

Introduction

The Palestinian Territories have been undergoing a transitional situation characterized by rapid urbanization in the last few years. According to the PCBS census results, about 53% of the Palestinian population lives in urban areas¹. In the West Bank 47% of the population live in urban areas, with the lowest percent in the Salfit district (28%) and the highest in the Hebron district with about 67%².

A dual pattern of disease has been observed in the Palestinian Territories³. This pattern means that infectious diseases characteristic of developing countries exist alongside rising chronic diseases such as cardiovascular diseases, hypertension, diabetes and cancer which are also known as “modern-day diseases”. According to the Ministry of Health 1998 Annual Report, the main cause of death for children less than five years was respiratory diseases and pneumonia, among the other infectious diseases, accounting for 20.8% of the total deaths in that age group. In adults (20-59 years), cerebrovascular accidents (CVA) 10.6%, heart diseases 6.8%, and hypertension 5.7% were the common causes of mortality as

¹ PCBS. Population report, Palestinian Territory: first part (Final results). May, 1999.

² PCBS. Population report, West Bank: first part (Final results). May, 1999.

³ Barghouthi M, Lennock J. Health in Palestine: Potential and challenges. MAS discussion papers. Palestinian Economic Policy Research Institute. 1997.

well as elderly (above 60 years)⁴. Malignancy was also one of the main causes of death for children, adolescents, adults and elderly⁵.

Despite the improvement of the surveillance system of the Ministry of Health, there is not enough information about the prevalence of chronic diseases at the national level. However, the surveillance system gives good incidence data for infectious diseases⁶. Recently, two population-based local studies indicated a high prevalence of type 2 diabetes. The studies found the prevalence of type 2 diabetes to be 9.8% in a rural community⁷ and 10.3% in an urban community⁸.

There are many factors influencing the increase of such chronic diseases. Urbanization is often accompanied by a nutrition transition. This means there is an increase in the fat and sugar content in the diet and decrease in the fiber and

⁴Ministry of Health. The status of health in Palestine. Palestinian National Authority, Ministry of Health, Annual Report. 1998.

⁵Salhab A. Palestinian National Cancer Registry Annual Report 1998. Ministry of Health. Beit Jala Hospital. Report No. (99/01). September, 1999.

⁶Barghouthi M and Lennox J. op. Cit.

⁷Husseini A, Abdul-Rahim H, Awartani F, Jervell J, Bjertness E. Prevalence of Diabetes Mellitus and Impaired Glucose Tolerance in rural Palestinian population. (Accepted for publication in the Eastern Mediterranean Health Journal, WHO).

⁸Abdul-Rahim H.F, Husseini A, Giacaman R, Jervell J, Bjertness E. Diabetes Mellitus in an urban Palestinian population: Prevalence and associated factors. (Accepted for publication in the Eastern Mediterranean Health Journal, WHO).

complex carbohydrate content. The urban life style also implies lower levels of physical activity. The combination of these factors increases the risk of chronic disease development, including the risk of obesity development.

Fortunately, various providers of health services, including the Palestinian Ministry of Health, non-governmental organizations (NGOs), UNRWA and the private-for-profit sector, have worked together to control or even eliminate some infectious diseases through immunization programs⁹. There is still a prevalence of gastrointestinal and parasitic diseases in some areas mainly because of poor sanitation conditions.

Recently, health providers have recognized the increase of chronic diseases and now provide specialist care services. The main focus in dealing with these diseases has been the curative as opposed to preventative approach, which increases the burden on the health care system. It was estimated that the expenditure on the curative secondary and tertiary care as well as on pharmaceuticals and medical equipment was extremely high at 35% of total national expenditure in the year 1995. On the other hand, approximately 15% of the total expenditure of the health system was on the primary health care level¹⁰.

⁹Ministry of Health. Op.cit.

¹⁰Barghouthi M, Lennock J. Op. Cit.

UNRWA has also taken note of the emerging problem of chronic diseases, and since the beginning of 1998 it has implemented control programs for diabetes and hypertension. These programs follow a protocol that provides early detection of diabetes and hypertension, their management and early identification of their later complications¹¹.

Many studies have indicated that obesity, with its various types, is a risk factor for many types of cancers, cardiovascular diseases, diabetes and hypertension, in addition to gallstone, osteoarthritis and respiratory diseases¹².

Deep understanding of the factors associated with obesity development will help in planning preventive programs. Various factors were studied worldwide and have proven to have effects on obesity development, such as genetic susceptibility, age, sex and ethnicity; individual life style including smoking status, physical activity, marital status, eating habits and parity. In addition environmental status whether it was urban or rural community, developed or developing countries, rich or poor class and many other factors also contribute to obesity development.

¹¹UNRWA. Annual report of the department of health. The United Nations Relief and Works Agency for Palestine Refugees in the Near East. 1998.

¹²National Task Force on the Prevention and Treatment of Obesity. Overweight, obesity and health risk. Arch Intern Med 2000; 160: 898-904.

Finally, obesity is more likely to be a preventable disorder. The prevention of weight gain is easier, less expensive and more effective than treating obesity and its complications after its complete development. Moreover, obesity prevention also contributes to the prevention of several chronic diseases such as diabetes and hypertension.

Obesity is an emerging problem locally. However, there is a lack of information on the prevalence of obesity and its associated risk factors in the Palestinian Territories which is required to develop an effective preventive program.

The aim of the study

This study aims to assess the prevalence of obesity and its associated factors in an urban Palestinian population. The focus will be on the effect of the following factors on obesity distribution among the two sexes and different age groups: socioeconomic status, dietary habits, educational level as well as number of pregnancies for females and smoking status for males. Finally, the study will investigate the association between obesity and fat distribution with other chronic conditions such as hypertension and dyslipidemia.

Hypotheses

This study entails the following hypotheses:

- ~~(a)~~(i) The prevalence of obesity is expected to be high, as the situation in Jordan, Egypt and other neighboring developing countries in the region indicates.
- ~~(b)~~(ii) Obesity is higher among women than men; women begin to gain weight at define early ages in life. Women gain weight at their reproductive age because of multiple pregnancies, and gain weight at older ages because of menopause and hormonal changes.
- ~~(c)~~(iii) The older are expected to be more obese than the young because of lower physical activity and low metabolic rate. And the young are overweight because they have a more sedentary life style.
- ~~(d)~~(iv) The type of obesity differs between the sexes, where central obesity (fat storage in the abdominal and upper region of the body) is more common among men.
- ~~(e)~~(v) Smoking is associated with obesity; ex-smokers and non-smokers have the highest prevalence of obesity because smoking may have an effect on the metabolic rate and food intake.
- ~~(f)~~(vi) An individual's level of education is associated with their weight. Educated people try to have a body weight within the normal range, especially in women. Obesity is expected to be higher among people with low levels of education.
- ~~(g)~~(vii) The urban community is not homogeneous, and it is expected to find in the study population different communities with different characteristics. Each community has specific cultural and behavioral characteristics. People

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with different origins may have different educational levels, wealth status and eating habits, and these factors may have an effect on obesity development

~~(h)~~(viii) The socioeconomic status for the sample population is not the same. People with low social class are expected to be more obese than people in the higher socioeconomic class, especially among women.

