for maternal age, number of pregnancies, and months of breastfeeding. [12]

Obesity in specific population groups

There are a number of small cross-sectional studies that primarily focus on or incidentally note the prevalence of obesity in specific subpopulations of the Filipino society. Table 2.3 summarizes the retrieved data for this section.

1) Students

An unpublished thesis (Ramos CT, 1995) on obesity among 2nd year students of the De La Salle University – College of Medicine showed that according to the WHO BMI cut off, 10%, 5%, and less than 1% of the students had grade I, II, and III obesity, respectively. In contrast to the general trends, the mean BMI of males were higher than that of the females in this study population.In another study involving 397 freshman students (186 males, 211 females) aged 16 – 18 years from the University of Santo

Table 2.2. Prevalence Rates of Generalized Obesity and Central Obesity in the Philippines by Socioeconomic Characteristics (N=3307)

Characteristic	Generalized obesity		Central obesity (WC≥102cm, men; ≥88cm, women)	
	Male n (%)	**Female** n (%)	**Male** n (%)	**Female** n (%)
Age (yrs)				
20-35	18 (2.7)	26 (5.3)	15 (2.2)	47 (10.1)
36-49	17 (4.0)	28 (7.3)	17 (4.1)	76 19.1)
50-65	17 (4.1)	42 (9.6)	20 (4.3)	172 (31.3)
Education				
Primary	9 (2.0)	19 (7.2)	4 (1.2)	53 (14.7)
Secondary	23 (3.8)	54 (8.5)	27 (3.9)	149 (19.0)
Tertiary	20 (3.6)	23 (4.7)	21 (3.3)	90 (17.1)
Income				
≤PHP 53,064	10 2.6)	14 (4.7)	6 (2.1)	33 (9.3)
PHP 53,065 - 92,192	5 (1.3)	19 (6.7)	4 (0.7)	51 (14.6)
PHP 92,193 – 173,397	16 (3.8)	28 (7.4)	15 (3.7)	88 (17.5)
≥PHP 173,388	21 (5.4)	35 (7.9)	27 (5.8)	122 (24.8)

Tomas, the mean BMI was 21.8. Using the WHO cut-off, about 12.1% were overweight while 4.0% were obese. On the other hand, using the Asia-Pacific guidelines on BMI, 17.1% were obese and another 17.1% were overweight. By WHO criteria for central obesity, the prevalence of obesity was 1.0% (WHR) to 1.1% (waist circumference) for male students and 34% (WHR) to 4.7% (WC) for female students. [13]

2) Mothers

The Fifth National Nutrition Survey in 1998 involved 2,880 pregnant and 2,990 lactating women selected from 778 barangays from all provinces of the country except Basilan. The obesity (BMI > 30) rate for adult lactating women was 2.4%. For every 1 obese teenaged lactating Filipino woman, there were 3 obese lactating women 20 years old and above. Overall, the number of obese lactating women decreased from 15.8% in 1993 to 13.6% in 1998. [14] In another study assessing dual forms of malnutrition in Filipino families, 653 mothers with children aged 2 – 6 years old and residing in Makati City were surveyed. The mean BMI of the mothers was 23.5 kg/m^2.

Table 2.3. Local Studies Mentioning Obesity Prevalence in Specific Population Groups.

Population	Number of studies (n)	Prevalence rate
College students	1 unpublished	16% by BMI-WHO
	1 published (397)	12.1% obese and 4% overweight by BMI-WHO
Lactating women	1 (2990)	2.4% by BMI-WHO
Mothers in Makati City	1 (653)	32.6% with BMI ≥25
Local residents with T2DM	2 (347)	44.5% by BMI-AP 24% BMI >25 in men and >24 in women
Filipino immigrants with T2DM)	4 (1386)	10% BMI>30 (California) 20% BMI >30 (Hawaii) 5.4% BMI >30 (Texas)
Non-diabetic Filipino immigrants	1 (127)	20% BMI ≥30 (Guam)
Filipinos with Polycystic Ovarian Syndrome	1 unpublished (85)	22.4% by BMI-WHO 54.1% by BMI-AP 83.5% WHR >.85
Filipinos with Non-alcoholic Fatty Liver Disease	1 (134)	60% BMI >30 9% BMI 25-29.9
Inpatients	1 (1,104)	44.4% by BMI-AP

Up to 32.6% had a BMI $\geq$ 25 kg/m^2. The mother's nutritional status was significantly related to 1) her habit of eating the plate waste of the children; and 2) her perception of her own body size. [15]

3) Filipino immigrants to other countries

Only one study is available that reported a prevalence rate for obesity among non-diabetic Filipinos residing outside of the Philippines. In this cross-sectional study involving 61 Filipinos, aged 25 to 65 years old living in Guam, 20% of the subjects had a BMI$\geqq$ 30. This rate is significantly lower than the Chamorros who had a 49% prevalence rate for the same BMI. The mean BMI of the Filipinos in this study was 25.9 kg/m^2). [2, 16]

4) Individuals with diabetes mellitus

There is no local study specifically looking at the prevalence of obesity in diabetic patients, but there are studies on other cardiometabolic and endocrine diseases which look at parameters of obesity. In a cross-sectional study looking at obstructive sleep apnea in 307 diabetic Filipinos aged 18 – 65 years seen at the outpatient clinics of

the Philippine General Hospital, 44.5% of these subjects had obese BMI according to the Asia Pacific Classification. [17]. Among 40 non-insulin dependent diabetic patients seen at the Santo Tomas University Hospital Pay and Clinical Divisions from August to November 1995, 25% had obesity (defined as BMI >25 kg/m^2 for men, > 24 kg/m^2 for women). [18].

Diabetic Filipinos who had migrated out of the country exhibited a 5.4% to 20% prevalence rate of obesity. A small study on diabetic Filipino women living in San Diego County, California, showed that Filipinos and Caucasians did not differ in mean BMI (25.6 *vs.*25.4 kg/m^2), percentage of body fat (33.5 *vs.* 34.2%), or waist-hip-ratio (0.84 vs. 0.83). However, Filipina women had larger waist circumference and higher percentages of truncal fat determined by dual-xray absorptiometry. Ten percent of the Filipinas had obesity (BMI > 30 kg/m^2) compared to one third of the Caucasians with diabetes. [19] Interestingly, Filipinas in Hawaii (20% of 109 subjects) had a higher prevalence of BMI $\geqq$ 30 kg/m^2 compared to women in San Diego (9.3% of 446 subjects). Only 1.3% of the San Diego participants were United States (US)-born, whereas 36.2% of Filipinas in Hawaii were US-born. Moreover, immigrants in Hawaii had resided in the US longer (26.4 years) compared to San Diego residents (16.5 years). The mean BMI in Hawaii was 26.2 kg/m^2 compared to 25.4 kg/m^2 in San Diego. However, when the Asia Pacific BMI cut off for obesity was applied, the prevalence did not differ between Filipino women in Hawaii or San Diego. [20] Finally, a cross-sectional survey in Houston, Texas involving 831 Filipino-Americans aged 20 – 74 years noted a 5.4% prevalence of BMI > 30 kg/m^2. [21]

5) Women with Polycystic Ovarian Syndrome (PCOS)

From May to December 2004, eighty-five patients with PCOS were recruited at the Philippine General Hospital for a case-control study that aimed to characterize the disease in Filipino women. Mean BMI was 26.07 kg/m^2 ($\pm$ 5.18), mean WC was 88.89 cm ($\pm$11.9), and mean WHR was 0.90 ($\pm$ 0.06). Obesity prevalence by the BMI criteria of WHO and Asia-Pacific Consensus were 22.35% and 54.12%, respectively. Android obesity (defined as a WHR > 0.85) was found in 83.53% of subjects. (Celzo MF, et. al., PCOS: The Metabolic Syndrome in women, A study of the metabolic profile of Filipino adult PCOS patients. Unpublished data, 2004.)

6) Individuals with Non-Alcoholic Fatty Liver Disease (NAFLD)

A retrospective review of the charts of 134 patients diagnosed with NAFLD in the Philippine General Hospital from January 1999 to December 2004 showed a mean BMI of 31.8 $\pm$ 7.2 kg/m^2. Sixty percent of patients had a BMI > 30 while 9% had a BMI = 25 – 29.99. The percentage of males and females who were overweight were equivalent (9%), while there were more obese females (74%) compared to males (34%). [22]

7) Inpatients

The Council on Hypertension of the Philippine Heart Association conducted a nationwide survey among secondary and tertiary hospitals in 11 cities and provinces of the Philippines from 2003 – 2004. [23] A total of 1,104 patients were included, 50.4% are females. Majority of admissions were either due to infections (29.6%) or cardiovascular causes (28%), while only 1.8% of admissions were due to diabetes. The mean BMI of patients was 22.4 kg/m^2. Obesity according to the BMI criteria of the Asia Pacific consensus was present in 44.4%.

SUMMARY AND RECOMMENDATIONS

Most of the studies retrieved were cross-sectional or retrospective investigations. There is a good amount of local research on the prevalence of obesity in adult Filipinos residing in the Philippines. Thanks to the periodic National Nutrition and Health Surveys, we are able to look at our national prevalence rates from 1998 to the current time. These surveys show a rising prevalence for obesity in Filipinos, particularly in women, regardless of what anthropometric measure is used. These data strongly underscore the need for more aggressive measures to control the rise of obesity in the country.

In contrast to the adequate data for national prevalence rate, only a few small studies on the burden of obesity in specific population groups exist. Particularly lacking are data on obesity prevalence in secular groups that are otherwise considered healthy (e.g., college students, office workers, fishermen). Prevalence data in terms of geographical areas (coastal, inland, upland), dietary patterns (high protein, low carbohydrate, soft drink consumers, eat-out versus home-cooked meals, etc.), physical activity levels, and wealth index may likewise yield useful information. Looking at such data may help to streamline the efforts for obesity diagnosis, treatment, and prevention.

Finally, from the literature presented, it is clear that obesity prevalence rates are higher when the WC or WHR rather than the BMI is used as the parameter. However, while it is not correct to directly compare the two measures of obesity as they differ in what they actually measure, the important question to answer is which one would be a more sensitive parameter in predicting the metabolic and clinical consequences of obesity in Filipinos. This is one of the questions that remain unanswered by local literature at this time.

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Chapter 3

Risk Factors of Obesity in Adult Filipinos

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Key words: Risk factors; obesity; overweight; Filipinos; Philippines; diet; physical activity; genetics; ethnicity; behavior; lifestyle; socioeconomic; environment

INTRODUCTION

The obesity epidemic has become a worldwide problem, afflicting developing countries at increasing rates like never before. What leads a person to become overweight and obese has been attributed to changes in lifestyle and eating patterns that tip off the energy equilibrium. Physiology teaches us that energy status is sensed by long- and short-term afferent signals mediated by leptin and gastrointestinal peptides, respectively. These afferent signals are integrated in the brain or the hypothalamus, where these central controls then regulate energy homeostasis via efferent signals that sense either hunger or satiety. [1]

Obesity is a condition that can lead to many chronic complications such as diabetes, hypertension and cardiovascular disease. Identifying its risk factors is imperative.

Studies on the role of diet in overweight and obesity

Obesity occurs when caloric intake is disproportionate to energy expenditure. And this was indeed manifest in the longitudinal study by Adair,showing an association between increased dietary energy intake and weight gain, especially from fat intake. [2]

A modified nested case control study done in the rural area of Bicol among adults ≥20 years old also identified a significant association between energy intake and adequacy and a BMI of 25kg/m^2 (n=634) vs a BMI of ≥ 25 kg/m^2 (n=317). Although no odds ratio was mentioned in the study, they identified that age and sex were confounders to the BMI-energy intake association. [3]

Another cross-sectional study of Filipinos living in Guam, showed that obese subjects had higher energy density diets (amount of energy in a given weight of food = kcal/g) compared to those who were non-obese, (p=0.12). On the other hand, what was found to be a statistically significant association with overweight and obesity was diet from intake of sugar-sweetened beverages (8-9% *vs*. 3% $p<0.05$), as compared to those with normal BMI. [4]

A local study on urban households who had underweight children and overweight mothers (UC/OM) showed that there was a statistically significant higher overall energy intake (with more fat and carbohydrates), compared to those families who have normal weight mothers and children (NC/NM). The preference of mothers for meat and fried foods (frying being the predominant home cooking method in 45% of UC/OM and 53% of NC/NM) may lead to the higher prevalence of obesity. Children's preferences for meats, fried foods, sweets, and sugars were also significantly associated with nutritional state ($p<0.05$). [5]. Street food vending is fast growing in Metro Manila, especially in school vicinities, leading to easy access to high-fat-caloric foods that are affordable and very attractive to children's tastes.

Fast food or restaurant food is usually characterized by high energy density, palatability, large portion size, excessive amounts of refined starch and added sugars, high fat content and low levels of dietary fiber. Over a period of 3 years, French, Harnack and Jeffery (2000) cross-sectionally and prospectively studied adult women and the frequency of fast food restaurant use. An increase of 1 fast food meal/week was associated with an increase of 56 kcal/day and a weight gain of 0.72 kg (1.6 lbs) above the average weight gain over 3 y period (average weight gain was 1.68 kg (3.7 lb). [6]

The portion sizes of foods sold in fast food restaurants, supermarket and grocery stores have also increased in recent years. Larger portions not only deliver more calories but also encourage people to eat more. Studies have shown that energy intake increased with increasing portion served. [7]

Florentino (2007) also observed that people consume approximately 25% more calories in a meal when served a variety of foods that differ in sensory properties, such as flavor, texture, and appearance, than they do when an unlimited amount of single and equally palatable food is served. The variety of vegetables consumed was inversely associated with body fatness, while the variety of sweets, fats, condiments, meal entrees and carbohydrates consumed, were positively associated with body fatness. Cohen, Sturm, Scott et al (2010) found an excessive consumption of discretionary calories (soda, candies, cookies and salty snacks) far exceeding what is in dietary guidelines. It was concluded that if the excessive consumption of discretionary calories is not curtailed, other interventions to control overweight and obesity will have limited impact. [8]

Farshchi, Taylor and Macdonald (2004) found that though there was no difference in mean energy intake between regular and irregular meal eaters, there was lower postprandial energy expenditure, evidenced by a significantly lower thermic effect of food, TEF, ($P=0.003$) among the irregular eaters. This suggested that an irregular meal frequency may lead to weight gain in the long term due to the reduced TEF. [9] Overall however, it remains to be elucidated whether there is a clear relationship between eating frequency, energy balance and obesity.