~~(i)~~(ix) The dietary habits of obese individuals are expected to be different than those for individuals with normal weight. Obese individuals are expected to eat foods rich in saturated fats and sugar more frequently.

~~(j)~~(x) General and central obesity are associated with dyslipidemia, that is borderline-high total cholesterol concentrations, high triglycerides and low density lipoprotein (LDL) concentration and low concentration of high density lipoprotein (HDL).

~~(k)~~(xi) General obesity and central obesity are associated with hypertension, that is high systolic and diastolic blood pressure.

CHAPTER ONE: LITERATURE REVIEW

1.1 DEFINITION

Obesity is described as “an excess of fat storage in the body adipose tissue”, whereas overweight is defined as “an excess of body weight relative to height”¹³. Weight gain occurs first by increase in the size of fat cells in the body and later by increase in their number, to the extent that health may be affected significantly¹⁴. According to the World Health Organization’s (WHO) classification—which is based primarily on the association between body mass index (BMI) and mortality— a person with a BMI (the weight in kilo grams divided by the height in meters squared) of more than 30kg/m² is considered obese¹⁵ and a person with a BMI between 25 and 29.9 is considered overweight. Some researchers may classify BMI based on the 85th percentile of the study population¹⁶. However, using percentile cut-offs will minimize the estimated risk associated with obesity because the cut-off points will increase as a population gain weight.

¹³WHO. Obesity: Preventing and managing the global epidemic. Report of a WHO consultation on obesity. Geneva, 1998.

¹⁴Bray G. An Approach to the classification and evaluation of obesity. In Björntorp P and Brodoff B (editors). Obesity. London: J.B. Lippincott Com. 1992:294-308.

¹⁵ WHO. Op.cit.

¹⁶Megnien J, Denarie N, Simon A, Levenson J. Predictive value of waist to hip ration on cardiovascular risk events. Int J Obes 1999; 23:90-97.

1.2 OBESITY INDICATORS

A variety of measures are used for obesity. Generally, BMI is used to indicate general (overall) obesity and total fat storage¹⁷. BMI is widely used to estimate the prevalence of obesity and its associated risks within a population¹⁸, based on the assumption that an individual with a BMI of more than 30kg/m² has an excess of fat mass in his/her body with no distinction between muscle or fat weight. Further, BMI is considered an inappropriate measure for children and adolescents. Although there are some studies recommending the use of BMI in these cases, WHO recommends to classify overweight children as those exceeding the median weight-for-height plus two standard deviations¹⁹.

Abdominal (central or regional) obesity is a specific form of obesity. It is estimated using a waist to hip ratio (WHR), which is highly correlated with

¹⁷Dietz W, Bellizzi M. Introduction: the use of body mass index to assess obesity in children. *Am J Clin Nutr* 1999; 70(1):123S-125S.

¹⁸Shaper G, Wannamethee G, Walker M. Body weight: Implication for the prevention of coronary heart disease, stroke and diabetes mellitus in cohort study of middle aged men. *BMJ* 1997;314:1311.

¹⁹Gurney M, Gorstein J. The global prevalence of obesity: an initial overview of available data. *Wls Hlth statist. Quart* 1988; 41:251-254.

visceral adipose tissue²⁰, to identify individuals at increased risk of obesity related diseases²¹. BMI and WHR are the most routinely used anthropometric measures in epidemiological studies, because they are easy to measure and have high reliability. Recently, waist circumference was used to estimate intra-abdominal fat mass and total body fat²². It is a direct measurement of the waist circumference without standardizing it with hip circumference. It is thought that changes in WHR may result from changes in the hip circumference and result in increased or decreased risk estimation, especially among females with large hip circumferences. Thus, waist circumference may reflect abdominal obesity and associated risk²³.

²⁰Björntot P. Abdominal fat distribution and disease: An overview of epidemiological data. *Ann Med* 1992; 24:15-18.

²¹Ibid

²²Pounder D, Carson D, Davison M, Orihara Y. Evaluation of indices of obesity in men: descriptive study. *BMJ* 1998; 316: 1428-1429.

²³Han T, Van Leer E, Seidell J, Jean M. Waist circumference action levels in the identification of Cardiovascular risk factors: prevalence study in a random sample. *BMJ* 1995; 311:1401-1405.

1.3 OBESITY PREVALENCE

Obesity is considered pandemic in developed countries²⁴. Many intensive studies have been held around the world to study the prevalence of obesity, its etiology, effects on health and treatments for it. Different BMI cut-offs and terminology were used to refer to obesity and overweight status. In Britain, the prevalence of overweight has doubled between 1980 and 1991²⁵. Recent surveys in the United States show that overweight and obesity prevalence is even more than that in Britain and is still increasing. Over half the adult population in the US is overweight or obese (BMI ≥ 25)²⁶⁻²⁷. A similar situation is found in other developed countries. Further examples show the prevalence of obesity in Sweden, Finland and Western and Southern Europe are 10%, 20% and 15-20% respectively²⁸.

²⁴Egger G, Swinburn B. An "ecological" approach to the obesity pandemic. *B MJ* 1997; 315:477-480.

²⁵Prentice A and Jebb S. Obesity in Britain: gluttony or sloth. *BMJ* 1995; 311:437-439.

²⁶Must A, Spadano J, Coakley E, Field A, Colditz G, Dietz W. The disease burden associated with overweight and obesity. *JAMA* 1999; 282(16): 1523-1529.

²⁷Koplan J, Dietz W. Caloric imbalance and public health policy. *JAMA* 1999; 282 (16): 1579-1581.

²⁸Sundquist J, Johnsson SE. The influence of socioeconomic status, ethnicity and life style on body mass index in a longitudinal study. *Int J Epi* 1998; 27:57-63.

As developing countries are becoming more urbanized²⁹ with the accompanying rise in national income, people in these countries are adopting the life style of those in the developed countries. People are becoming less physically active, changing their dietary habits, and consuming larger quantities of food containing saturated fats, and sugar³⁰. Developing countries are under an “epidemiological and nutritional transition” that is increase in the prevalence of diet-related chronic diseases, and the continued presence of undernutrition and infectious diseases³¹. Obesity is becoming more prevalent in the developing countries. The increased prevalence of obesity in developing countries is most evident in urban and high-income areas. This is the situation, for example, in Asia and Latin America³². Hodge and colleagues studied the prevalence in Indian, Creole and Chinese Mauritian adults aged 25-74 years. Their study indicated an increase in the prevalence of overweight and obesity (BMI ≥ 25) for men from 26% to 35.7%, and for women, 37.95 to 47.7%³³.

²⁹Olomons N, Gross R. Urban nutrition in developing countries. *Nutr Rev* 1995;53(4):90-95.

³⁰Drewnowski A, Barry M, Popkin M. The nutrition transition: New trends in the global diet. *Nutr Rev* 1997; 55(2): 31-43.

³¹Romieu I, Hernandez-Aivera J, Ruel M, Rarra S. Dietary studies in countries experiencing a health transition: Mexico and Central America. *Am J Clin Nutr* 1997; 65(suppl): 1159S-653.

³²Barry M, Popkin BM. The nutrition transition in low- income countries: an emerging crisis. *Nutr Rev* 1994; 52:285-298.

³³Hodge AM, Dowse GK, Gareeboo H, Aberti KGMM, Zimmet PZ. Op. Cit.

The Arab and Mediterranean countries lack sufficient and representative information about obesity prevalence and associated risks. Some local studies indicate that these countries are facing the same epidemiological transition, that is obesity and other chronic diseases are becoming prevalent. A cross sectional study conducted in Iran reported that obesity is emerging although it is not yet high. The prevalence of overweight men (BMI 25-29.9) was 25% and 30% for women, while obesity prevalence was 8% and 2.5% for women and men respectively³⁴.

In Saudi Arabia, the obesity estimates ranges from 14% to 82%³⁵ according to different sources. Al-Nuaim et al found, in a cross-sectional national household survey in different regions in Saudi Arabia, that the prevalence of obesity was 24% and 16% for females and males respectively. Women had higher obesity prevalences than men but a lower overweight prevalence, and in both women and men, obesity increased with age³⁶ reaching a maximum at the 5th decade³⁷.

³⁴Pishdad GR. Overweight and obesity in adults aged 20-74 in southern Iran. *Int J Obes* 1996;20:963-965.

³⁵Madani K, Khashoggi R. The affluent diseases in Saudi Arabia. In Musaiger AO, Miladi SS(eds). *Diet related non-communicable diseases in the Arab countries of the Gulf*. Cairo: FAO/RNE; 1996.P:83.

³⁶Al-Nuaim AR, Al-Rubeaan S, Al-Attas O, Al-Daghari N, Khoja T. High prevalence of overweight and obesity in Saudi Arabia. *Int J Obes* 1996; 20:547-552.

³⁷Al-nuaim A, Al-Rubeaan K, Al-Mazrou Y, Khoja T, Al-Attas O, Al-Daghari N. Prevalence of diabetes mellitus, obesity and hypercholesterolemia in Saudi Arabia. In Musaiger AO, Miladi SS

Similar results were found in the Kuwaiti population. The prevalence of obesity in Kuwait is reported to be one of the highest in the world. Based on the WHO criteria for obesity classification, the prevalence of overweight and obesity was 70.2% and 36.4%, respectively³⁸. Females showed significantly higher overweight and obesity prevalences among all age groups than males³⁹.

In other Arab Gulf countries the focus of the studies was on females. Studies in Bahrain investigated females' obesity and found it to be similar to other Arab Gulf States, high in prevalence. Studies found that in Bahrain, about 39% of women were obese ($>120\%$ Wt/ht), and among mothers aged 18 years and above,

(eds). Diet related non-communicable diseases in the Arab countries of the Gulf. Cairo: FAO/RNE. 1996.

³⁸ Al-Isa AN. Prevalence of obesity among adult Kuwaitis: a cross-sectional study. *Int J Obes* 1995; 19:431-433.

³⁹ Al-Moussa Z. Nutrition- related chronic diseases in Kuwait. In Musaiger AO, Miladi SS(eds). Diet related non-communicable diseases in the Arab countries of the Gulf. Cairo: FAO/RNE; 1996.

the prevalence of obesity reached 64%⁴⁰. In Qatar the prevalence of obesity among women aged 20 years and over was found to be 63.7% (BMI \geq 25)⁴¹.

In Jordan, one study within four semi-urban communities indicated that almost half of the population was obese (BMI \geq 30)⁴². The prevalence of obesity in females was about two times higher than that for males. The estimated prevalence was 59.8% for females and 32.7% for males. Since the Palestinian and Jordanian populations have similar cultures, customs and life styles, and since about half of the Jordanian population is of Palestinian origin, it is expected that the Palestinians would have a high prevalence of obesity as well.

In Palestine, there is lack of information about obesity distribution among adults in the urban areas in specific and in the whole country in general. Some studies were conducted primarily to assess the nutritional status of children and pregnant women. One study investigated the relation of nutritional status to wealth, the results showed that children in the high wealth group weighed more and were

⁴⁰ Al-Musaiger AR. Diet related non-communicable diseases in Bahrain. In Musaiger AO, Miladi SS(eds). Diet related non-communicable diseases in the Arab countries of the Gulf. Cairo: FAO/RNE; 1996.

⁴¹ Al-Musaiger AR, Al-Khalal F, Shahbeek N. Factors associated with obesity among women attending health centers in Qatar. *Int j Food Sci Nutr* 1998; 49:S53-S57.

⁴² Ajlouni K, Jaddou H, Batieha A. Obesity in Jordan. *Int J Obes* 1998; 22:624-628.

taller than other children in the medium or lower wealth classes⁴³. To our knowledge in adults however, only one population-based study to date was held in a rural community to investigate the prevalence of chronic diseases, including obesity. The total obesity prevalence ($BMI \geq 30$) among women aged 30-65 years, was 42%. This was over double the prevalence of obesity among men of the same age group, which was about 19.5%. On the other hand, the prevalence of overweight was higher among men⁴⁴.

⁴³Abdelnour S. Study on nutritional status of a selected sample of under five Palestinian children. 1991.

⁴⁴Stene L, Giacaman R, Abdul-Rahim H, Hussein A, Norum, Homboe-Ottesen G. Obesity and associated factors in a Palestinian West Bank Village Population. (Unpublished).