Breakfast eaters generally have a higher total daily intake of energy compared with breakfast skippers. This is associated with significantly higher whole-diet nutrient adequacy, in contrast to breakfast skippers whose overall diets tended to be of poor quality or inadequate. On the other hand, some cross sectional studies showed that the BMI or weights of breakfast skippers were higher than breakfast eaters. In fact, usual breakfast consumption was associated with 30% lower odds of being overweight or obese in boys and on being obese in girls. Omitting breakfast impairs fasting lipids and postprandial insulin sensitivity that may lead to weight gain if the observed higher energy intake is sustained. [10]

Studies on the influence of physical activity on overweight and obesity

More than diet, other metabolic predictors of weight gain also need to be considered, such as: low adjusted sedentary energy expenditure, a high respiratory quotient (RQ; carbohydrate-to-fat oxidation ratio) and a low level of spontaneous physical activity.[11]

Few local studies examine the relationship of physical activity with weight gain. It is interesting to note, however, that in the mid – late 1990s women from Metropolitan Cebu who worked away from home were shown to gain more weight than those who were domesticated, and this may be attributed to greater physical activity at home.[2]

In another cross-sectional study by Apuhin, 86% of obese women in urban Bacolod were identified to be sedentary based on a researcher-validated questionnaire. (Apuhin, E. Degree of obesity and lifestyle among female call center agents of Teletech and Teleperformance in Bacolod City 2007. Unpublished)

Studies on the role of genetics and pathological conditions

While excess caloric intake and a sedentary lifestyle predispose an individual to obesity, individuals have varying levels of susceptibility despite the same environmental pressures. This has been attributed to genetics. Genetic epidemiologic studies of twins and adoption studies show that genetics account for 40-70% of the population variation in BMI and that heritability increases the more severe the obesity.[1]

In addition to leptin, which is secreted by the adipose cell and informs the brain of the level of energy stores, adipose cells also secrete adipokines such as adiponectin. Adiponectin levels are negatively correlated with fat mass and are reduced in obesity. This hormone improves insulin sensitivity by stimulating fatty acid oxidation and glucose uptake in the skeletal muscle and suppresses glucose output in the liver.[1] Thus hypoadiponectinemia has been suggested as an independent risk factor for metabolic syndrome and may lead to obesity, type 2 diabetes and atherosclerosis. [12]

The genome wide association study for adiponectin in Filipino women identified the association with plasma adiponectin at the CDH13 locus. The study also identified a novel uncommon KNG1-ADIPQ haplotype strongly associated with adiponectin levels in Filipinos. [13]

Adiponectin levels were determined in 491 normoglycemic women, of whom 136 or 27.7% were Filipinos, mean age was 54.2 years, 87% were post-menopausal with a mean BMI of 24.3 kg/m^2. The study found out that Filipino women had significantly lower adiponectin levels compared to African-Americans after adjusting for BMI, waist, percent body fat, or lean-to-fat mass ratio ($p<0.001$). Plasma adiponectin was also inversely associated with increasing tertiles of BMI, waist girth, waist-to-hip ratio (WHR) and homeostasis model assessment-estimated insulin resistance (HOMA-IR), with the WHR having the highest correlation ($r=0.330$, $p<0.0001$) at a mean ratio of 0.81. [14]

Another hormone of interest in the study of obesity is plasma ghrelin, a gastro-intestinal hormone secreted by the fundus of the stomach during fasting and suppressed by food intake. Araneta and Barrett-Connor (2007) showed that ghrelin levels are decreased in obesity, and age-adjusted fasting plasma ghrelin levels were significantly lower in Filipino women compared with African-American women after adjustment for BMI, waist, or (WHR), with BMI having the highest correlation with log ghrelin ($r= -0.112$, $p=0.013$) in the combined cohort using multivariable analysis. Ghrelin concentrations were significantly lower among Filipino women and African Americans, in regression models that adjusted for age, BMI, HOMA-IR,high density lipoprotein cholesterol HDL-C, triglyceride exercise, and alcohol use. [14]

Within Individual Risk Factors

Age and Sex:

National surveys done in the Philippines show that there is a difference between sexes in the prevalence of overweight and obesity, and this also varies depending on *age*. Generally, women have higher rates of obesity than men and it is well recognized that women have more body fat than men at the same relative body weight index. This is because women have the preponderance to develop fat in the lower portion of the body, while men do in the upper portion. Also, men have the largest number of fat cells in the abdominal depots, while women have a greater number in the gluteal and femoral regions. Moreover, women accumulate extra fat after each pregnancy and have a tendency to be less active compared to males. Factors associated with weight gain during pregnancy were higher pre-pregnancy BMI, greater weight gain during pregnancy, limited breastfeeding, and cessation of smoking during pregnancy. [15] National prevalence of high waist circumference (WC) was significantly higher among females (>88.0cm) at 10.7%, than in males (>102cm) at 2.7%. Overall, prevalence of android obesity was found significantly higher among females (39.5%) than among males (7.9%).[15]

Across both sexes, obesity and central obesity increase with age. The prevalence of obesity and central obesity increased with increasing income especially among women. Compared with the youngest age group, older men and women were more likely to become centrally obese.[16] In the 16-year longitudinal study by Adair on women age 15-45 years, maternal age showed an inverse relation to weight gain, and this was consistent as the prevalence of overweight and obesity rose.[2]

Using BMI, the proportion of men who are overweight is much less than in women across all age groups except in young adults, with both sexes reaching a peak by 40-49 years before declining to a much lower level as they grow older. Men reach a peak in prevalence of being overweight of 28%, while women reach a peak of 37%. The peak in prevalence for women is observed by 50-59 years at 8.7%, while men peak earlier, i.e., by 40-49 years at 4.4%, only half of that in women. [12]

Using WHR as the criteria for defining increased risk to metabolic abnormalities, central obesity rises to as high as 70% in women at 50-59 years of age, while men reach a peak of only 20% at age 50-59 yrs. In all age groups, the prevalence of central obesity is much less in men than in women.[12] For Filipinos living in Rome, every decade of life is significantly associated with increasing prevalence of abdominal obesity (OR 1.56; 95% CI 1.21,199; p=0.001), BMI $\geq$25kg/m^2 (OR 1.55 95% CI 1.16,2.06 p=0.003). [17]

Family history/Ethnicity:

No studies among Filipinos were found that sought to determine if obesity runs in the family. However, prevalence studies show that Filipinos have significantly greater visceral adipose tissue than Caucasians even in the setting of comparable body mass indices: truncal fat (p=0.005) and waist girth (p=0.02). [18]

Behavioral and Psychological status:

As mentioned, behaviors and social norms on what is acceptable body weight play a crucial role in the perception of obesity. Agdeppa, Lana and Barba (2003) studied a Philippine urban population, and showed that the perception of mothers of their body size is significantly related to their nutritional status. About 38% of overweight mothers still considered their body size as somewhat thin and just right, with 13% saying they were fat and only 7% saying they are very fat. Normal weight women, on the other hand, considered themselves as still thin and somewhat thin. In the same study, mothers who tended to eat plate waste were found to be more overweight than those who gave plate waste to pets or threw it away.

Mothers' perception of their child's body size is also related to the child's nutritional status. 39% of the UC/OM group *vs*. 37% of NC/NM group preferred their children who are somewhat fat to be very fat to be more attractive. Mothers in the NC/

NM group who perceived their children's body size as thin (17%) may have had the tendency to binge-feed their children and cause them to become overweight.[5]

Floresca found that students living in Baguio in northern Philippines cited lack of motivation, lack of serious effort to exercise and adhere to a strict diet as reasons for their excessive weight problem.

Lifestyle:

Smoking and alcohol intake have both been positively correlated with android obesity in Filipino male adults.[19]

Physiologic Status: Total number of pregnancies and breastfeeding duration is inversely related to weight gain. Although manifested only for a period of time, the association corresponded to the steep rise in prevalence of overweight (23.0% to 60.0%) and obesity (1.9% to15.7%).[2]

Socioeconomic Status:

In a longitudinal study of reproductive women, improved socio-economic status was shown to be consistently associated with increasing prevalence of overweight and obesity throughout the 16-year study period.[2]

In the 2003 National Nutrition Survey, the prevalence of overweight adults rose with higher educational level of the household head, from primary, to secondary, to at least tertiary level of education, particularly during the middle age. The prevalence of overweight and obesity was also directly associated with household income [10]. Another cross-sectional study of Filipino mothers living in an urban area found that a mother's educational level, occupation and number of children in the family showed significant association with nutritional status ($p<0.05$). This is so because it is generally assumed that when mothers have some education they are more aware of the health and dietary precautions for their children. In terms of the mother's occupation, lack of time could hamper proper menu planning, selection, preparation of foods and effective child rearing practices.[5]

A smaller study on young call center agents in urban Bacolod also inferred that higher educational attainment and salary leads to higher spending power including that for food. (Apuhin E, 2007, unpublished) However, one study of women with excessive fat problem in Baguio City claimed that social stratification was not a factor, as most women generally had the same reasons as to what they think were the major causes of their weight problem. Nevertheless, those who were professionals cited that having a hectic schedule impaired their participation in weight loss activities. [FlorescaJA. Women with excessive fat problem in Baguio city: a case analysis. 2003, unpublished]

Another study on 262 Filipinos from the province of Cavite found that there was no significant association between economic status and obesity based on monthly household income. [Suministrado MS. A case-control study on the relationship between obesity and socioeconomic status among individuals ages 12-45 years old residing in Bayan Dasmarinas Cavite. 2002, unpublished] However, men with secondary and tertiary education were more than twice as likely to become centrally obese than those with only primary education, while women with higher incomes were significantly more likely to become centrally obese than those in the lowest income quartile.[16]

Environmental:

Obesity is the result of the interplay of inheritance and the environment, the latter playing a key role. Famine is cited as a strong example of the influence of the environment – obesity being prevented in even the most obesity prone individual [20]

Acculturation or change in environment, for example, can be a determinant of weight change, with one study showing that the prevalence of overweight and obesity was greater in Filipinos who have lived in the United States (US) than those who were in the Philippines. Significantly, for US based Filipinos, those in Hawaii who have resided there for a longer time (average of 26.4 years) showed a higher percentage of overweight and obesity compared to those in San Diego who have lived there for a shorter duration with an average of 16.5 years. [21]

The same is true for Filipinos living in Rome, where years of residence showed a significant direct correlation with the degree of changes in alimentary behaviors ($p=0.18$, $p\leq0.001$) and with weight gain ($p=0.27$, $p\leq0.001$). The highest weight gain of $\geq$5 kilograms occurring with a residence of >20 years.[17]

Studies on associated co-morbidities

Certain co-morbidities cannot be cited as true risk factors, rather only as associations with obesity, until longitudinal cohort studies can be conducted.

One of the more well known conditions associated with obesity is *polycystic ovarian syndrome (PCOS)*. Despite a younger age, Filipinas with PCOS were found to be at an increased risk to develop obesity with an odds ratio (OR) of 3.45 (WHO criteria), or 3.09 (Asia-Pacific criteria). Although no statistical difference was seen for both overweight and obese class 1 categories (using Asia Pacific Classification), there was a significantly higher prevalence of PCOS in women classified with obese class 2 ($p=0.0062$). A higher WC ($p=0.0314$) and a predisposition to android obesity (WH >0.85) were also noted in these women ($p=0.0075$) (Celzo MF. PCOS: The Metabolic Syndrome in women: A study of the metabolic profile of Filipino adult PCOS patients, 2004. Unpublished data.)

Obesity is also part of the cluster known as the metabolic syndrome along with hypertension, dyslipidemia (increased triglycerides and low HDL) and diabetes (FPG and PPG).[10] Even at comparable BMIs, this syndrome was found to be more prevalent amongst Filipina women than their Caucasian counterparts.[18]

One good example is a study on Filipinos residing in the US. In the study, those with diabetes had lower BMIs compared to those in the National Health and Nutrition Examination Survey (NHANEs) II population. The study went on to conclude that while higher mean body mass indices were associated with diabetes (p=0.00001), obesity alone could not explain the increased prevalence of diabetes. [23] In fact, the prevalence of obesity among non-insulin-requiring diabetes mellitus (NIDDM) was found to be 25%, not significantly different from those who were non-diabetics at 27%. However, the sample size was just small (n=40) and not conclusive of the general population. [24]

How about dyslipidaemia? While one study showed a predictive correlation of weight with the lipid profile, it was not enough to recommend "height-weight as a basis for initial screening for those requiring blood chemistry tests." [22] On the other hand, among women who participated in the Cebu Longitudinal Health and Nutrition Survey, total cholesterol and triglycerides were positively correlated with higher levels of BMI but not high-density lipoprotein (HDL-c), which was found to be uniformly low at all levels of BMI. Since low HDL-c is a strong cardiovascular risk factor even in non-European countries, the study suggests that BMI cut-offs derived from Western populations is not applicable to Asian populations in identifying cardiovascular disease(CVD) risk. However, it remains unclear if low HDL-c is a significant independent CVD risk factor in this Filipino population. [25]

Android obesity or accumulation of body fat in the abdominal area has been found to be more predictive of metabolic complications and is defined as an elevated ratio of WC to hip circumference of $\geq$1.0 in males and $\geq$0.85 in females. In men this was positively correlated with BMI, blood levels of low density lipoprotein-cholesterol (LDL-c), triglycerides, fasting blood sugar and blood pressure. In females, this was also correlated to BMI, waist circumference, LDL-c, HDL-c, triglyceride and fasting blood sugar levels, as well as blood pressure.[19]

Like Caucasians, Filipinos with non-alcoholic fatty liver disease (NAFLD) has been associated with obesity, in which as much as 60% had a BMI of 30kg/m^2 or more, most of whom were female. [26]

A number of studies also showed relationship of blood pressure to body weight, as well as to other measures of adiposity. Numerous epidemiological studies have demonstrated increasing adiposity associated with higher levels of blood pressure.[15]

SUMMARY

The cause of obesity is clearly multifactorial, involving a complex interplay of genetics, environment, behaviors and sociocultural norms

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Existing research in the Philippines are mostly prevalence or cross-sectional studies that can only *associate* obesity with certain risk factors. Based on these studies, increasing age and being female are strongly linked with obesity, while engaging in domesticated work and longer breastfeeding duration are associated with the opposite. Mothers play an influential role in the family's diet, and their perception on what is considered healthy reflects on their children's body weights.

The only prospective longitudinal study done, which spanned 16 years, is the Cebu Longitudinal Health study by Adair. In this study, weight gain was positively associated with fewer pregnancies and months of lactation, living in an urban area, and having a higher socioeconomic status. And this may be explained by the trending habit of eating for convenience that progress brings along with higher socioeconomic and household income.

While there are no specific diets or physical activity identified to be obesogenic, westernization of diet along with duration of residence abroad is significantly correlated with greater prevalence of being overweight compared to Filipinos living in the Philippines.

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Chapter 4

Screening For Overweight And Obesity In Adults

Cecille R. dela Paz

Key words: Obesity screening; BMI;obesity; polycystic ovary syndrome; obstructive sleep apnea; hyperthyroidism; waist circumference; lipid profile; hyperinsulinemia; bone mineral density; C-reactive protein

SCREENING

Which measure should be used to diagnose obesity in Filipinos?

The anthropometric measure used to assess obesity in Filipinos is a very important concern. Florentino reviewed the available literature and concluded that body mass index (BMI), waist circumference (WC), and waist to hip ratio (WHR) correlate well with objective measurements of body fat using MRI, CT scan or densitometry. These measures can be suitable surrogate parameters for defining obesity, i.e., that BMI is the best measure of total body fat, even if it is also indicative of abdominal fat, while WC and WHR are better indicators of abdominal and visceral fat. [1] There are few Philippine studies available exploring the utility of different anthropometric measures to diagnose obesity.

Lemoncito, et. al. [2] recognized that while WC is widely used as an index for visceral fat accumulation, there is no standard location for this measurement. The study sought to determine WC measurement variations among Metabolic Syndrome (MS) patients at three levels: (A) umbilical level, (B) midline level (between the inferior margin of the ribs and the superior border of the iliac crest) and (C) level of the superior border of the iliac crest. Results showed that WC measurements at 3 levels did not significantly differ among MS patients when stratified to age and sex. However, when WC was measured at three levels among all patients with MS, there was significant difference in WC taken at level B and level C. WC at level B was smaller than WC at level A and smaller than level C (WCB < WCA < WCC). There was greater variability in mean WC measurements at level B and level C. Mean WC measurements at level A and level B (midpoint level) were similar and less variable and may be better WC measurements to level C (superior border of the iliac crest).