1.4 FACTORS ASSOCIATED WITH OBESITY

Simply, obesity occurs when energy intake exceeds the energy expenditure over a period of time. This imbalance may be due to higher energy intake than required, or to a lower level of the energy expenditure or a combination of both. The excess is stored in the body in the form of fat in the adipose tissues⁴⁵. This excess in fat storage is the result of complex interactions between genetic, environmental, behavioral and cultural factors. Some of these factors will be discussed in this section.

1.4.1 Age

Some observational studies suggest that there are critical periods during early life associated with persistent obesity during adulthood. These stages include gestation and early infancy, the period of adiposity rebound that occurs between 5-7 years of age, and adolescence⁴⁶. A follow up study found that the prevalence of obesity was high among young men who were exposed to famine *in utero* in the first two trimesters of pregnancies. In contrast, the prevalence of those who were exposed to famine in the last trimester of pregnancy was low⁴⁷. One of the

⁴⁵WHO. Op. Cit.

⁴⁶Dietz W. Critical periods in adulthood for the development of Obesity. Am J Clin Nutr 1994; 59: 955-959.

⁴⁷Ibid.

explanation is that the fetuses adapt to the famine condition by changing their physiology and metabolism permanently⁴⁸. The period of adiposity rebound is the time at which the BMI for a child begins to increase and starts at the age of 5 years. Few cohorts found that for those who start the period of adiposity rebound before the age of 5 years, BMIs were significantly higher in the adolescence and adult stages. Finally, long term follow up studies suggested that the risk of both onset and persistence of obesity appear greater for females than for males⁴⁹. One potential explanation may be the pattern of fat deposition occurs at this time.

Obesity becomes more prevalent with age. It increases in men until the age of 50 and in women up to the age of 65, although this varies between different populations. This increase is due to the slowdown of the metabolic rate⁵⁰, especially among menopausal women, and to decrease of physical activity while still maintaining the same level of caloric intake as in younger ages⁵¹.

1.4.2 Sex

⁴⁸Barker D. The welcome foundation lecture, 1994: The fetal origins of adult disease. *Pro R Soc Lond.* 1995; 262: 37-43.

⁴⁹Dietz W. *Op. Cit.*

⁵⁰Grundy S. Multifactorial causation of obesity: implication for prevention. *Am J Clin Nutr.* 1998; 67(suppl): 563S-572S.

In general, after puberty, women have a higher prevalence of obesity than men, to ensure their reproductive capacity⁵². Normally, on average for a young adult, adipose tissue accounts for approximately 15% of body weight in males and about 27% in females⁵³. This is explained by the ability of the male's body to utilize energy in protein synthesis, while the female's body tends to change excess energy into fat storage⁵⁴.

In addition, males and females differ with respect to the location of fat deposition. Men tend to have more abdominal fat forming the “android” pattern of fat distribution. Women tend to have more gluteal fat (larger hip circumferences) forming the “gynoid” pattern of fat distribution.

Abdominal fat accumulations occur as a result of stimulation of fat uptake by combination of both cortisol and sex steroid hormones; or as a result of lipoprotein lipase inhibition or a combination of both.

1.4.3 Genetics

⁵¹Garrow J, James W (editors). Human nutrition and dietetics. (9th ed). England: Churchill Livingstone. 1993.

⁵²WHO. Op.C it.

⁵³Grundy S. Op.Cit.

⁵⁴WHO. Op. Cit.

Obesity tends to run in families. Studies in twins, adoptees and families have estimated that 40-70% of the variation in obesity is heritable⁵⁵. Guillaume et al studied familial obesity through three generations. This study showed high prevalences of obesity in school children, their parents and grandparents; it also showed the relation between birth weight and children's current BMI and their mothers' BMIs⁵⁶, suggesting that the genetic trait is inherited mainly through mothers.

Many gene loci have been identified in animal models as having an effect on fat distribution and storage in the body. Studies indicate that a single gene does not cause obesity, unless it is extreme (BMI>60)⁵⁷. Some researches support the hypothesis that inherited genes may be responsible for poor appetite control and low levels of lipid oxidation rate⁵⁸. Furthermore, abdominal obesity also tends to be inherited through families⁵⁹.

⁵⁵Comuzzie A, Allison D. The research for human obesity genes. *Science*. 1998;280:1374-1377.

⁵⁶Guillamue M, Lapidus L, Beckers F, Lambert A, Björntorp P. Familial trends of Obesity through three generations: The Belgian-Luxembourg child study. *Int J Obes* 1995;19(suppl 3):35-59.

⁵⁷Rosenbom M, Leibel R, Hirsch J. Obesity. *New Eng J Med* 1997; 337(6): 396-4-5.

⁵⁸WHO. Op. Cit.

⁵⁹Lemieux S. Genetic susceptibility to visceral obesity and related clinical implications. *Int J Obes* 1997; 21:831-838.

However, heredity alone does not explain the obesity pandemic occurring worldwide. Obesity appears to be a result of many complex interactions between many genes and the environment.

1.4.4 Eating and dietary patterns

People in developed countries have undergone many changes in their dietary habits. Intake of sugar and fats, especially unsaturated fats, has markedly increased. This trend is emerging also in the developing countries, and it is more common in the urban and high-income areas⁶⁰. The availability of a wide variety of highly palatable, an inexpensive food enhances the consumption of large quantities of it⁶¹. In the Near East Region, there has been an increase in the availability of all food groups such as cereals, sugar, vegetable oil, meat and poultry over the last 30 years⁶². Several studies support the link between obesity and high fat intake –independent of total energy intake⁶³. One of the explanations for this link is that fat is considered the least satiating macronutrient, in addition to

⁶⁰WHO. Diet, Nutrition, and the prevention of chronic diseases. WHO technical report Series 797. Geneva. 1990:36-39.

⁶¹James H, Peters J. Environmental contributions to the obesity epidemic. *Science* 1998; 280: 1371-1377.

⁶²Miladi S. Changes in food consumption in the Arab countries. FAO regional Office for the Near East. 1996.

⁶³Romieu I, Willett W, Stapfer M, Colditz G, Sampson L, Rosner B Hennekens C, Speizer F. Energy intake and other determinants of relative weight. *Am J Clin Nutr* 1988; 47:406-412.

its low ability to suppress hunger. Further, fat has high energy density and storage capacity in the body⁶⁴. On the other hand, fiber intake, which may protect against obesity and consequently its complications by lowering insulin levels⁶⁵ has markedly decreased.

Dietary variety may also influence body weight. A high variety of sweets, snacks, condiments, entrees and carbohydrates, joined with a low variety of vegetables promote long term increase in individuals' energy intake and body weight⁶⁶.

1.4.5 Physical activity

In these days, people tend to adopt sedentary life styles with low physical activity. Urbanization is associated with motorized transport and mechanized equipment such as televisions, computers and video games, and all these factors have a negative effect on an individual level of physical activity⁶⁷. Even in the workplace, computerization and mechanization have negatively influenced the physical activity, and only a small proportion of manual work now, involves

⁶⁴WHO. Op. Cit.

⁶⁵Ludwig D, Rereira M, Kroenk C, Hilner J, Horn L, Slattery M, Jacobs D. Dietary fiber, weight gain and cardiovascular disease risk factors in young adults. JAMA 1999; 282:1539-1546.

⁶⁶McCrory M, Fuss P, McCallum J, Yao M Vinken A, Hays N, Roberts S. Dietary variety within food groups: association with energy intake and body fatness in men and women. Am J Clin Nutr 1999; 69:440-7.

relatively high activity⁶⁸. It was estimated that one hour of average office work uses only 10 to 15 calories⁶⁹.

Studies investigating the effect of television viewing estimated those men who watch television for more than 3 hours a day and women who watch television between 3 to 4 hours a day are twice as likely to be obese than those who viewed television less than one hour a day. Buchowski and colleagues explain this by changes in the energy balance. They observed that obese individual choose to watch television as a form of leisure activity more often than non-obese individuals. As a result they reduce other forms of physical activities⁷⁰.

Exercise is negatively associated with obesity and is considered as one of the treatment options for obesity⁷¹ and weight control. One longitudinal study reported that those who stopped exercise had a larger increase in BMI than those who were having regular exercise⁷².

⁶⁷ Prentice A, Jebb S. Op. Cit.

⁶⁸ WHO. Op.Cit.

⁶⁹ Kirschmann G, Kirschmann J. Nutrition Almanac (4th ed). McGraw-Hill. New York. 1996.

⁷⁰ Buchowski MS, Sun M. Energy expenditure, television viewing and obesity. Int J Obes 1996; 20:236-244.

⁷¹ Weinstoch R, Dai H, Wadden T. Diet and exercise in the treatment of obesity. Arch Intern Med 1998;158:2477-2483.

⁷² Sundquist J, Johnsson SE. Op. Cit.

1.4.6 Smoking

The link between smoking and weight gain is not clear among smokers, but it becomes more obvious after smoking cessation. Weight gain is strongly related to smoking cessation, although major weight gain (>13Kg) occurs in only a minority of those who stop smoking. Williamson et al found in a follow up study that the mean weight gain due to cessation of smoking was 2.8kg in men and 3.8kg in women. They found also that major weight gain occurred in 9.85% of men and in 13.4% of women who quit smoking⁷³.

The relation between smoking and weight gain was reported to be U-shaped in several studies. That is, non-smokers and heavy smokers have the heaviest body weight, while moderate smokers weighed the least. The U-shaped relation was observed to be true for males. However, some studies showed that female heavy smokers have the least body weight⁷⁴. These relations are thought to be explained by the ability of smoking to induce an acute rise in metabolic rate and to reduce food intake through its effect on the sympathetic nervous system. Thus, smoking

⁷³Williamson D, Madabs J, Anda R, Kleinman J, Giovino G, Byers T. Smoking cessation and severity of weight gain in a national cohort. *New Eng J Med* 1991; 324(11): 739-45.

⁷⁴Klesges R, Klesges L. The relationship between body mass and cigarette smoking using a biochemical index of smoking exposure. *Int J Obes* 1993; 17:585-581.

cessation would return sympathetic activity and catecholamine levels to normal and, thus facilitating more efficient energy storage and weight gain.

1.4.7 Socioeconomic status

Studies show that high socioeconomic status (SES) is negatively correlated with obesity in developed countries⁷⁵ but positively related with obesity in the developing countries. Once the national income increases in the developing countries, the positive relationship between SES and obesity is slowly replaced by the negative correlation as seen in developed countries. However, individuals in different SES groups may have different patterns of dietary intake and physical activity. There is a difference between males and females in the relation between obesity and SES. Among women, obesity is associated with a lower SES; and among men, obesity is associated with higher SES⁷⁶. Obesity is considered as one of the wealth indicators in some cultures.

Education, in some communities, may be used as an indicator for the socioeconomic status, and is consequently associated with obesity. Generally, those with high levels of education are wealthy, or wealthy individuals have high

⁷⁵James W, Nelson M, Ralph A, Leather S. Socioeconomic determinants of health: the contribution of nutrition to inequalities in health. *BMJ* 1997; 314:1545-1549.

⁷⁶Young T. Sociocultural and behavioral determinants of obesity among Inuit in the central Canadian Arctic. *Soc Sci Med* 1996; 43(11): 1665-16671.

level of education. In developed countries, body weight is inversely associated with individual's level of education. One of the potential explanations is the attitude of educated females to their body image and body weight. This relation was supported in many studies for females. However, it was debatable, in some studies, for males⁷⁷.

1.4.8 Number of pregnancies

The developing countries in general and the Arab world in specific, have high fertility rates and high prevalences of female obesity. Thus it is thought that the number of pregnancies is associated with obesity. Since the interval between pregnancies is usually short, this does not allow the women to lose the weight gained during pregnancy⁷⁸. It was also suggested in a longitudinal study that women who gained weight during the first pregnancy gained more weight from one pregnancy to the next⁷⁹. Nevertheless, the relation between parity and obesity is debatable and the results differ according to the study design used. In cross-

⁷⁷Madani K, Khashoggi R. The affluent dietary diseases In Saudi Arabia. 1996. In Musaiger AO, Miladi SS(eds). Diet related non-communicable diseases in the Arab countries of the Gulf. Cairo: FAO/RNE; 1996.P:83.

⁷⁸Hodge AM, Dowse GK, Gareeboo H, Aberti KGMM, Zimmet PZ. Incidence, increasing prevalence and predictors of change in obesity and fat distribution over 5 years in the rapidly developing population of Mauritius. *Int J Obes* 1996;20: 137-146.

⁷⁹Harris HE, Ellison GTH, Holliday M, Lucassen E. The impact of pregnancy on the long-term weight gain of primiparous women in England. *Int J Obes* 1997; 21:747-755.

sectional studies the relation between obesity and parity may be the result of confounding factors.