Salomon, Hizon and Raboca [3] determined that ultrasound can be a viable tool to measure intra-abdominal or visceral fat, but there is no normative data available yet for visceral fat measurement (VFT) and its correlation with the WC among Filipinos. This study aimed to provide the minimum WC and visceral fat values by

ultrasonography to identify adult urban Filipinos at risk of the metabolic syndrome. Results showed that in general, the VFT showed a strong and significant correlation with the waist circumference and a weak correlation with the other components of the metabolic syndrome: elevated FBS, elevated TG, elevated BP and low HDL. The visceral fat values obtained by ultrasonography were weak predictors of risk factors for metabolic syndrome.

Neck circumference measurements were done on patients in a Metro Manila private tertiary hospital as an index for upper body obesity and consequently, cardiovascular disease (Ang, N, Raboca, J. Neck circumference as a screening measure for abdominal obesity and its association with metabolic syndrome among high risk Filipino patients in Makati Medical Center - a pilot study, unpublished data, no date). The authors sought to determine the cut off level of neck circumference as a screening measure for abdominal obesity, with WC as the gold standard and determine its correlation with metabolic syndrome. Results showed that neck circumference with cut off levels of ≥ 40cm for males and ≥ 33.8cm for females was a strong predictor of abdominal obesity with 62.1% sensitivity, 90.1% specificity for males and 67.6% sensitivity, 85.6%specificity for females. It was also a relatively strong predictor of metabolic syndrome with 69.2% predictive accuracy for males and 69.7% predictive accuracy for females.

Reyes, et. al. [4] noted that transition to college life may be a factor for weight gain among college students. The study determined the anthropometric (WHR, WC, and BMI) profile of college freshmen and identified the percentage of individuals who were at high risk of having health-related problems because of abnormal values. Using the World Health Organization's cut-off point for BMI, 62.5% of the students belonged to the normal category. The WC values showed that 95.2% and 86.6% of the male and female subjects, respectively, had normal measurements and were at low risk for health related problems. There was low correlation between BMI and WHR for males and no association for females, and a positive correlation between the BMI and WC for both sexes.

Which anthropometric parameter is the best predictor for risk of obesity-related co-morbidities among Filipinos?

Another issue that needs to be raised is which anthropometric parameter is the best predictor of risk for obesity-related co-morbidities. Florentino reviewed prospective studies that have shown the association of the general measures of obesity (weight and BMI) and central fat distribution (WC, WHR) with the development of Type 2 diabetes, hypertension, dyslipidemia and the metabolic syndrome. He concluded that for epidemiological studies, health economic planning and population screening, WC would be a better and simpler index of risk than BMI. For clinical assessment, combined use of BMI and WC would be more sensitive for predicting metabolic risk

than either BMI or WC alone. For self- assessment and individual monitoring of progress, WC and weight would be enough. [5]

Further studies are needed to assess the correlation of body fat using the anthropometric parameters and the risk for chronic diseases.

Which anthropometric cut-offs should be used to diagnose obesity in Filipinos?

While the WHO BMI cut-offs are the internationally accepted values, there is some merit in making the cut-offs ethnic - and gender - specific. The use of the higher cut-offs in the WHO guidelines increases the risk for potentially missing the diagnosis of overweight and obesity and its attendant co-morbidities. A head-to-head comparison between the cut-offs in the WHO Guidelines [6] and Asia-Pacific guidelines [7] was done in a cross-sectional analytical study of 300 type 2 diabetic patients. [8] In this study, the prevalence of obesity was higher when using the Asia-Pacific Guidelines (43% *vs*. 11.6%). The average sensitivity of the Asia-Pacific guidelines was significantly higher in detecting co-morbidities associated with diabetes and the average specificity of the Asia-Pacific guidelines was significantly lower (36.9% *vs*. 53.5%) compared to the WHO guidelines.

Studies among diverse Asian populations such as multicultural Singapore, as well as Japanese and mainland Chinese showed that morbidity increased at a lower BMI and some countries have tried to formulate their own cut-offs specific to their population. Is there a need to come up with Filipino-specific cut-offs?

An attempt to answer this question was made after the National Nutrition and Health Survey (NNHeS) of 2003. It was a national survey of a randomly selected sample of adults from all regions and provinces in the Philippines, except Basilan, that gathered data using anthropometry, biochemical determinations, clinical tests and dietary questionnaire. Among the data that were related to obesity and its co-morbidities were weight, height, waist and hip circumferences, fasting blood sugar, BP and lipid profile. Researchers from the Food and Nutrition Institute (FNRI) did a preliminary analysis to assess the applicability of the various cut-off points being proposed for BMI, WC and WHR for the assessment of overweight and obesity among Filipino adults. From this analysis, they arrived at tentative cut-off points recommended for Filipinos (See Table 4.1). These values are close to the provisional International Association for the Study of Obesity (IASO) recommendations for Asians, except for WHR (Velandria F, Florentino RF, Duante C. The applicability of proposed Asian cut-off points of anthropometric indices for the assessment of the overweight and obesity among Filipino adults, Unpublished data, no date) but lower than the cut-offs proposed by WHO, particularly for BMI and WC. Further research, however, is needed to validate these proposed cut-offs as well as the cut-offs in the Asia-Pacific guidelines for their applicability in Filipinos.

Table 4.1. Proposed Tentative Cut-offs for BMI, WC and WHR for Filipinos, Compared to WHO Recommendations ([6,8] and Asia-Pacific Guidelines {7,8]

	BMI (kg/m^2)		WC (cm)		WHR	
	Over-weight	Obese				
	Both sexes		Male	Female	Male	Female
Tentative cut-off (NNHeS 2003)	≥23	≥27	≥90 (High risk)	≥80 (High risk)	≥0.90 (Incr. risk)	≥0.85 (Incr. risk)
Asia-Pacific	≥23	≥27	≥90 (High risk)	80 (High risk)		
WHO	≥25	≥30	≥94 (Incr. risk)	≥80 (Incr Risk)	≥1.0 (Incr. risk)	≥0.85 (Incr risk)

How do we improve obesity screening?

Overweight and obesity screening identifies individuals at risk for the disease and its co-morbidities. While clinical guidelines published by the US National Institutes of Health and the WHO are invaluable references for clinicians in the screening and management of obesity, these recommendations may not reflect locally available resources and improve screening rates. A review of local literature yielded a local clinical practice guideline (CPG) for diagnosing and treating obesity in family practice. This guideline was developed at the Department of Family and Community Medicine at the University of the Philippines Philippine General Hospital (DFCM UP-PGH). [9] The author used the National Heart, Lung, and Blood Institute (NHLBI) cut-offs [10] for diagnosing overweight and obesity by BMI and waist circumference (Table 4.2).

The CPG contained the following 10 recommendations:

1. In family practice, obesity is defined as BMI of 30 kg/m^2 and above. Classification of overweight and obesity is based on this index: (Grade C)
2. Waist circumference can also be used as an adjunctive measure to define obesity. A waist circumference of > 102 cm for males and > 88 cm for females would also warrant a diagnosis of obesity regardless of BMI. (Grade C)
3. The following points should be elicited in the history taking of patients with obesity: age, gender, family history of obesity and physical activity. (Grade C)
4. The following information should include in the physical examination report:

Table 4.2. Classification of Obesity by BMI.

	Obesity Class	BMI (kg/m^2)
Underweight		<18.5
Normal		18.5- 24.9
Overweight		25 – 29.9
Obesity	I	30 – 34.09
	II	35 – 39.9
Estreme Obesity	III	≥40.0

height, weight, waist circumference and blood pressure. (Grade B)

5. The following ancillary laboratory procedures must be requested on all patients diagnosed to have obesity: FBS and lipid profile. (Grade B)
6. The initial goal of weight loss therapy should be to reduce body weight by approximately 10% from baseline to be lost at a rate of 1–2 lbs. per week. (Grade A)
7. A low calorie diet is recommended for weight loss in overweight and obese patients (Grade A). Reducing dietary fat along with reducing dietary carbohydrates can facilitate caloric reduction (Grade A). An individually planned diet that helps create a deficit of 500-1000 kcal/day should be prescribed as part of therapy (Grade A)
8. Physical activity contributes to weight loss, either alone or in combination with dietary therapy (Grade A).
9. Behavior therapy is a useful adjunct when incorporated into the treatment of weight loss and weight maintenance (Grade B).
10. In instances wherein non-pharmacologic therapy is ineffective after being implemented for 6 months, pharmacologic therapy (BFAD-approved drug) may be prescribed combined with non-pharmacologic intervention to reduce weight of overweight and obese patients (Grade B).

In a related study, Agrimon, et. al. utilized the CPG developed by the Department of Family and Community Medicine (DFCM) UP-PGH to screen for overweight and obesity to determine if this can improve obesity screening rates by residents-in-training in patients with hypertension and Type 2 diabetes. [11] In their study, it was found that overall appropriateness of screening improved when academic detailing and desk chart reminders were used. More studies are needed to validate the utility of this locally developed CPG in improving screening for overweight and obesity.

CLINICAL PRESENTATION

Obesity in Filipino Women with PCOS

Polycystic ovary is a common endocrinopathy among women in the reproductive age presenting with a variety of clinical manifestations. The presentation of PCOS among Filipino women was described in a study by Valdez-Faller, et. al. [12] Clinical features that were seen in this population were obesity, presence of acne, acanthosisnigricans, hirsutism, and polycystic ovaries on ultrasound. Metabolic studies showed impaired glucose tolerance with hyperinsulinemia. Endocrine studies showed hyperandrogenism and normal prolactin and gonadotropin levels.

Obesity is a frequent comorbidity in patients with Polycystic Ovary Syndrome (PCOS), along with other risk factors for cardiovascular disease including impaired glucose tolerance, hypertension, lipid abnormalities and insulin resistance. The clustering of all these risk factors is known as the metabolic syndrome. Celzo determined the prevalence of the metabolic syndrome and obesity among with women with PCOS. In this study, the prevalence of metabolic syndrome in women with PCOS was 39 % and 49 % using the National Cholesterol Education Program-Adult Treatment Panel (NCEP-ATP) III and the International Atherosclerosis Society (IAS) criteria, respectively. Using the NCEP-ATP III criteria, 91 % of those who had the metabolic syndrome had abnormalities in WC. The prevalence of obesity among individuals with PCOS was 22 % (NCEP-ATP III criteria) and 55 %(IAS criteria). Diabetes, hypertension, high triglyceride level, low HDL level, obesity, insulin resistance and the metabolic syndrome all occurred at significantly higher rates among those with PCOS as compared to those without (Celzo M, et. al., PCOS: The Metabolic Syndrome in Women: A study of the metabolic profile of Filipino adult PCOS patients. 2004. Unpublished.)

Obesity in Filipino Patients with Obstructive Sleep Apnea

Obstructive Sleep Apnea (OSA) is a condition characterized by complete or partial upper airway obstruction during sleep. When this is accompanied by symptoms of excessive daytime sleepiness, it is called Obstructive Sleep Apnea Syndrome. OSA is associated with significantly increased risk of morbidity and mortality and its must be recognized and treated early. The most significant risk factor for the development of OSA is obesity, particularly of the face and neck. Veloro, et al. evaluated the relationship between collar size, BMI, and polysomnographic parameters in male patients suspected to have OSA. Results showed that the mean collar size and BMI were significantly higher among patients with OSA compared to normal individuals. Increasing collar size and BMI also correlated with increasing severity of sleep apnea in the OSA group. Collar size $\geq$40 cm among male adults with symptoms of sleep

apnea was 80% sensitive and 67% specific with a positive predictive value of 94% in predicting true OSA. [13]

Mendoza, et al. sought to determine the association of snoring history, obesity, daytime sleepiness with sleep-disordered breathing and its severity using the apnea-hypopnea index. Results showed that majority of patients with sleep-disordered breathing were middle-aged obese males. There was a significant association between weight, BMI, neck circumference, snoring frequency, and intensity with sleep-disordered breathing. Snoring was significantly associated with daytime sleepiness and its severity. There was no association observed between snoring and obesity. [14]

Obesity in Patients with Hyperthyroidism

While weight loss is a common finding in hyperthyroid states resulting from increased catabolism, some patients may paradoxically present with increased body weight. Due to the scarcity of studies of obesity among this population, Matawaran and Mercado-de Asis [15] sought to describe the clinical profile of obese patients with hyperthyroidism. In this study of 419 hyperthyroid patients, obesity was present in 20 or 4.8%. TSH was significantly lower in non-obese patients than in obese patients. Determination of the pathophysiologic mechanism for this finding was not put forth by the authors. [15]

DIAGNOSTICS

Obesity and Lipid Profile

Obesity is one of the risk factors associated with the development of cardiovascular disease. Others include hypertension, diabetes and dyslipidemia. The relationship between obesity and lipid profile was studied by a few Filipino investigators. Dy, et. al. noted that cholesterol had a 53 % positive predictive value and a negative predictive value of 52% for obesity. Triglyceride had a 72% positive predictive value and a negative predictive value of 62%. There was no positive or negative predictive value for HDL. LDL had a 53% positive predictive value and a negative predictive value of 50%. [16] Ho, et al. looked into associations between lipid profile and BMI, age or glucose control among Filipino diabetic patients. There were no significant associations between BMI and total cholesterol, triglyceride, HDL, LDL. [17] In a similar study, Mongado-Jao, also explored the relationship between BMI and lipid profile among drug-naïve type 2 diabetics. There was no sufficient evidence for association between BMI, and total cholesterol, HDL, LDL. There was borderline association between BMI and triglycerides. (Mongado-Jao CT. Correlation between body mass index and Lipid profile among Drug-naive Type 2 Diabetes Mellitus Patients at the Institute for Studies on Diabetes Foundation, 2006. Unpublished data)

Obesity and Insulin Levels

Hyperinsulinemia and insulin resistance are mechanisms linked to the development of type 2 diabetes, the metabolic syndrome, dyslipidemia, hypertension, and cardiovascular disease. Obesity is a risk factor for the development of insulin resistance, gestational diabetes and impaired glucose tolerance. The relationship of obesity and insulin levels has been examined by a number of Filipino researchers. Ang, et. al. sought to determine the range of C-peptide levels among obese and lean subjects. The obese group was found to have a higher fasting C-peptide level but this was not statistically significant. There was a significant increase in the C-peptide concentrations at 2 hours postprandial in the obese compared to the lean group. They concluded that there is a positive correlation between the magnitude of obesity and the C-peptide secretion. [18] Isaguirre, et. al. explored the association between blood pressure and insulin levels in obese and non-obese hypertensives; the association between blood pressure and glucose intolerance in obese and non-obese hypertensives, and the association between insulin and lipid levels. Fasting insulin levels and overall insulin response were significantly higher in the obese hypertensive group than in the non-obese hypertensive group. Glucose disappearance rates of the obese hypertensive group were significantly lower. The obese hypertensive group likewise had significantly lower HDL concentration. These findings suggest that hyperinsulinemia and/or insulin resistance is present among hypertensive Filipinos specifically among obese hypertensive patients. [19]

The gold standard for the measurement of insulin sensitivity is the hyperinsulinemiceuglycemic clamp. [20] However, this method is difficult and expensive to replicate in epidemiologic studies. The Homeostatic Model Assessment (HOMA) developed by Mathews, et. al. utilizes computer models to compute for insulin sensitivity using plasma glucose and insulin levels [21]. Lim-Alba, et. al. determined the prevalence of insulin resistance among the obese and to determine the relationship of BMI and insulin resistance using the HOMA Insulin Resistance (IR) index. The prevalence of insulin resistance was 76% in the obese group (45/60) and 4.9% (3/61) in the control group. Obese individuals had a greater likelihood of having insulin resistance. As BMI increased, so did the HOMA IR. [22]

Insulin resistance and hyperinsulinemia are frequently seen in PCOS. Lagaya, et. al. investigated the relationship between obesity and insulin levels in women with PCOS. The fasting insulin levels were noted to be highest in the PCOS group. There was no significant difference between insulin levels of non-obese women with PCOS compared to obese and non-obese women without the PCOS(Lagaya S, et al., The Relationship of Obesity with Plasma Insulin Levels of Filipino Women with Polycystic Ovarian Syndrome, unpublished data, n.d.).

Obesity and Bone Mineral Density

Body weight is identified as a one of the strongest predictors for bone mass and obesity can confer some protective effect against the development of osteoporosis. The study done by Magboo, et al., compared the bone mineral density among underweight, normal weight, overweight and obese postmenopausal Filipino women. Women with BMI > 30 kg/m^2 showed the highest bone mass. There was no difference in the lumbar, femoral, radial, and total BMD among those with normal weight, overweight and mildly obese groups. Women with BMI > 30 kg/m^2 had the least number of osteoporotic cases. [23]

Waist circumference and CRP

C-reactive protein (CRP), a marker of chronic, low-grade inflammation, is strongly associated with current central adiposity, and has been linked to elevated risk of cardiovascular disease [24] . In this study, researchers evaluated the extent to which current WC and change over an 11-year interval contribute independently to low-grade systemic inflammation measured in a group of 1,294 women, 35–69 years, participating in the Cebu Longitudinal Nutrition and Health Survey. Results showed that WC was a strong predictor for elevated CRP. Cumulative risk of elevated CRP due to increased central adiposity was 25.7%. Women who reduced their waist circumference had greatly reduced risk (6.2%). [24]

SUMMARY AND FUTURE RESEARCH

There are few Filipino studies available that explore the utility of different anthropometric measures to diagnose obesity. There are no studies on body composition upon which to base the relationship of anthropometric parameters with body fat. There are also no prospective studies that show the relationship of anthropometric parameters and chronic disease risk, morbidity and mortality. There has been a move to lower the cut-offs for the diagnosis of overweight and obesity among Filipinos. The proposed cut-offs to diagnose obesity among Filipinos are close to the provisional IASO recommendations for Asians, except for WHR and are lower than the cut-offs proposed by WHO, particularly for BMI and WC. Though a locally developed clinical practice guideline has been put forth as a means to improving screening for overweight and obesity, this is yet to be validated in a larger Filipino population.

Obesity is a feature in Filipino patients with polycystic ovary syndrome and obstructive sleep apnea. Various studies have been done to correlate obesity with lipid profile, hyperinsulinemia and C-reactive protein with inconsistent results. Obesity, however, is not seen in Filipino patients with hyperthyroidism and osteoporosis.

In this review of obesity research pertaining to screening and diagnostics, there have been some inquiries into interesting clinical questions. However, gaps in basic research can be seen. Studies on body composition of Filipinos in relation to different anthropometric parameters must be prioritized. Validation of the NHLBI and Asia-Pacific cut-offs for the diagnosis of obesity among Filipinos needs to done. Longitudinal studies are needed to study the relationship of obesity and the risk factors for cardiovascular disease among Filipinos.

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Chapter 5

Treatment of Obesity in the Philippines

Monica Therese B. Cating-Cabral, Imelda Digna S. Antonio, Cristina V. Jaring

Key words: Obesity; overweight; Filipino; diet; exercise; weight loss; nutrition; thinber; fiber; metformin; orlistat; benfluroex; virgin coconut oil; bariatric surgery

The treatment modalities for obesity among the Filipino population can be grouped into diet, exercise, drugs, alternative/herbal medicines as well as surgical and non-pharmacological interventions. From 26 articles found, 17 were appropriate for review as the others did not specify that the study population was composed of Filipino subjects or did not clearly identify a therapeutic intervention for obesity.

FILIPINO BEHAVIOR AND PRACTICES

In a prospective observational study of 3080 postpartum women with single live births, it was found that the likelihood of weight loss was significantly increased by lactation of more than 12 months, greater maternal age and low dietary energy intake. [1]

Another study sought to describe how and what people understand and feel about the risk factors for cardiovascular disease in general and how this understanding affects decisions to seek health care and manage disease. They found that attitudes toward controlling weight, eating correctly and regular exercise were generally favorable, but attempts at unsupervised weight loss were unsuccessful. Only 7% consulted a doctor who advised them on proper diet and exercise. [2]

In a review of 100 cases at the out-patient department of the University of the Philippines - Philippine General Hospital, a majority (58%) were given dietary advice by the physician, 29% were referred to dietary division, 23% were given advice on exercise, 9% were referred to Endocrinology, and none were given pharmacologic therapy specific for obesity and offered surgery (Dagang D. and Nicodemus NA, unpublished data, 2010).

Diet

An observational cross-sectional study (Magboo 2007) revealed that the kilocalories prescribed for admitted obese and overweight patients at a university hospital in Manila, the University of Santo Tomas Hospital were quite high (mean kcal ±) compared to usual dietary prescriptions for such patients at outpatient clinic.

Follow-up rate of these patients at the outpatient clinic was low. It was therefore recommended that these patients be seen again by dietary service prior to discharge for dietary revisions at home. [3]

Tanchoco et. al. 2001 came up with nutritional guidelines for Filipinos to encourage consumption of an adequate and well-balanced diet and promote desirable food and nutrition practices and health habits. Specifically, the guideline gave advice on proper feeding of children to avoid under- and over nutrition, to address the already high prevalence of underweight children and increasing trends in overweight children. [4]

Nutritional Guidelines for Filipinos [4]

1. Eat a variety of foods everyday.
2. Breastfeed infants exclusively from birth to 4-6 months and then give appropriate foods while continuing breastfeeding.
3. Maintain children's normal growth through proper diet and monitor their growth regularly.
4. Consume fish, lean meat, poultry or dried beans.
5. Eat more vegetables, fruits and root crops.
6. Eat foods cooked in edible/ cooking oil daily.
7. Consume milk, milk products and other calcium-rich foods, such as small fish and dark green leafy vegetables everyday.
8. Use iodized salt, but avoid excessive intake of salty food.
9. Eat clean and safe food.
10. For a healthy lifestyle and food nutrition, exercise regularly, do not smoke and avoid drinking alcoholic beverages.

Drugs

Obesity has been observed to occur with other conditions, such as polycystic ovary syndrome, for which metformin is commonly prescribed. One prospective, randomized open-label study of 52 Filipinos evaluated the effect of metformin with exercise and diet modification versus exercise and diet modification alone on BMI, Ferriman Galwey Score (FGS), ovarian cycle and menstrual length. At baseline, mean BMI for all subjects was 24.48 ± 0.61 kg/m^2. After 6 months of metformin 500mg TID, there was no significant decrease in BMI in the metformin group, but there was a significant difference in the decrease in BMI between groups ($p=0.010$). [5]

Benfluorex is a hypolipemic agent that also has anorectic effects. In a 2-phase study looking at the use of this agent in the treatment of hyperlipidemia, 30 patients were initially placed on a prescribed diet with weight measured at baseline and at the end of 1 month, significant weight loss was observed. The subjects were then treated with benfluorex for 3 months but no significant weight loss was noted. [6]

Orlistat is therapeutic agent that is a powerful inhibitor of pancreatic lipase, a primary enzyme responsible for hydrolysis and subsequent absorption of the fat in the diet. The inhibition of this enzyme has been shown to reduce fat absorption from the diet due to inhibition of hydrolysis of triglyceride. Where undigested triglycerides are not absorbed, the resulting caloric deficit has a positive effect on weight control, making it useful in the treatment of obesity and hyperlipidemias.

In a local multicenter study, 142 subjects were enrolled in a double-blind, placebo controlled, randomized parallel study looking at the effectiveness of orlistat 120 mg TID vs. placebo over 12 weeks. Both groups were also started on a hypocaloric diet with 28% of the calories as fat. At the end of the study period, there was significant BMI reduction ($p=0.001$) and weight loss ($p=0.007$), particularly seen objectively and subjectively in waist ($p=0.029$) and hip ($p=0.033$) circumference reduction, despite non-adherence of the study subjects to the prescribed hypocalorlc diet (70% of the subjects in orlistat group and 62% in placebo group). Adverse effects were mostly mild and tolerable, occurring in 67% of the orlistat group, 88% of which were probably or possibly related to the drug and were mainly gastrointestinal symptoms such oily stool/ spotting (52%) and increased defecation/fecal urgency (29%). [7]

A succeeding randomized controlled trial looked at the effect of orlistat on lowering lipids in overweight and obese individuals. After 12 weeks of treatment, the reduction of body weight ($p=0.001$) and cholesterol/LDL blood levels ($p<0.001$) was significantly greater among subjects treated with orlistat. For every kilogram of body weight lost, total cholesterol and LDL decreased by 0.066 mmol/L and 0.058 mmol/L, respectively. Adverse effects were similar to that of the previous study and were mostly mild gastrointestinal side effects that did not warrant modification of treatment. [8]

Fiber has been thought to reduce weight. Thinber is a dietary food supplement made from fruit fiber. An RCT by Lazaro on the effectiveness of thinber vs placebo as adjunct to a low calorie diet among adults showed that it is not effective in reducing weight among overweight and obese patients. [9]

Two studies showed no significant statistical effect of virgin coconut oil on weight reduction, with the trend of each study conflicting, one favoring weight reduction, the other increasing the weight. [10-11]

BARIATRIC SURGERY

A cross-sectional study on the profile and post-operative outcomes of patients who underwent bariatric surgery was done by Berioso et al. Medical records of 23 patients who underwent the procedure at an urban private tertiary hospital, the St. Luke's Medical Center from March 2002 to November 2003 were reviewed. Mean age of the population was 36 ± 13.5 years. Mean body mass index (BMI) was 42.63 ± 7.84

kg/m^2 and mean weight was 119.86 kg (range 67-165.8 kg). Seventy-eight percent had at least one obesity-related disease. Forty-eight percent underwent gastric banding and 52% underwent Roux-en-Y gastric bypass. Successful mean excess weight loss was achieved 6 months post-operatively. The mean excess weight loss in kg was 19.25±6.14, 31.61±9.46, 59.66±27.94, 69.52±26.54, 75.19±19.62 at 1, 3, 6, 9, 12 months after bariatric surgery. Of the 17 patients who had follow-up 1 month after surgery, 35% reported peri-operative complications. There were 2 major peri-operative complications, namely a small anastomotic leak and hepatic failure. Fourteen patients were interviewed on follow-up regarding co-morbidities and 43% had resolution of all co-morbidities. All patients expressed satisfaction with the procedure and claimed improved overall health post-operatively. [12]

A retrospective review of the metabolic profile of 44 bariatric patients at St. Luke's Medical Center from March 23, 2002, to July 31, 2004, was done by Tan-Tin Hay, et al. Average BMI was 42.2 kg/m^2. Mean age was 37.8 years and there was a preponderance of female patients (63.6% vs. 34.4%). Most of the patients were Southeast Asian (90.9%), while a smaller percentage was Caucasian (6.8%), and a minority was from the South Pacific Islands (2.3%). There was a high prevalence of diabetes mellitus type 2, hypertension, dyslipidemia, fatty liver, gallbladder disease and sleep apnea in the subjects. Laparoscopic adjustable gastric banding was the most common bariatric procedure performed, and the most common post-operative complication was pulmonary in nature. The greatest percentage of excess weight loss (-25.2%) was noted in those who underwent Roux-en-Y gastric bypass surgery. A patient who underwent laparoscopic non-adjustable gastric band placement had weight gain of 21.7% which was attributed to poor band placement. A limitation of the study was the poor long-term follow-up after surgery and a paucity of post-operative data regarding the eventual outcome of any of their obesity-related morbidities. [13]

Dineros et. al. reported on the procedure of bariatric surgery and outcome as part of a weight management program of the St. Luke's Medical Center, a tertiary care private hospital. Fifty patients were included from March 2002 to November 2004. All were screened and assessed at the weight management center of the institution. They first underwent a weight management protocol. A multidisciplinary team handled all obese patients and took part in the preparation and follow-up of all candidates for bariatric surgery. Sixty percent of the patients underwent laparoscopic adjustable gastric banding and 40% underwent Roux-en-Y gastric bypass. There were more females than males (64% vs. 36%) with mean age 38±13.1 years. Initial BMI was 46.2 kg/m^2, which decreased to 27.0 kg/m^2 in 1 year. Initial mean weight was 126.7±25.4 kg, of which the 1 year weight loss was 32.3 kg for the morbidly obese (obese class 2, BMI 40.1-50 kg/m^2) and 58.0 kg for the super obese (obese class 3, BMI >50 kg/m^2). The percentage of excess weight loss at 1 year was 30.2%. There was greater weight loss with Roux-en-Y gastric bypass compared to laparoscopic adjustable gastric banding at 1 year (43.5 kg vs. 30.2 kg). There was no mortality, and early complications were: wound infection (2/50 or 4%), and 1/50 or 2% each for pneumonia, dehydration,

gastritis, and leakage. Late complications were: band slippage (2/20 or 10%), stomal stenosis (1/20 or 5%), and ventral hernia (1/5 or 20%). The authors concluded that bariatric surgery is safe with a low complication rate, and the outcome was similar to the reported data from Asia and the western world. [14]

Reyes, et. al. reported the case of a 42-year-old Filipino male who was the first individual to undergo bariatric surgery at the University of Santo Tomas Hospital, as treatment for his obesity and co-morbid diseases. A multidisciplinary team approach was used for extensive pre-operative screening and management, psychological counseling, and patient education. Initial weight was 173.7 kg. The patient underwent vertical ring gastric bypass, Roux-en-Y gastroenterostomy, and cholecystectomy. There were no post-operative complications. Post-operation weight loss was satisfactory with 10%, 11%, 15%, and 16% weight loss at the 1st, 2nd, 3rd, and 4th weeks, respectively. Progressive decrease in weight was noted at subsequent follow-ups, such that at 5 months, 30% (52.6 kg) of initial weight was shed, and at 1 year post-surgery, weight loss was 40% (69.4 kg) of initial weight. There was also improvement in previously experienced symptoms and resolution of some obesity-related conditions. [15]

NON-PHARMACOLOGIC INTERVENTIONS

A descriptive and quasi-experimental study was done to determine which weight loss method was effective in reducing the BMI of overweight and obese employees of La Salle Academy. Participants were subjected to 2 weight loss methods: exercise only and exercise with dietary modifications. Moderating variables like gender, age, civil status, socio-economic status, fat predictor scores and physical activity were studied in relation to obesity and weight loss method efficacy. Results showed that the weight loss methods were effective in reducing the BMI of the participants but exercise with dietary modifications had higher rates of BMI reduction than the exercise only program. Moreover, it was noted that age, income, occupation, physical activity and fat predictor score were not correlated with weight loss method, although some of the moderating variables were significantly related to each other (Casimero G., unpublished data, 2008).