1.5 OBESITY AND CHRONIC DISEASES

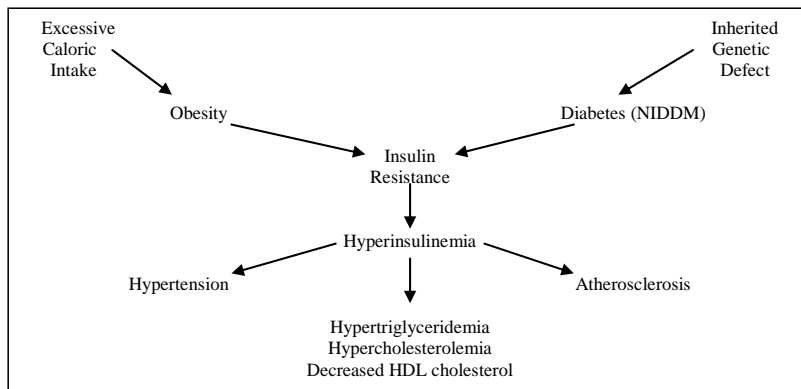
Obesity can induce multiple metabolic abnormalities, which include dyslipidemia (borderline-high cholesterol concentration, high triglyceride and LDL- cholesterol concentrations, and low HDL-cholesterol concentration), raised blood pressure, insulin resistance and glucose intolerance, and abnormalities in the coagulation system (procoagulant state). The cluster of these factors was observed and termed Syndrome X, the Insulin Resistance Syndrome, or the Multiple Metabolic Syndrome⁸⁰. It is believed that the metabolic syndrome is the precursor of cardiovascular disease and type 2 diabetes mellitus.

The mechanisms by which obesity can affect body organs are not clear. One hypothesis states that high concentrations of non-estrified fatty acids resulting from energy overload may affect many organs in the body such as the skeletal muscles causing insulin resistance by switching energy utilization from carbohydrates to fatty acids⁸¹. Insulin resistance is defined as “resistance to insulin stimulated glucose uptake”. It may stimulate pancreatic β -cells and result in hyperinsulinemia as in **Figure 1**, which result, first, impaired glucose intolerance and then type 2 diabetes.

⁸⁰WHO. Definition, diagnosis and classification of diabetes mellitus and its complication: diagnosis and classification of diabetes mellitus. Geneva. 1999. P: 31-33.

⁸¹Grundy S. Op.Cit.

Figure 1: Obesity effect mediated by insulin resistance syndrome.



(Reproduced from insulin resistance: multifaceted syndrome responsible for NIDDM, obesity, hypertension, dyslipidemia and atherosclerotic cardiovascular disease)

Another organ which can be affected by the high concentration of non-estrified fatty acids, is the liver. As a result, triglyceride and cholesterol syntheses and release from the liver are increased⁸².

The presence of high concentrations of non-estrified fatty acids and insulin can induce the synthesis of coagulation proteins and result in a pre-coagulant state.

Finally, obesity is usually observed with high blood pressure. One of the hypotheses that explain this association is the discrepancy between the increased body mass and the unchanged filtration surface area, which leads to the

⁸²Liese A, Mayer-Davis E, Huffner S. Development of the multiple metabolic syndrome: An epidemiological perspective. *Epi Rev* 1998; 20(2):157-172.

development of hypertension⁸³. Another hypothesis emphasizes the role of hyperinsulinemia caused by obesity. Studies assert that insulin resistance may affect the kidney by one or more of the following mechanisms: increasing sodium ion retention, activating the sympathetic nervous system, increasing vascular sensitivity to the vasoconstrictor effect and causing proliferation of arterial smooth muscle cells⁸⁴.

The effects of obesity vary with age. For obese persons in a prospective cohort study, mortality increased with body weight increase. But the excess mortality due to obesity decreased with age at all levels of obesity. Individuals aged 18 to 29 years with BMI ≥ 40 had the highest mortality rate⁸⁵ among all other ages.

The risk associated with obesity may start at early life stages. Vanhala et al indicated that half of the obese children in a cohort started at 1947 had become obese adults with a high risk of developing the metabolic syndrome, which is

⁸³Eliahou H, Shechter P, Blou A. Hypertension in obesity. In Björntorp P and Brodoff B (editors). Obesity. London: J.B. Lippincott Com. 1992: 532-539.

⁸⁴DeFronzo R, Ferrannini E. Insulin resistance: A multifaceted syndrome responsible for NIDDM, obesity, Hypertension, dyslipidemia and atherosclerotic cardiovascular disease. Diabetes Care 1991; 14(3): 173-194.

⁸⁵Bender R, Jöckel Kh, Trautner C, spraul M, Berger M. Effect of age on excess mortality in obesity. JAMA 1999; 281:1498-1504.

thought to be the precursor for diabetes mellitus and CVD. Also the risk was lower among obese adults who had not been obese at childhood⁸⁶.

Abdominal obesity has been examined in relation to CVD and type 2 diabetes mellitus. It appears to be an independent contributor to CVD and type 2 diabetes mellitus at a given level of general obesity⁸⁷.

From an epidemiological point of view, the relation between obesity and CVD is now well established. The greater the degree of obesity, the higher the blood pressure, insulin resistance, triglycerides and low-density lipoprotein (LDL-cholesterol) levels. As a result obesity is associated with increased risk of coronary and stroke events⁸⁸.

Hypertension is associated with both general and abdominal obesity. Although large proportions of hypertensive individuals are obese, not all hypertensives are obese and vice versa. The association becomes apparent when an obese person

⁸⁶Vanhala M, Vanhala R, Kumpusalo E, Halonen P, Takala J. Relation between obesity from childhood to adulthood and the metabolic syndrome: population based study. *BMJ* 1998; 317:319-320.

⁸⁷Gurney M, Gorstein J. The global prevalence of obesity: an initial overview of available data. *Wls Hlth statist. Quart* 1988; 41:251-254.

⁸⁸Kannel W, D'Agostino R, Cobb J. Effect of weight on cardiovascular disease. *Am J Clin Nutr* 1996; 63(suppl): 419S-422S.

with high blood pressure loses weight; his /her blood pressure is reduced to the accepted normal range.

The Framingham study found that an excess of only 20% in body weight over ideal weight (which is estimated to be 22kg/m²) is associated with an eight-fold increase in the incidence of hypertension later on⁸⁹. The association with increased body weight is not only among children but also among adults.

Summary

Obesity occurs as a result of an imbalance between energy intake and expenditure. Although heredity is an important determinant of obesity, its effect is rather small. However, obesity is more likely to result from the interaction between genes and environmental factors, such as physical activity, diet and cigarette smoking. Age, sex and socioeconomic status are also related to the frequency and distribution of obesity.