SUMMARY AND RECOMMENDATIONS

Due to the paucity of FDA-approved pharmacologic interventions for the treatment of obesity, it would appear that non-pharmacological strategies such as diet, exercise and patient education should be the methods that need further investigation in the treatment of obesity. Bariatric surgery remains a viable therapeutic option, but its use is limited by the cost of the procedure.

One method would be the formulation of an information booklet on proper diet and increasing physical activity, as well as the risk factors for obesity that the general population should be aware of. This booklet would be part of a larger awareness campaign and the impact of this information dissemination be followed in a longitudinal study to identify its impact on achieving a healthy weight and lifestyle.

Conventional programs on weight management should be compared with structured comprehensive multi-level/multi-component programs to distinguish whether either program is more efficient. This should include both adult and pediatric groups.

There should also be a review and update of current treatment guidelines on obesity in both children and adults, as this has not been revised in recent years. The Filipino Pyramid Food and Physical Activity Guides should be validated as well, being tools in the treatment of obesity.

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Chapter 6

Complications of Adult Obesity

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Key Words: complications; obesity; overweight; Filipinos; metabolic syndrome; cardiovascular risk

Hypertension, diabetes, and the metabolic syndrome are among the most frequently reported complications of adult obesity. In a meta-analysis of 16 cohorts comprising 20,827 subjects (of which 3,841 were Filipinos), the glucose and blood pressure levels were directly associated with body mass index (BMI) and indicators of central obesity, such as waist circumference, waist-stature ratio, and waist-hip ratio. [1] Adult obesity was associated with increased risk for development of Type 2 diabetes among young Filipino adults (OR 3.4, 95% CI 1.5,4.6; p=0.04 for obese class I; OR 4.5, 95% CI 2.8;6.7; p=0.02 for obese class II). [2] It was likewise associated with increased incidence of metabolic syndrome (OR 5.40 95% CI 1.95,14.9; p=0.001), particularly hypertension. [3] However, lipid profile levels, a component of the metabolic syndrome was not observed to be correlated with increasing weight. In a cross-sectional study done by Ho, et. al, BMI was not correlated with lipid profile levels among Filipino diabetic patients. [4] Another study showed a profile of isolated low HDL-c across all ranges of BMI among adult Filipino women as compared to Caucasian women wherein HDL-c levels were inversely related to BMI. [5] These were consistent with results of an earlier study which found no correlation between weight and lipid profile levels among obese Filipinos. Cardiovascular risks among heavier Filipinos were primarily due to their associated risk factor profile than to the degree of the obesity itself. [6]

Other cardiovascular risk factors which may arise due to obesity or increase in weight include the development of heart failure, mild to moderate diastolic dysfunction, and elevated C-reactive protein (CRP). In a local registry done on 1,078 symptomatic heart failure patients, being overweight was among the five most common risk factors for the development of heart failure, occurring in 21% of the subjects and ranking next to known cardiovascular risks such as hypertension, diabetes, smoking, and dyslipidemia. [7] In another study involving 2,711 apparently well obese Filipinos, increasing BMI resulted in an increased risk of developing mild to moderate diastolic dysfunction. Although many confounding factors and co-morbidities associated with obesity may also affect cardiac performance (such as the components of the metabolic syndrome), a subgroup analysis of those with uncomplicated obesity was consistent with this finding. Those who were overweight (BMI 23-27.49) had a two-fold increase in risk for mild to moderate diastolic dysfunction (adjusted OR 2.02 95%CI 0.99,4.1; p=0.05), while those classified as having Gr. 2 and 3 obesity (BMI 35-39.99 and >40,

respectively) had a four-fold increase in risk (adjusted OR 4.00 95% CI 1.94,8.21; p<0.001). [8] Waist circumference and height were also found to be independent predictors of elevated CRP. Each centimeter increase in waist circumference and height were associated with a 10% increased and 4% decreased risk of having elevated CRP, respectively (OR 1.023 95% CI 1.00,1.05; p< 0.05). [9]

Obstructive sleep apnea (OSA) is another reported complication of obesity. Severity of apnea directly correlated with increasing obesity grade (p=0.043) and risk of apnea was increased approximately ten-fold among those with BMI >30 compared to the general adult population. [10] In another study by Garcia, et. al., on OSA patients who underwent sleep studies, 84.9% of obese subjects were positive for OSA, as compared to 67.9% of non-obese who tested positive, giving a significant association between OSA and obesity (p<0.001). [11] In a study which correlated collar size, a measure of external neck circumference, with the incidence of OSA, collar size, was significantly associated with BMI in both men and women. The cross-sectional study on 149 Filipino males showed that collar size increased progressively with increasing severity of sleep apnea, with a collar size ≥40 cm presenting a 94% probability of OSA. [12]

In general, adult obesity most commonly results in the development of cardiovascular risks and the metabolic syndrome (Table 6.1) Strict lifestyle modification and medical treatment, if necessary, in order to reduce weight to ideal levels, may significantly decrease the incidence and risk of cardiac-related morbidity and mortality. Given the growing incidence of adult obesity in the Philippines, development of local programs directed at weight-reduction would help promote improvement in the health of the Filipino adult obese population.

Summary and Recommendations

Early screening for co-morbidities among the obese is recommended to prevent progression into complications. This may be done through lay forums to increase public awareness on the health risks of obesity. Promoting lifestyle modification through exercise and proper diet may also complement early screening. Projects which can address this may include marathons to advocate physical activity and a campaign to encourage all food service establishments to alternatively offer affordable healthy food choices. Further research on obesity in the different regions in the Philippines is also recommended. Regional differences in diet and living conditions may bring about different prevalence rates in the various regions, thus requiring individualized approach for prevention and intervention.

Table 6.1. Summary of Complications of Adult Obesity

Complication	Study	No. of Participants	Results
Hypertension	Geronimo, et al. (2006) [3]	134 hypertensive patients	60(45%) obese by BMI 98 (73%) obese by WC 99 (74%) obese by WHR 30 (22%) overweight
	Docoda Study Group (2008) [1]	3,841 obese Filipinos (1,351 males) 2490 females)	OR 1.77 (95 CI 1.57, 2.01) for males*; OR 1.43 (95% CI 1.31, 1.56) for females*
Diabetes Mellitus	Obrero et al., (2006) [2]	82 diabetic Filipinos	OR 3.4 (95% CI 1.5, 4.6) for obese class I; OR 4.5 (95% CI 2.8, 6.7) for obese class II
	Decoda Study Group (2008) [1]	3,841 obese Filipinos (1,351 males) 2490 females)	OR 1.71 (95% CI 1.37, 2.89) for males**; 1.6 (95% CI 1.37, 1.86) for females**
Metabolic Syndrome	Geronimo, et al. (2006) [3]	134 hypertensive patients	OR 5.4 (95% CI 1.95, 14.9) for obesity by BMI
Heart Failure	Jorge, et al. (2007) [7]	1078 heart failure patients	21% overweight
Diastolic dysfunction	De Guzman et al. (2008) [8]	2711 obese patients	OR 2.02 (95% CI 0.99, 4.4) for overweight
High CRP	Rutherford et al. (2010) [9]	1,294 Filipino women	OR 1.023 (95% CI 1.00, 1.05) or each cm increase in WC
Obstructive Sleep Apnea	Garcia et al. (2003) [11]	555 adults (259 obese and 201 non-obese with OSA (p<0..001)	
	Magboo et al (2006) [10]	43 overweight and obese subjects	39 (90.7% with OSA (8 overweight, 31 obese
	Veloro et al. (2008) [12]	149 adults (128 withOSA)	BMI related to severity of OSA and different among groups (p<0.005); mean BMI: 25.9 (mild OSA), 29.39 (moderate OSA), 29.7 (severe OSA)

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Chapter 7

Review of Epidemiology, Risk Factors, Diagnosis, Treatment and Complications of Obesity in Filipino Children and Adolescents

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Key words: Diet; physical activity; obesity; overweight; obesity prevalence; overweight prevalence; epidemiology; children; skin-fold thickness; BMI; waist-hip ratio; neck circumference; diabetes; non-alcoholic fatty liver; dyslipidemia; metabolic syndrome

EPIDEMIOLOGY

How is obesity measured in children?

At present, there is still no widely agreed upon standard to measure obesity in children and adolescents. The measurement of overweight and obesity in children is difficult due to differences in maturation and growth rates. Different measures and references such as weight-for-height (WFH), Body Mass Index (BMI) percentiles, and skin-fold thickness have been used.

Since the end of the 1990's, BMI has been increasingly accepted as a valid indirect measure of adipose tissue in both children and adolescents. However, this is a relatively crude measurement as it provides no information regarding the distribution of fat, nor does it take into account the extremes of musculature, aging or growth phases. There is no consensus on a cut-off point for excess fatness in overweight and obese children. A number of different BMI references (percentiles) have been developed and widely use[1]:

1. The World Health Organization (WHO) reference defines BMI percentiles as cut-offs for overweight among children and adolescents (10-19 year olds), and weight for height z-scores for obesity in children <10 years of age with the 85th and 95th percentiles denoting overweight and obesity, respectively. The reference values include age and sex specific data from the first National Health and Nutrition Examination Survey (NHANES 1) collected in 1971-1974 in the United States of America.

2. The Centers for Disease Control and Prevention (CDC) reference uses BMI percentiles for aged 2-20 years (85th and 95th percentile denoting overweight and obesity, respectively). The year 2000 reference included BMI for age growth charts and

was a revised version of the 1977 National Health Care Survey (NCHS) growth charts.

3. The Childhood Working Group of the International Obesity Task Force (IOTF) reference uses sex and age specific BMI cut offs that correspond to BMI 25 kg/m^2 for overweight and 30 kg/m^2 for obesity at age 18 years. The reference population was made up of 6 nationally representative datasets.

Waist circumference (WC), as a surrogate marker of visceral obesity, is presently being studied as a measurement of obesity related risks in children.

Obesity in Children and Adolescents: a global problem

The prevalence of obesity and overweight is increasing in both adult and pediatric population throughout the world. Obesity has reached epidemic proportions globally. Recent data indicate a rise in obesity both in children and adolescents in developing countries undergoing rapid nutrition and lifestyle transition. Reports showed that nearly 22 million children under the age of five are estimated to be overweight worldwide, and more than 17 million are presumed to live in developing countries. Obesity often co-exists with undernutrition. [2]

Prevalence of Overweight and Obesity in Children and Adolescents (by country)

In the United States, data from two NHANES surveys (1976–1980 and 2003–2004) show that the prevalence of overweight is increasing: for children aged 2–5 years, prevalence increased from 5.0% to 13.9%; for those aged 6–11 years, prevalence increased from 6.5% to 18.8%; and for those aged 12–19 years, prevalence increased from 5.0% to 17.4%. [3] In the United Kingdom, in children aged 7-11 years, prevalence of obesity changed from 8.0% to 20.0% from 1984-1998. In Australian children and adolescent aged 7-15 years, prevalence increased from 1.4% to 4.7% in boys and 1.2% to 5.5% in girls from 1985-1995 (age adjusted BMI cut off linked to the adult value of 30 kg/m^2). Japan reported an increased prevalence of obesity from 5% to 10% in children aged 6-14 years from the year 1974-1993. This trend was also seen in Chinese children aged 6-9 years, where the prevalence of overweight and obesity increased from 10.5% to 11.3%, and for aged 10-18 years, obesity prevalence increased from 4.5% to 6.2% from year 1991-1997. This trend was likewise seen in other Asian countries such as Singapore, Malaysia, Indonesia and Taiwan among other countries. [4] (See Table 7.1)

Prevalence of Overweight in Children and Adolescents in the Philippines (NNS-FNRI Surveys of 1998, 2003, 2008)

In the Philippines, the sixth National Nutrition Survey (NNS) conducted by the Food and Nutrition Research Institute (FNRI) in 2003 showed that among children

Table 7.1. Summary of global increases in childhood obesity

Country	Prevalence of obesity by age group	Time periods
United States of America	2-5 yr olds – 5.0% to 13% 6-11 yr olds – 6.5% to 18.8% 12-13 yr olds – 5.0% to 17.4%	1976-1980 to 2003-2004
United Kingdom	7-11 yrs – 8.0% to 20.0%	1984 to 1988
Australia	7-5 yr olds 1.4% to 4.7% in boys 1.2% to 5.5% in girls	1985 to 1995
Japan	6-14 yr olds – 5.0% to 10%	1974 to 1993
China	6-9 yr olds – 10.7% to 11.3% 10-18 yr olds – 4.5% to 6.2%	1991 to 1997
Singapore	School age – 5.0% to 15.0%	1980 to 1992
Taiwan	Adolescent age 18.5% in boys 15.0% in girls	2002
Thailand	Kindergarten 22.7% in urban areas 7.4% in rural areas	2000
Indonesia	16.1% obese	-
Thailand	7-16 yr olds 6.0% are overweight 3.5% are obese	-
Hongkong	6-8 yr olds 13.4% in boys 10.4% in girls	1996

aged 0-5 years surveyed, 1.4% were overweight (compared to only 0.4% in 1998). Among children aged 6-10 years, 1.3% were overweight (negligible percentage in 1998), and among 11-19 year olds, 3.6% were overweight (only 2.9% in 1998). These results were based on the old system of classification using weight-for-age, not BMI. [5] (see Figure 1-3). The latest NNS survey in 2008 showed that among children aged 0-5 years, overweight prevalence increased to 1.9%. Among the 6-10 year olds, prevalence increased to 3.0% and, for the adolescent age the prevalence of overweight declined to 1.5%. [6] (see Figure 7.1-7.3)

Figure 7.1. Trends in the prevalence of overweight among 0-5 year old children: 1989-1990 to 2008 (FNRI)

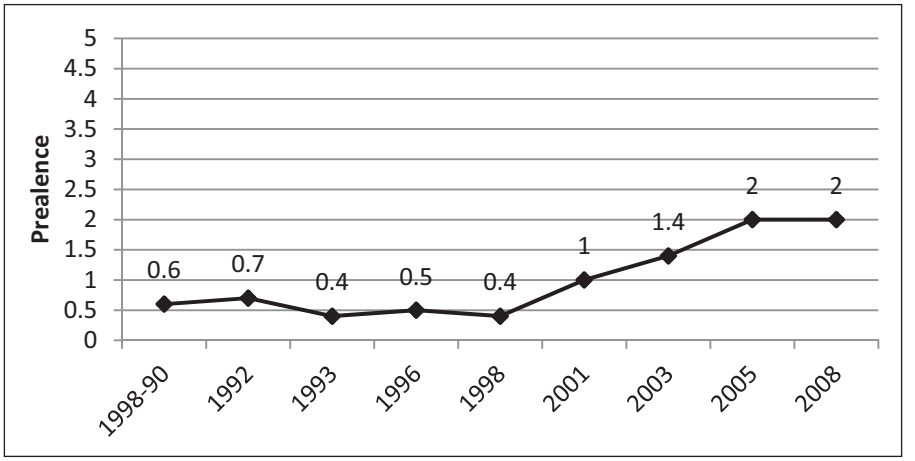
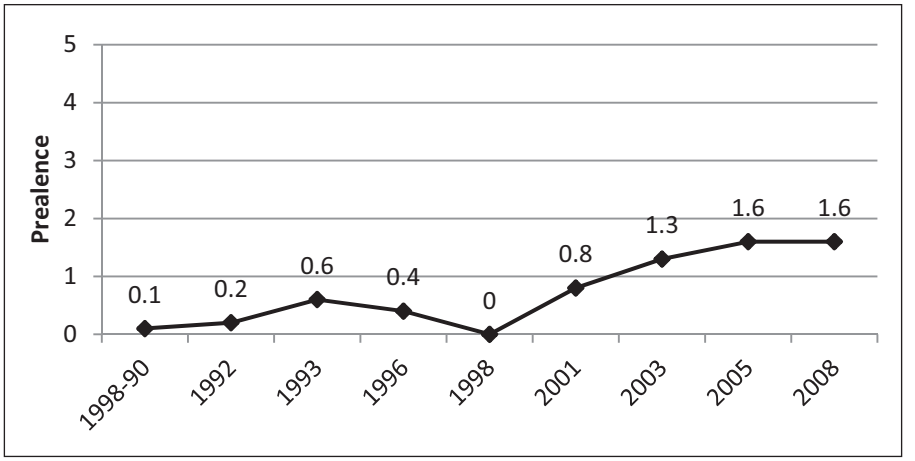


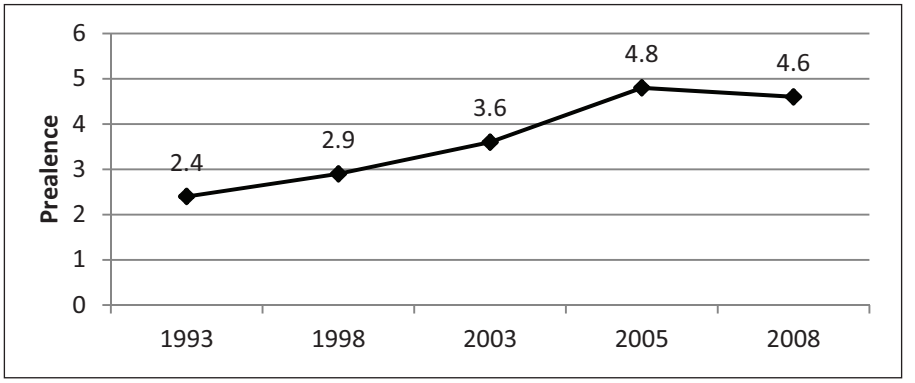
Figure 7.2. Trends in the prevalence of overweight among 6-10 year old children: 1989-1990 to 2008 (FNRI)



The rise in childhood obesity worldwide is of great concern as it poses significant health risks for those affected, both during childhood and adulthood. As the prevalence of childhood obesity increases there will be more chronic illnesses and lifestyle diseases in the population over time. These epidemiological shifts have a significant impact on the demands for health care and support services for the chronically ill, potentially placing significant strains on international economies in the future.

A total of 12 local studies on the prevalence of childhood obesity were identified (Table 7.2). The prevalence of obesity based on age, sex and school type is shown

Figure 7.3. Trends in the prevalence of overweight among adolescents: 1993 to 2008 (FNRI)



in Tables 7.3 – 7.7. In these studies, CDC definitions for overweight and obesity were widely used. Among children and adolescents aged 6-12 years, the prevalence of obesity was 2.7% to 10.3% from the year 2003 to 2006. For the teenage group aged 11-19 years, prevalence of obesity was 6.2% to 8.0% from the year 2007- 2008. Overall, there were more males who were obese compared to females. Childhood obesity was also more prevalent in children enrolled in private schools compared to public schools (Table 7.8) [13]

The definitions of overweight and obesity in children differ between the 12 epidemiological studies included in this review, making comparisons of prevalence data difficult. Nevertheless, there is an increasing trend of childhood obesity similar to our local survey and the global trend both in developed and developing countries. The demographic distribution of the different studies included in this review covered areas from the 3 main island groups, Luzon (including Metro Manila, the National Capital Region), Visayas and Mindanao. However, there is a paucity of data on the prevalence of childhood obesity in specific population groups and specific diseases. There is a need for a standardized definition of overweight and obesity in children and adolescents as well as normative parameters for identifying obesity related risks in children, e.g., waist circumference.

RISK FACTORS

Obesity is a complex condition with genetic, metabolic, behavioral and environmental factors contributing to its development. [16] A number of known risk factors for childhood obesity have been identified in several studies internationally such as parental overweight and obesity, maternal diabetes, birth weight and size, and infant feeding (breastfeeding vs. bottle feeding). [17] Obesity in parents is strongly correlated with obesity in their children. [18]. The effects of environmental factors

Table 7.2. Prevalence Studies on Childhood and Adolescent Obesity in the Philippines

Author (year)	**Age Gp.** (year)	**Population** (n)	**Definition of obesity**	**Location**	**Prevalence** (%)
Cruz, et al (2009) [7]	6-17 yr	2,823	OW BMI 25-29.9 Obese BMI >30	Baguio City	OW – 4.4 Obesity – 5.5
Alawi, et al. (2008) [8]	13 – 16 yr	833	CDC	Cagayan de Oro	Obesity – 8.0
FIRST Research Colaborative Group[a] (2007)	11-19 yr	3671	Must criteria CDC IOTF Dole IOTF Asia	Metro Manila	Must – 15.2 CDC – 6.1 IOTF Cole –16.9 IOTF Asia - 18
Cagadas, et al. (2006) [9]	6-12 yr	456	CDC	Cagayan de Oro	Overall prevalence 10.3 (recalculated) Private – 9.0 Public – 1.1
Ricafort, et al. (2006) [10]	6-12 yr	1951 subjects	CDC	Naga City	OW – 6.9 Obesity – 5/3
Parker & Alejandro (2005) [11]	6-12 yr	835	FNRI BMI cut offs: Underwt. 8.5 Normal – 8.5 - 24.9 OW – 25.0-29.9 Obese - >30	Makati Medical Center	OW – Private- 59.0 Public – 7.7 **Obese –** **Private- 14.5** **Public** - 0
Lim, et al. ((2003) [12}	6-12 yr	5,809	CDC	Cebu City	Public school: Overall – 6.7 OW – 4.0 Obese – 2.7
Santos (2003)[b]	18-80 months	228	IOTF Cole	Metro Manila	OW – 19.0 Obesity – 11.3

Table 7.2. (continued)

Author (year)	**Age Gp.** (year)	**Popula-tion** (n)	**Definition of obesity**	**Location**	**Prevalence** (%)
Florentino, et al (2002)[c] [13]	8-10 yr	1208	BMI ≥ 85th – at risk of OW; BMI ≥95th - OW	Manila	At risk of OW – 24.9
Macasaet & Manalang (2000) [14]	5-18 yr	133	National Examina-tion survey	Hospital of the Infant Jesus	Obese – 42.0 5-10 yr- 27.0 11-18 yr- 15.0 Males obese – 31.0 Female obese – 11.0
Regidor (1996)[d]	5-6 yr	273	OW – BMI >85th percentile; Obese – BMI >95th percentile for age and sex	Metro Manila	OW – 20.0 Obesity – 49.0
Chan-Cua (1995) [15]	6-14 yr	1822 boys	Wt for Ht - >120% FNRI NCHS	Metro Manila	Obesity FNRI – 47.0 NCHS – 41.0

[a] FIRST Research Collaborative Group. Overweight and obesity in selected high school students in selected public and private schools in Metro Manila. 2007. Unpublished.

[b] Santos C, Chan-Cua SC, Bugayong-Regidor P. Overweight and obesity among pre-school aged Filipino children. 2003. Unpublished

[c] Subjects were 8-10 yr old school children from randomly selected public and private schools the City of Manila.

[d] Regidor PB, Cua SC, Guerrero M, Juico CC. Five year surveillance of the body mass index of school entrants in an urban private schoo.. Unpublished.

Table 7.3. Frequency and Percentage Distribution of Overweight and Obese Subjects by Age and Sex (Cruz, 2009) [7]

Age Group (yr)	Overweight (f)	Overweight (%)	Obese (f)	Obese (%)
6-9	8	6.4	-	-
10-12	42	33.9	-	-
13-17	74	59.7	-	-
Sex				
Male	79	63.7	21	67.7
Female	45	36.3	10	32.3

Table 7.4. Frequency distribution of obese high school students based on the age, sex and type of school (Alawi, et al.2008 [8]

Age (yrs), gender, type of school	Frequency	Percentage in obese population	Percentage in overall population
Age			
13	22	31.9	2.6
14	19	27.5	2.3
15	19	27.5	2.3
16	9	13.0	1.1
Sex			
Male	41	59.4	4.9
Female	28	40.6	3.4
Type of school			
Private	57	82.6	6.8
Public	12	17.4	1.4

Table 7.5. Frequency and Distribution of Obese Children according to age, gender and type of school (Cagadas and Aleria, 2006 [9]

Age (yr) and Sex	Private school (n)	Public School (n)	Percentage
6-9	15	4	4.2
10-12	26	2	6.1
Male	26	3	6.4
Female	15	3	4.0

on childhood obesity such as an increase in caloric and fat intake, excessive sugar intake by cola consumption, eating patterns and increased portion size have been also widely studied. Likewise, sedentary behaviors such as television viewing, playing

Table 7.6. Prevalence of Overweight and Obese by Age and Sex (Ricafort, et al. (2006) [10]

Age and Sex	Obese (n)	Obese (%)	Overweight (n)	Overweight (%)
6	6	5.8	10	7.4
7	27	26.0	32	23.7
8	31	29.8	18	13.3
9	8	7.7	7	5.2
10	1	1.0	2	1.5
11	20	19.2	26	19.3
12	11	10.6	40	29.6
Boys	83	4.3	88	4.5
Girls	21	1.1	47	2.5

Table 7.7. Prevalence of Overweight and Obese by Age and Sex (Lim, et al. (2003) [12]

Age and Sex	Obese (n)	Obese (%)	Overweight (n)	Overweight (%)
6	7	3.0	13	5.5
7	20	2.5	26	3.2
8	28	3.0	37	4.0
9	30	2.0	40	4.0
10	26	3.5	38	3.6
11	22	2.1	41	3.8
12	22	3.0	40	5.4
Boys	112	4.0	105	3.8
Girls	43	1.4	130	4.3

video games and computer use for long periods of time have likewise been identified to be associated with increased prevalence of childhood obesity. [19]

Five local studies have similarly identified risk factors associated with childhood obesity in our setting.

Hereditary/ Genetic Factors

.

Macasaet and Manalang demonstrated that in children aged 5-18 years, 68% of obese subjects have a positive family history of obesity. Among these 43% have at

Table 7.8. Mean BMI os Schoolchildren according to age, sex and type of school. (Florentino, et al. (2002) [13]

Sex and Age	School	Population (n)	Mean ±SD BMI (kg/m^2)
Male			
8	Private Public	95 102	16.7 ± 3.2 15.4 ± 2.3
9	Private Public	94 105	17.1 ± 3.2 15.4 ± 2.6
10	Private Public	92 110	18.2 ± 3.7 15.4 ± 1.8
Female			
8	Private Public	90 105	16.3 ± 2.8 15.1 ± 1.9
9	Private Public	99 109	17.2 ± 3.2 15.5 ± 2.2
10	Private Public	96 111	17.8 ± 3.5 15.8 ± 2.3

least one parent who is obese. On the other hand, only 16% of those who are not obese have a family history of obesity. [14] Hereditary or genetic factors were associated with the occurrence of obesity among teenagers aged 13-16 years. Sixty-eight percent of students in the obese population had a positive family history of obesity while 26.1% students had no family history. [8]

Birth Weight and Gestational Age.

Aguila demonstrated that boys who were born small for gestational age and large for gestational age are 1.9 and 1.5 times, respectively, more likely to be overweight than boys who were born appropriate for gestational age. However, girls who were born large for gestational age were 1.9 times, and those small for gestational age were 1.4 times, more likely to be overweight than girls who were born appropriate for gestational age. (Aguila, D. Dietary intake, physical activity level and birth weight among overweight and normal weight Grades 4 to 6 public schoolchildren in Makati. 2008. Unpublished). The birth weight of children born to mothers with gestational diabetes was not a significant factor in predicting early childhood obesity. [20]

Maternal Diabetes.

Widjaja and Aguilar (2007) showed that maternal overweight or obesity significantly predicts early childhood obesity (p=0.05) using multivariate analysis.

The risk was nearly two times as much in a child with an obese mother than a child whose mother was not obese (RR 1.99; 95% CI 1.19-3.32). Maternal BMI was also significantly associated with later childhood obesity; the higher the maternal BMI, the more likely the child would become obese at ages 1-5 years. [20]

Infant Feeding.

Macasaet and Manalang reported that among 5-18 year old obese children studied, 18% were exclusively breastfed, 50% were exclusively formula fed, while the remaining 32% were mixed fed. Of the non-obese subjects, only 5% were exclusively breastfed, 40% were exclsuively formula fed and 55 % were mixed fed. However there was no significant statistical correlation with BMI. [14]

Caregiver's Perception.

Budiprananto in 2011 surveyed caregivers of overweight and obese children aged 3-18 years with 29.7% failing to recognize their child as overweight or obese and nearly 48% with overweight /obese children perceiving their child as being of normal weight. Disagreements between weight perception and the actual nutritional status based on BMIs were statistically significant ($p<0.01$). Eighty two percent of respondents believed that overweight/obese children may have health problems. [21]

Dietary Factors.

Aguila (2008, unpublished), studied public schoolchildren in Makati and demonstrated that overweight respondents have a higher intake of carbohydrate, protein and fats than normal weight respondents. Using logistic regression to test for association between BMI and diet, results showed that children consuming more than 100 percent of their energy requirement were six times more likely to become overweight. Children's preference for meat, fried foods, and sweets were also significantly associated with nutritional state ($P<0.05$).

Alawi, et al. showed that dining in fast food establishments at least 1-2 times per week was associated with obesity in teenagers. Regular softdrink consumption was found in 58% of these obese students. However, the number of meals and number of snacks per day did not show any significant relationship with obesity. [8] Overweight/obese students had a higher tendency not to eat 3 full meals daily regardless of snack habit (53% vs. 43%). Comparing the habit of not eating 3 full meals daily with eating 3 full meals with increasing snack habit, it was observed that the overweight/obese students had a lower likelihood to eat 3 full meals with 2 to 3 snacks daily (15% vs. 22%, OR 0.53 95% CI 0.40, 0.70; $p<0.001$) from eating 3 full meals without daily intake of snack (20% vs. 23%, OR 0.73 95% CI 0.57,0.93; $p=0.008$). Skipping breakfast and obesity were also significantly associated, in congruence with results of the cross-

sectional study in which those who skip breakfast had higher BMI values than those who do not. (FIRST Research Collaborative Group, 2007. Unpublished) Macasaet and Manalang reported that 59% of the obese subjects had most of their meals in front of the television, while the rest had their meals in the dining area. In contrast, only 9% of non-obese subjects had their meals in front of the television, and the majority had their meals in the dining area. [14]

Physical Activities.