Obesity is linked to many chronic diseases. Obesity has a role in the development of cardiovascular diseases and type 2 diabetes mellitus. The postulated hypothesis is that in obese individuals the increase in free fatty acids causes insulin resistance and consequently an abnormal serum lipids profile and impaired glucose

⁸⁹Epstein F, Higgins M. Epidemiology of obesity. In: Björntorp P and Brodoff B (editors). Obesity. London: J.B. Lippincott Com. 1992: 330-342.

tolerance. Finally, hypertension may be caused directly or indirectly by obesity and mainly abdominal obesity.

CHAPTER TWO: BACKGROUND

2.1 Ramallah City

The city of Ramallah, located 16 kilometer north of Jerusalem, was historically known as a summer resort, rich in agricultural lands and springs. Olive trees were the main features of the city and its surrounding villages. By 1942, urbanization had begun to replace the trees with buildings⁹⁰. The urbanization process spread in all directions in a circular form until it reached the buildings in al-Bireh City, which is today Ramallah's twin city.

The City of Ramallah is centrally located on the road between Jerusalem and Nablus. Further, external money, sent by natives who had migrated to the Americas, encouraged the building of houses, commercial stores, hotels and schools, and finally the building of the municipality. In addition, many professionals such as physicians, teachers, and lawyers, etc started moving into the center of Ramallah City. All these factors have helped in the rapid development of Ramallah City into an urban center. Although not heavily populated, by the 1960's, Ramallah had turned into the principal resort town of the area, and possessed many of the characteristics of an urban center.

⁹⁰ Younis N et al. The Transformation of an urban community: Studies in the social morphology, ruralization and the informal sector in the City of Ramallah. Afaq Filistinyya Series, working paper No.4, March 1991 (Arabic Text)

Today Ramallah is one of the main cities in the West Bank, and its dynamic commercial center provides numerous employment opportunities. Many government offices are centered there, in addition to hotels, restaurants and cafes. An active transport system facilitates movement within the city and connects it to other parts of the West Bank.

According to the 1997 census results, the total population of the city is about 17,851. In Ramallah city, 48.3% of the population are males and 51.7% females, while in the larger Ramallah district, 50.1% are males and 49.9% females. Refugees comprise the majority, about 60%, of the population. Before 1948, Ramallah was predominantly Christian but, as a result of the in- migration of Muslims and out-migration of Christians, the Muslims proportion has increased since then.

2.2 Old Ramallah City

The first urban area formed in Ramallah is known as the Old City or Old Ramallah. Old Ramallah city is comprised of three different communities⁹¹: Native original families present in Ramallah since before 1900, refugees from the 1948 war, and migrants from Ramallah villages or cities such as Hebron.

⁹¹Shaherr A. outsiders who settled in Ramallah. In Ramallah: history and genotypes. Birzeit University. 1982. 25-32.

Nowadays, natives form the minority of Old Ramallah residents because of the migration of the majority to the Americas⁹². The economic status of old Ramallah natives is relatively high⁹³, and they earn money by renting the houses they own and receive external support from their relatives in the Americas. Refugee residents in old Ramallah are mainly from Lydda (al Lidd), al-Ramleh, and the surrounding villages along the Mediterranean Coast whose homes were destroyed or occupied in the 1948 war. These refugees were absorbed in the Ramallah City community and did not live in camps, in part because they were mainly Christians and in other part because it was easy for them to reach Ramallah city through a main road connecting their villages with Ramallah. Their integration with the Ramallah city community may have also been due to their higher education than other refugees, which facilitated employment. These refugees mainly have private businesses today, and generally their economic status is good. Migration from Hebron villages (Qaysiyah) and Ramallah surrounding villages occurred mainly for the purpose of seeking employment. The poorest groups in Old Ramallah are those who were absorbed into the informal sector⁹⁴, mainly the migrants from Hebron district-villages

⁹²Younis N et al. Op.cit.

⁹³Ibid.

⁹⁴Ibid.

CHAPTER THREE: METHODOLOGY

3.1 The survey process

This study is part of a larger population-based cross-sectional study, conducted to investigate the prevalence of chronic diseases, mainly diabetes, in an urban Palestinian area, Old Ramallah City.

The larger study took place in two phases⁹⁵. The first phase was a census survey of the population in the study area that was delineated with the aid of a field guide and municipality maps. In the second phase eligible subjects were invited to participate in a more comprehensive procedure, including a medical history check, anthropometric measurements, blood tests and administering a standardized questionnaire assessing various risk factors.

The first phase was carried out in September through November 1997, before the National Census Survey was conducted. The study area was divided into eight blocks. A complete census of the population in the study area was held, where all estimated 600 households were visited. Five teams of two local field workers each conducted the survey and interviewed the female heads of households (household was defined as a group of people eating the main meal together). They provided

⁹⁵Adul-Rahim H, F, Hussein A, Giacaman R, Jervell J, Bjertness E. Op.Cit.

information on each member of the household with regard to age, sex, social status, educational level, occupation, and dietary data. Dietary data included a recall list of 25 food items covering the main contributors to energy consumption. Quantities were reported in units individually preferred by the respondent according to the ease of conceptualization.

The second phase took place during April and May 1998. Eligible subjects were defined as those who had been residing in the Old City for at least six months prior to the individual testing phase and were physically and mentally able to participate in the screening process. Men between 30 and 65 years and women between 15 and 65 years of age in Old Ramallah City were invited to participate in the study. Eligible subjects were visited by a field worker and were then given appointments to come to the survey site (which was set up at a community center) for testing. They were asked to fast for 12 hours before the appointment and to bring all their current medications to the survey site.

On their appointed day⁹⁶, trained fieldworkers asked the participants to provide information on educational level, employment, physical activity, smoking history, history of diabetes in the family, an 11-item qualitative food frequency list and a 24-h dietary recall (but without estimation of portion sizes), using a standard questionnaire⁹⁷.

⁹⁶See Annex 1, Survey Methodology Diagram.

⁹⁷Annex II shows some of the questions out of the questionnaire.

Anthropometric measurements (including height, weight, waist and hip circumferences) were taken for each participant by trained fieldworkers. The height was measured to the nearest 1-cm with the individual standing to a wall-mounted rod and wearing no shoes. Weight was measured to the nearest 0.1-kg with the subjects wearing a light layer of clothing. Balance scales were calibrated every morning. Waist circumference was measured with the subject standing and breathing normally at the midpoint between the iliac crest and the lower margin of the ribs to the nearest 1-cm. Hip circumference was measured, to the nearest 1-cm, as the maximum circumference around the buttocks posteriorly and at the symphysis pubis anteriorly. Waist and hip measurements were taken in duplicate. A third measurement was taken if the first two were more than 2-cm apart, and then the average of the two closest values would be calculated.