Aguila (2008, unpublished) reported that children with low physical activity were 33 times more likely to become overweight regardless of age, sex and dietary intake. Alawi, Auguis, Banderado, et al showed that the level of physical activity and the number of hours spent on computer usage and computer-related activities were both associated with obesity. [8] Similarly Macasaet and Manalang reported 39% of obese subjects, and only 7% of non-obese subjects engage in computer games and play stations. Obese subjects spent an average of 28 hours a week compared to 18 hours a week spent by non-obese subjects. [14] There is also a significant association between walking to school with not being obese. Students who did not walk to school were more likely to be obese ($p \leq 0.001$). Also, students who rode in private vehicles to and from school were more likely to be obese than those who commuted to school ($p < 0.001$). There was also a significant correlation between not doing household chores and obesity. The students who did not do household chores were more likely to be obese than those who did them ($p < 0.001$). It was also observed that overweight/obese students spent more time playing with computers as compared to non-overweight/obese students ($p< 0.001$). (FIRST Research Collaborative Group, 2007. Unpublished) As similarly found [8], there was no significant association between watching television and obesity. Miranda demonstrated that normal weight, overweight and obese adolescent and young adults aged 12-22 years performed activities of moderate intensity for less than 1 hr a day. The normal weight group did activities daily compared to the overweight and obese groups who do the activities only 2-4 times a week. (Miranda, T. Association of body mass index with the physical activities of high school students in a private school in Manila, 2003. Unpublished)

Financial Status and Educational Attainment.

Alawi, Auguis and Banderado et al noted that 39% of families in the obese population earn more than 50,000.00 Philippine pesos (PhP) per month. Parents in the obese population also had higher levels of educational attainment. [8] Eighty two percent of obese children belonged to families whose income was above poverty level (> PhP 11,000.00 per month), while the remaining 18% belonged to families below the poverty level (< PhP 11,000.00 per month). [14]

There is little data on diet and physical activity patterns specific to Filipinos (regional, urban versus rural), genetics and ethnicity, behavior and environmental factors among Filipino obese children. Other areas that need to be explored are the effects of infant feeding practices, sleep deprivation, parents and caregiver's perception and other maternal factors. These risk factors associated with obesity must be identified to decrease if not stop the escalating numbers of children with this condition.

SCREENING AND DIAGNOSIS

Only a few Philippine studies have looked into the utility of different anthropometric measurements to diagnose obesity in children. To date, these parameters have been limited to: Body Mass Index, waist and hip circumferences and ratio, triceps skin-fold thickness and neck circumference.

Body Mass Index (BMI) is an objective measure of nutritional status and is used to screen for weight categories that may lead to health problems. It is calculated from weight (kg) divided by the height squared (m^2) using actual weight and height measurements. Self-report of weights and heights for calculating BMI (SR-BMI) is a subjective but relatively inexpensive and cost-effective alternative to direct measurement in large-scale studies, particularly in low-income developing countries. The concern, however, is the inaccurate prevalence estimates when using the SR-BMI.

A cross-sectional study by Chan-Cua and Amarillo aimed to assess the validity of BMI based on self-report of weight and heights (SR-BMI) in the estimation of overweight and obesity among adolescents in an urban setting. The overall prevalence of obesity using measured and self-reported body mass indexes were similar (21%). SR-BMI is 73.2% sensitive (95% CI 66.6%, 78.8%) and 93.5% specific (95% CI 91.5%, 95%) with a positive predictive value of 74.9% and a negative predictive value of 92.9%. It was concluded that SR-BMI, having a positive interclass correlation with measured BMI (0.64; 95% CI 0.60, 0.68), is a valid tool in the estimation of the prevalence of overweight and obesity among adolescents but should be interpreted with caution. [22]

In the analysis of obesity, attention has also been focused on ways to assess body fat distribution and the most convenient and preferred method has been the measurement of waist-hip-ratio. In adults, a ratio greater than 0.9 in males and 0.8 in females is associated with an increased risk of insulin resistance and associated diseases. Such standards have not been established in childhood obesity although a relationship between central fat distribution and abnormal glucose-insulin homeostasis has been shown. [23]

In a cross-sectional study conducted among adolescents from two private schools in Manila, Ley-Chua, Cua and Garcia established significant correlations between BMI and waist and hip circumferences in both sexes. (Waist circumference: Correlation coefficient 0.896 for boys, 0.909 for girls; Hip circumference correlation coefficient: 0.872 for boys, 0.91 for girls). Moreover, Waist-hip-ratio was found to be significantly related with BMI. (Correlation coefficient: 0.653 for boys, 0.707 for girls). [23]

Sanchez also aimed to study the correlation of BMI and adipose tissue distribution with metabolic parameters among 175 obese high school students in San Pablo City. A significant correlation between BMI and blood pressure (both systolic and diastolic) among obese children was demonstrated. A similar correlation was found between waist-hip-ratio and blood pressure levels. (Sanchez, MCP. Correlation of adolescent obesity and regional adipose tissue distribution with various metabolic parameters**.** 1999. Unpublished)

Similar to adults, neck circumference, an index of upper body subcutaneous adipose tissue distribution, was found to be significantly correlated with obesity in children.[22] . Neck circumference was measured in between the mid-cervical spine and mid-anterior neck, i.e., midway of the neck. In male adolescents with a laryngeal prominence (Adam's apple), it was measured just below the prominence. The Pearson correlation analysis of data yielded correlation coefficients of 0.652 (p-value=0.000) and 0.833 (p-value=0.000) in boys and girls, respectively, inferring a positive relationship between BMI and neck circumference. There are no local data on neck circumference cut-off levels in children, however. [23]

Ley-Chua, Cua and Garcia likewise studied the correlation of BMI and obesity to skinfold thickness. It is believed that when BMI's are used in conjunction with skin-fold measurements, it is possible to differentiate between large size due to obesity (increased fat) and that due to non-obesity (increased muscle mass, as in athletes). A Slimguide® Skinfold caliper was used to measure the triceps skinfold thickness. There was a positive correlation between BMI and triceps skin-fold thickness. (Pearson correlation coefficient= 0.815 (p-value=0.000) in boys and 0.828 (p-value=0.000 in girls). [23]

The First Research Collaborative Group (2007, unpublished.) showed the association of the different anthropometric measurements with overweight/ obesity using the IOTF/MUST classification. All measurements were significantly associated with being overweight/obese. The measurement with the highest odds of being overweight/ obese was the neck circumference (adj.OR 3.25; 95% CI 2.95,3.59). This was followed by the mid arm circumference (adj.OR 2.81; 95% CI 2.56, 3.08) and the waist circumference (Adj.OR 1.49; 95% CI 1.44, 1.55). Which then among the anthropometric measures is the best predictor for obesity in children? At present, there is no gold standard. It is reported that

waist circumference is the best predictor for boys (Coefficient of determination = 80.1%) while the hip circumference is the best predictor for girls (Coefficient of determination = 82.6%). [22] However, larger scale-studies need to be done to validate these findings. The need for standardized measures for indicators of obesity in children should be emphasized.

TREATMENT AND PREVENTION

Childhood obesity has become a problem for Filipino children with its increasing national prevalence. Early recognition and institution of treatment best prevent its serious long-term complications. A multidisciplinary approach combining behavioral therapy with diet and exercise has been advocated as it has the greatest impact in pediatric weight management. However, to date, there are only a few studies that have investigated the effectiveness of different or combination of treatment modalities to prevent or control childhood obesity.

Simao and Resurreccion (2007) aimed to study the efficacy of an oatmeal diet in decreasing body weight, BMI and cholesterol levels among 110 obese and overweight students aged 13-16 years. Subjects were randomized to oatmeal and placebo treatment groups. Weight, BMI and cholesterol level reduction with oatmeal and placebo diets were compared after 30 days. Weight decreased by an average of 1.81 kg (± 1.82 SD) in the oatmeal group, while in the placebo group it significantly increased by 0.6 kg (± 0.9 SD; p value <0.001). Seventy-three percent (38) of the subjects in the oatmeal group decreased in BMI by 0.68 kg/m^2 (± 0.93 SD), while the placebo group increased significantly by 0.16 kg/m^2 (± 0.53 SD; p-value <0.001). Seventy seven percent (40) of subjects in the oatmeal group had a decrease in cholesterol level by 0.16 mmol/L (± 0.44 SD) or 6mg/dL while 58% (29) increased by 0.086 mmol/L (± 0.17 SD; p-value <0.001). There were no adverse reactions noted in both treatment groups. The study concluded that oatmeal is an effective healthy dietary alternative for decreasing the weight, body mass index and cholesterol levels in children. [24]

In a prospective hospital-based study by Tan-Ting, the effect of a staged 3-month weight loss multidisciplinary program consisting of combined dietary, exercise and behavior modification among enrolled obese children was determined. At the end of the program, a decrease in the weight, BMI, body fat, systolic blood pressure and waist circumference was observed. Among 44 obese children aged 5-17 years, the mean weight loss was 4.2 kg ($p<0.01$) with an average of 5.3% weight loss; BMI decreased by 1.5 units ($p<0.01$), body fat by 14.0%, systolic blood pressure by 7.25 mmHg ($p<0.05$) and waist circumference by 5.4 cm ($p<0.05$). Decrease in the weight, BMI and waist circumference were significantly correlated with the number of sessions attended. [25]

A local randomized controlled trial by Chua aimed to investigate the effectiveness of an 8-week combined dietary-behavior-physical activity program using physical activity vs. step count goals in the management of overweight children and adolescents. 37 overweight children aged 9-15 years, not previously in a weight management program were included. Participants underwent a seminar on healthy living with dietary and physical activity recommendations and were later randomized to 2 groups. The control group was encouraged to have 60 minutes of moderate intensity activity per day. The pedometer group, on the other hand, was encouraged to take 2000 additional steps per day from baseline. Measurement data, 3-day food recall and activity or step logs were gathered every 2 weeks for 8 weeks. The main outcome measures were mean daily activity, steps per day, weight, BMI, BMI%, waist and hips circumference. Both groups significantly decreased in weight ($p<0.001$), BMI ($p<0.001$) and waist circumference ($p<0.001$). Physical activity level increased to what was recommended for the control group 60 minutes/day or increasing step counts to 2000/day. The pedometer group was able to successfully increase their steps to 7193 ($\pm$ 2391) to 12832 ($\pm$ 1904). It was concluded that the brief preliminary multi-component program that encourages increased physical activity or step count to recommended levels both reflected an increase in physical activity, reduced weight, BMI and waist circumference in the study population. [26]

The dramatic increase in obesity prevalence in the past few decades may be due to significant changes in lifestyle influencing children and adults alike. Disturbingly, obesity in childhood, particularly in adolescence is a key predictor for obesity in adulthood. Therefore prevention of obesity in childhood and effective treatment of overweight children are essential.

A summary of local studies on treatment of childhood obesity is tabulated (Table 7.9).

COMPLICATIONS

Obesity among children is not without consequences. It is associated with significant health problems in the pediatric age group and is an important early risk factor for development of adult morbidity and mortality. Medical complications common in obese children and adolescents include problems in cardiovascular health (hypercholesterolemia and dyslipidemia, hypertension), endocrine (insulin resistance, impaired glucose tolerance, type 2 diabetes mellitus, menstrual irregularity), pulmonary (asthma, obstructive sleep apnea), orthopedic (genu varum, slipped capita femoral epiphyses), gastrointestinal/hepatic (non-alcoholic steatohepatitis) and mental health (depression, low self esteem) [27].

Table 7.9. Summary of Local Studies on Treatment of Childhood Obesity

Author	Population/ Age/ Setting	Study De-sign	Intervention	Result
Chua, BJG (2005) [27	37 OW children, 9-15 yr old Metro Manila	Randomized Control	Combined dietary behavioural and physical activity (PA), weight management program (with and without pedometer)	Multi-component program that encourages increase PA and step count to recommended levels both reflected an increased PA, reduced weight, BMI and WC
Simao and Resurrecion (2007) [25]	110 obese and overweigth students 13- 16 yr old Urban school (Metro Mla)	Rndomized Control	Oatmeal diet	Oatmeal is an effective dietary alternative for reducing weight.
Tan-Ting and Llido (2011) [26]	44 obese children 5-17 yr old Hospital-based weight management Center	Prospective study	Multi-discip-linary weight-loss program (combined dietary, exercise and behavioural approach)	Decreased weight, BMI, body fat, WC and systolic BP

Seventeen local papers (11 published and 6 unpublished papers) report that in Filipinos there is an association of high BMI with various respiratory, immunologic, metabolic and cardiovascular dysfunctions.

Respiratory/Immunologic.

Asturiano and Cajigal-Baccay (2003) compared pulmonary function tests between obese and non-obese female adolescents and reported a 17% change in the Maximum Mid-Expiratory Flow Rate (MMEF), in the obese group (p=0.000) after a bronchodilator challenge test. [28] This suggests the existence of reversible obstructive airway disease in the obese. 158 females (47 obese and 111 nonobese) aged 10-16 years underwent baseline and post bronchodilator challenge test spirometry and peakflow determinations. Results revealed no significant difference in the baseline pulmonary function between the two groups and in the percent change in pulmonary function of obese vs. nonobese after nebulization. This predisposition among the obese explains the results of the cross-sectional prospective study of 230 (84 obese and 146 nonobese) children aged 2-18 years by Gutierrez-Santos and Gonzales-Andaya (2005) which revealed that obese children aged 10 years and above were 25.2 times more likely to develop bronchial asthma (OR = 25.19, CI = 3.12-203.19) compared to the nonobese . [29] A multiple logistic regression model showed that as BMI increases, the probability of developing bronchial asthma also increases (p=0.0001). Among patients diagnosed with bronchial asthma, Abueg and Kwong reported a statistically higher proportion of obese asthmatic children who experience attacks more than the nonobese (p=0.007) and who seek consult more than the nonobese (p=0.011). [30] Obese children are also at risk for atopy as reported in another study of 163 children (91 obese and 72 nonobese) aged 2-10 years by Gutierrez-Santos and Gonzales-Andaya. A 51.7% prevalence for atopy in the obese and a 29.2% prevalence in the nonobese was observed. Obese children were 1.8 times more likely to have atopy but this was not statistically significant. [31]

Metabolic.

Metabolic derangements reported locally among obese Filipino children are dyslipidemia, hyperinsulinemia and elevated liver enzymes. The prevalence of dyslipidemia among pediatric patients is tabulated below (see Table 7.10). Cua and Bugayong-Regidor (2000) did a cross-sectional study of 34 obese children (mean age of 10.8 years) with a male to female ratio of 1.8: 1. The mean BMI was 32.2 and the waist to hip ratio was 0.96, with no significant sex difference. All except one (33/34 or 97%) had acanthosis nigricans. The patient without acanthosis nigricans had a waist to hip ratio of 0.87 (lower than the mean). The mean fasting serum insulin level of the subjects was elevated at 34.8 µU/ml (mean for male: 30.4 µU/ml; female: 42.6 µU/ml). The fasting insulin to glucose ratio was 0.40 µU/ml (34.8 /87.9 mg/dl). Serum ALT (SGPT) level was elevated (mean: 51 Units) as well as cholesterol to HDL ratio

Table 7.10. Prevalence of Dyslipidemia among Obese Children and Adolescents.

Authors	Participants (n)	Dyslipid-emia (%)	Isolated Dyslipidemia (%)			
			High TG	High TC	Low HDL	High LDL
Chan-Cua & Regidor (2002) [33]	78 obese	NR*	36	31	34	19
Tan-Ang (2006) [34]	61 obese	NR*	43 males 30 females	55 males 78 females	18 males 48 females	39 males 43 females
Fernandez, et al. (2006)[a]	88 (28 overweight and 60 obese	100	99	45	58	31
Salud, et al. (2010)[b]	96 obese	86	60	38	21	20
Gardia-Feliciano et al. (2007)[c]	45 children (38 obese and 7 over-weight				100	

* No reported data

[a] Fernandez EG, Ramos-Abad L, and Chan-Cua S. Association between waist-for-height and sylipidemia among overweight and obese pediatric patients seen at the Out-Patient Department of the Philippine General Hospital. 2006. Unpublished

[b] Salud JLM, Chan-Cua S, Ramos-Abad L. A pilot study on the risk of dyslipidemia among obese adolescents with a family history of diabetes mellitus. 2010. Unpublished.

[c] Gracia-Felicano C, Padilla-Campos S, Laurel A. The validity of two-hour post-prandial glucose compared to fast blood sugar in the screening for type 2 diabetes mellitus among overweight and obese Filipino children and adolescents. 2007. Unpublished.

(4.2). The study subjects also had strong family histories of overweight or obesity, diabetes mellitus, dyslipidemia and hypertension. [32] The association of the risk of dyslipidemia with family history (FH) of diabetes mellitus was investigated by Salud, Chan-Cua and Ramos-Abad, in an, among 96 obese adolescents, with mean age 12 (IQR: 11,14) years. The overall incidence of dyslipidemia was 86%; 74% (n=65) in the FH+ and 67% (n=18) in the FH- group. An increased risk for those with FH+ to have elevated total cholesterol (OR 1.25; 95% CI 0.49, 3.19) and LDL-C (OR 1.32; 95% CI 0.50,7.34) was observed, but the data did not reach statistical significance. A significant association ($p \leq 0.05$) for FH+ and dyslipidemia was observed . (Salud JLM, Chan-Cua S, Ramos-Abad L. A pilot study on the risk of dyslipidemia among obese adolescents with a family history of diabetes mellitus. 2010. Unpublished)

In another study done among 75 obese children, Chan-Cua and Regidor reported that the top causes of isolated dyslipidemia were hypertriglyceridemia and hypercholesterolemia. [33] When the risk of dyslipidemia was compared between the obese and nonobese, Tan-Ang reported in a cross-sectional study of 91 healthy patients (61 obese and 30 nonobese) aged 11-15 years, a significantly higher abnormal cholesterol (p=0.002) and LDL (p=0.053) level among obese females. Increasing BMI is also significant. There is a 6.31 increased risk (95% CI 1.36,31.57) for females to have high total cholesterol when BMI is > 25 (p=0.005), a 5.37-fold (95% CI 1.02,30.5) risk for females to have elevated LDL-cholesterol when BMI is >30 (p=0.029) and a 31.5-fold risk for males (95% CI 3.81,346.65) to have elevated blood pressure when BMI is >35 (p=0.0001). A waist circumference greater than 80 cms was independently related to elevated cholesterol and elevated LDL in females. Among males, a WC > 85 cms significantly related to increased triglycerides (OR 5.82 95% CI 1.01,59.60) and WC >90 cms to elevated blood pressure (OR 16; 95% CI 2.54,143.4) . [34] Fernandez, Ramos-Abad and Chan-Cua (2006, unpublished) screened 88 (28 overweight and 60 obese) children and adolescents (mean age 11.86 $\pm$ 3.77 years, mean WHtR 0.56 $\pm$ 0.056) to determine the relationship between waist-for-height ratio and dyslipidemia in an unpublished paper in 2007. An elevated waist-for-height ratio (WHtR) tended to increase the risk for hypercholesterolemia by 2.6 times, for low HDL by 1.40 times, for high LDL by 1.34 times and for hypertriglyceridemia, indeterminate. However, the data did not reach statistical significance.

Insulin levels were also noted to be significantly higher among the obese (n=15) compared to nonobese (n=14) subjects aged 10-20 years by Mata and Parungao-Crisostomo. Linear regression revealed a high correlation of insulin with BMI (r=0.793; P<0.000). Physical examination findings of acanthosis nigricans (p<0.001) and striae (p<0.000) were correlated with obesity. The severity of acanthosis nigricans was correlated with degree of rise in serum insulin with a correlation coefficient of 0.805 (p <0.000). Interestingly, hyperinsulinemia was observed in association with normal blood sugar determinations. [35] An unpublished cross-sectional study done by Garcia-Feliciano, Padilla-Campos and Aurora (2007. Unpublished) on 45 children (38 obese and 7 overweight) aged 10-19 years revealed that the prevalence of Type 2

Diabetes Mellitus (T2DM) among children with BMI > 85th percentile for age and sex was 2.2% (95% CI 0.0562,11.7704) while the prevalence of impaired plasma glucose was 4.4% (95% CI 0.5428,15.1493). Five percent showed impaired glucose tolerance on the background of normal fasting blood sugar (FBS). High insulin levels implying insulin resistance were seen in 81% of subjects with normal fasting plasma glucose and in 61% of subjects with normal two-hour postprandial glucose. High density lipoproteins (HDL) were low in 100% of subjects. There was a significant correlation found between BMI and two-hour postprandial glucose at a 0.05 level of significance.

Balatbat, Abraham, Gabriel, et al studied the aminotrasferase activity of 197 children aged 6-18 years (103 obese and 94 nonobese). It has been reported that in fatty liver, increased aminotransferase activity occurs. Abnormally elevated levels of ALT (p=0.000) and AST (p=0.000) were observed. When the group was segregated by age bracket, those in the 6-10 year old and 11-14 year old obese group had significantly elevated ALT while those in the 6-10 year old obese group had elevated AST. [36] Aragon, Arboleda Fegidero, Chan-Cua, et. al. showed that the prevalence of nonalcoholic fatty liver disease (NAFLD) among 56 obese children and adolescents (22 males and 34 females) with mean age 12.38 $\pm$ 2.82 years was 66.1%. An increased waist hip ratio was significantly correlated with NAFLD (p=0.02). The prevalence of insulin resistance determined by computing HOMA-IR in these children was 83.9%. An elevated IR HOMA increases by three times the likelihood of developing NAFLD (OR 2.94 95% CI 0.734, 11.80). Among the biochemical parameters, triglycerides (p 0.013) and alanine aminotransferase (p 0.02) were statistically correlated with NAFLD (Aragon J.M., Arboleda Fegidero. D., Chan-Cua S., Ramos-Abad, L. Insulin resistance and non alcoholic fatty liver disease among obese children and adolescents: a preliminary study. 2005. Unpublished)

Cardiovascular.

Ricafort, Palma, Claveria et al investigated the association of hypertension among obese and overweight elementary school children aged 6-12 years in Naga City. Among 1,951 children (104 obese and 1,712 normal BMI), those from private schools were 15 times more likely to be obese compared to those from public schools (chi square = 105, p=0.000). Those who were obese were 3.2 times more at risk for hypertension (95% CI 1.94,5.27) in both public and private schools (p=0.000). The reported risk of hypertension was 12.2 (95% CI 2.48, 66.10) times greater (p=0.000) in the public schools (n=8 obese children) compared to 3.94 (95% CI 2.18, 7.11) times (p=0.001) in private schools (n=96 obese children). Data did not show any significant association between hypertension and overweight but the risk for having a high normal blood pressure was observed at the overweight level (OR 4.11 95% CI 2.06, 8.09; p=0.000). [10] It is not surprising that the data of Nunez, et al on the echocardiographic parameters of obese children revealed significant differences in the left atrial size (LA), interventricular septum (IVS), left ventricular mass (LVM), LVM/m^2 (LVM corrected for height in meters) and shortening fraction (SF) the obese compared to those overweight

and normal BMI. Echocardiographic measurements of 89 children aged 11-19 years (32 obese, 28 overweight and 29 normal BMI) were grouped and analyzed according to BMI. The LA (p=0.000), IVS (p=0.030), LVM (p=0.036), LVM/m^2 (p=0.000), and SF (p=0.000) were significantly higher among the obese group. The authors speculate that obese patients must increase cardiac output in order to perfuse the adipose tissue by increasing contractility and mass. Hence, left ventricular mass increases at the cost of diastolic abnormalities including left atrial size. [37] Lagman, Abraham, Chan et al, investigated the relationship between arterial elasticity, as measured by pulse wave velocity (PWV), and body mass index (BMI) of obese and normal-weight normotensive Filipino children in a cross-sectional study. Among 128 normotensive children aged 5-12 years, the heart-brachial artery PWV of the obese group (M=174.99, SD=13.41) was significantly different from that of the normal-weight group (M=164.54, SD=14.01), t(65)= 3.117, p= .002. Similarly, the heart-posterior tibial artery PWV of the obese group (M=349.73, SD=31.32) was also significantly different from that of the normal-weight group (M=323.17, SD=23.08), t(59)= 3.779, p< .001. Significant correlations were found between heart-brachial artery PWV and BMI (r= .397, p= .001, two-tailed) and also between the heart-posterior tibial artery PWV and BMI (r= .527, p< .001, two-tailed). The study showed that BMI is directly related to arterial stiffness, and that the beginnings of arterial stiffness can be noted as early as childhood. (Lagman RPS, Abraham LL, Chan DFF, Chan MM, Dayrit CAF, Fabie NAV, et al. A cross-sectional study on arterial elasticity as measured by pulse wave velocity in normotensive obese Filipino children. 2006. Unpublished)

These complications once thought to belong to the adult obese are now upon the pediatric age group. Chan-Cua investigated the prevalence of the metabolic syndrome (MetS) a term once used only on the adult obese population. Using the International Diabetes Federation (IDF) definition among 350 overweight and obese adolescents (206 male and 144 female, aged 10 to 18 years), an overall prevalence of 19% (17.4 % in obese adolescents, and 1.7% in overweight adolescents) was observed. The males (11.7%) had higher proportion of MetS than females (7.4%), but this was not statistically significant. Among those with MetS, 14.0% had 3 components, 5.0% had 4 components and none exhibited all 5 components. Ninety-nine percent of those with MetS had abdominal adiposity or central obesity, 25.0% hypertension, 24.0% hypertriglyceridemia, 17.0% low HDL, and 12.0% hyperglycemia. Sixty-seven percent of participants had elevated fasting insulin level (>15 uU/ml) and 70.0% had insulin resistance based on HOMA-IR (>3). Participants with MetS had higher insulin and HOMA-IR levels than those without MetS. (Chan-Cua, S. Prevalence of metabolic syndrome in overweight and obese Filipinos based on IDF definition. 2000. Unpublished)

Are these complications reversible with proper weight management or do these complications persist up to adulthood regardless? Longitudinal studies are lacking in local data. Also, there are no studies on the psychosocial impact of obesity on adolescents. Other gaps in our knowledge include the complications of obesity on

pediatric patients with polycystic ovarian syndrome, the skeletal problems that obese adolescents have, and the gastrointestinal problems of obese children such as fatty liver and gallbladder disease.

Knowing the complications of obesity among children compels us to aggressively prevent and control obesity. We have to keep educating parents and caregivers. We also have to push for media literacy so that parents, caregivers and adolescents will develop the habit of reading food labels and counting calories. They should learn to discern proper food choices when faced with enticing advertisements.

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Chapter 8

2012 Obesity Research Agenda Recommendations

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Obesity is a complex condition with genetic, metabolic, behavioural and environmental factors contributing to its development.

The Philippine National Nutrition and Health Survey has provided interval estimates for overweight and obesity at various time points: 1998, 2003, and 2008. These data clearly show increasing prevalence rates for adults, children and adolescents. Categorization of prevalence rates into age groups and gender have been clearly demonstrated. There are more women than men across all age groups who are overweight or obese. (1)

Most of the studies on the risk factors of obesity are cross-sectional and retrospective. The 16- year longitudinal study of Adair does show a strong link between socioeconomic development and rising prevalence of overweight and obesity. (2)

After a careful review of all existing obesity researches among Filipinos in the Philippines and overseas, the following areas are considered priority areas for scientific investigation:

The areas for research in the adult population include the following:

I. Epidemiology
   a. Definition of measures of obesity for screening and diagnosis, to establish accepted criteria for all Filipino studies.
   b. Validation of the use of international cut-offs for BMI, waist circumference, waist-hip ratio (WHO, Asia-Pacific criteria) in Filipinos as diagnostic criteria determining risk and disease
   c. Applicability of these criteria to existing international practice guidelines
   d. Prevalence rates and characteristics of the obesity phenotype in specific population groups, according to socioeconomic status or wealth index or family occupational group, parents' education, geographic area of residence (urban versus rural; coastal, inland,

or upland); dietary patterns, physical activity levels, presence of gestational diabetes in the mothers, new born birth size and weights.

e. Body composition of Filipinos in relation to different anthropometric parameters

II. Risk Factors

a. Role of genetic predisposition to obesity among Filipinos
b. Rationale for greater women : men prevalence rates of obesity
c. Role of sleep deprivation (with new work hours in call centers, etc), role of stress, maternal post-partum weight retention, menopause, PCO
d. Determination of risk factors such as C-reactive protein among obese adults
e. Effect of media and Western habits in encouraging high fat and high calorie food intake, role of food in the social fabric of the Filipino, eating out habits

III. Screening and Diagnosis

a. Definition of measures of obesity for screening and diagnosis, to establish accepted criteria for all Filipino studies.
b. Validation of the use of international cut-offs for BMI, waist circumference, waist-hip ratio (WHO, Asia-Pacific criteria) in Filipinos as diagnostic criteria determining risk and disease
c. Applicability of these criteria to existing international practice guidelines
d. Validation of the Obesity CPG as developed by the Family Medicine group

IV. Complications

a. Psychosocial impact of obesity
b. Effect on quality of life
c. Longitudinal study to understand the relationship between obesity and cardiovascular disease
d. Economic cost of the disease for adults in relation to cost of complications
e. Validation of the use of international cut-offs for BMI, waist circumference, waist-hip ratio (WHO, Asia-Pacific criteria) in Filipinos as diagnostic criteria determining risk and disease in predicting risk of obesity related co-morbidities
f. Anthropometric parameters and chronic disease risk

V. Prevention
   a. Awareness campaign
   b. Prevention trials using locally specific diets and physical activity programs

VI. Control
   a. Validation of Filipino diet and physical activity pyramid as treatment tools
   b. Drug trials for anti-obesity agents to include Filipinos (to determine efficacy and safety with determination of Filipino cut-off points)
   c. Bariatric surgery experience among Filipino patients data on results and long term outcomes
   d. Strategies for effective weight loss and healthy weight maintenance in adults

The areas for research among children and adolescents include the following:

I. Epidemiology
   a. Definition of overweight and obesity and its various anthropometric cut-offs such as BMI, waist circumference and waist : hip ratio specific for children and adolescents to provide a national consensus consistent with international research

II. Risk Factors
   a. Risk factors for long-term development of obesity: Feeding patterns (use of breast-feeding and other practices), physical activity levels to include school policy on Physical Education (PE) time, association of prevalence of mothers with Gestational DM, Birth size(SGA, LGA)
   b. Pre-natal and perinatal risk factors affecting obesity
   c. Effect of media and Western habits in encouraging high fat and high calorie food intake particularly in children and adolescents, the role of food in the social fabric of the Filipino as it particularly affects children and adolescents, family eating out habits, parents and caregivers' perception of a healthy weight
   d. Socio-cultural aspect of obesity
   e. Role of genetic predisposition to obesity among Filipinos

III. Screening and Diagnosis

IV. Complications
   a. Psychosocial impact on obesity
   b. Complications of Obesity in children: respiratory, immunologic, metabolic, and CV long term outcomes, scholastic performance, school absenteeism

c. Longitudinal studies to determine the cost of obesity and its complications, given its early onset

V. Prevention and Control
   a. Behavioural motivation for effective weight loss in children
   b. Studies on treatment with adjunctive medications and even bariatric surgery for children to better understand their indication, with safety measures, to cover urban and rural based children
   c. Strategies to target parents; targeted multidisciplinary approach

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