Trained nurses recorded blood pressure measurements and a history of selected medical symptoms for each subject. Blood samples were collected using sodium fluoride, plain and EDTA tubes for glucose measurement, chemistry and hematology analyses, respectively.

3.2 Data coding

Two indices were used to measure overweight and obesity: body mass index (BMI) and waist-to-hip ratio (WHR).

Body mass index (Quetelet index) was calculated by dividing the weight (in kilograms) by the height (in meters) squared. BMI was used to estimate the prevalence of overweight and general obesity in the sample population for both sexes. Obesity was classified using the World Health Organization⁹⁸ (WHO) criteria, and recoded into three categories as shown in **Table 1**.

Table 1: BMI classification using WHO criteria⁹⁹.

BMI	
Normal	<25 kg/m ²
Overweight	25-29.9 kg/m ²
Obese	≥30 kg/m ²

Age standardization was done for the study population to eliminate the influence of age on the prevalence. The age structure of the study population was adjusted

⁹⁸See Annex III. WHO classification.

⁹⁹WHO. Op.Cit.

to the WHO “world” standard population structure¹⁰⁰ and the Palestinian population structure¹⁰¹ using direct standardization.

The prevalence of obesity was studied in relation to age and sex. The prevalence of obesity was studied for males aged 30 to 65 years and for females between the ages 15 to 65 years old. The age of females was divided into three groups 15-19, 20-49, 50-65 years. The ages 20 to 49 represent the reproductive females, while the ages 50 to 65 years represent the menopausal age.

The ratio of overweight to obesity was used to express the relation between them: <1 indicates more obesity prevalence, and >1 indicates more overweight prevalence.

Waist to hip ratio was calculated as a measure of central obesity. Because of the difference between males and females in fat distribution in the central (abdominal) area, different cut-off points were used for each sex. Males with $WHR \geq 0.9$ were classified as obese while females with $WHR \geq 0.85$ were considered obese¹⁰².

¹⁰⁰Jenicek M, Feinstien A. Epidemiology: The logic of modern medicine. Monterial: EPIMED. 1995.

¹⁰¹PCBS. Op.Cit.

¹⁰²WHO. Definition, diagnosis and classification of diabetes mellitus and its complication: diagnosis and classification of diabetes mellitus. Geneva. 1999. P: 31-33.

The origin variable was recoded into five groups: 1) the natives original to Ramallah City defined as those living in Ramallah before the year 1900, 2) Ramallah villages migrants whose origin is one of Ramallah villages, 3) 1948-refugees whose villages were occupied in 1948, mainly from al-Lidd, al Ramleh and the surrounding coastal villages, 4) Hebron villages migrants who came from Hebron surrounding villages, mainly al-Thahriya, Sa'eer and Samou', and 5) individuals from different areas in the Palestinian territories or other countries, including recent returnees (following the Oslo Peace Accords).

Wealth index: Variables used to calculate a wealth index included amenity ownership (including television, dish, video, car, telephone, overall house condition), house type (new, old or renewed house), house ownership (owned or rented), dependency ratio (number of family members divided by the number of workers), crowding ratio (the number of family members divided by the number of rooms) and head of household's level of education and work. The wealth index was calculated in two ways.

First, all variables were cross-tabulated with each other. The variables significantly associated with each other were included in the index while insignificant variables were excluded. The relation between variables was interpreted from both statistical ($\alpha=0.05$) and sociological (the contribution of the variable to wealth status) points of view. Television ownership, head of

household's level of education and the work of the head of household were excluded from the index. Then for the remaining variables, wealth was ranked based on amenity ownership, dependency and crowding ratio. The label that was assumed to indicate higher wealth status was counted as one. For example, with the type of house: the value one was given to new house made of stone. Another example is car ownership, where the value one was given to owning a private car, etc. The next step was counting the value one for all variables. The label wealth (1) was given to those with a total of 1, etc, until wealth (9) for those having a total of 9. The resulting wealth index, after studying its frequency, was further divided into three categories. Lower wealth class for those having a total of 2 or less, middle class for those having a total of 3-6, and the higher class for those having a total of at least 7.

The second method was the scoring method. All variables involved in the index were recoded in an ordinal scale from 0 to 100 points. Then all the variables were combined using a weighted average, with weights determined relative to the variance that each variable explained. An overall index was obtained. The weights were obtained by using the principle component analysis. The number (N) of variables that were involved in the analysis was reduced using the principle component method to three (k) components. Each component explains a certain percentage of the overall variance. The variables were divided into k groups representing the k components. Each variable belongs to a certain component if it has the highest correlation with the component. Then for each component, a sub-

index was constructed using the weighted average with weights proportional to the correlation of the variable with its corresponding component. Then all the sub-indicators of the k components were combined with an overall index with weights for each component proportional to the amount of variance it explains¹⁰³.

The wealth index ranged from 0.6 to 8.5. Further, the distribution of the derived wealth index was studied to determine the cut-off points. The wealth index was then divided into three categories.

The correlation between the two indices was very strong at about 0.90. The wealth index used in the analysis was estimated using a combination of the two methods. That is, the first method was used for determining the variable to be included in the index, and the index was calculated using the scoring method.

The smoking variable was recoded into three labels: current smoker, ex-smoker and non-smoker, and it was studied only for males because of the low number of smoking females. This variable was further split into three separate variables: non-smoker (yes/ no), ex-smoker (yes/ no) and current smoker (yes/ no).

The education variable was recoded into two categories using a cut-off point of 9 years of education to study the relation with obesity, but the categories 0-6, 7-9,

¹⁰³Awartani, F. The proceedings of the ISI 99 conference, 52nd. Session, Book1, 1999, P: 49 - 50.

10-12 and >12 were used to study patterns with wealth and origin. Education was used as continuous variable in the regression model.

The number of pregnancies variable was recoded into 0-4 pregnancies, 5-7 and more than 7 pregnancies after examining first the frequencies of the number of pregnancies and finding the natural cutoffs.

Food variables were compared between the two sexes, different ages, wealth groups and obesity levels. Foods from twenty-four hour (24-hr) recall were recoded into four major meals representing breakfast, lunch, dinner and snacks between meals. Food items were recoded into 11 food types. Food types were: 1) breads and pies (pies include manaeesh Za'ter, eggs or meat), 2) dairy products including eggs, 3) fats and oils, 4) vegetables, 5) fruits, 6) meat (including red meat, poultry and fish), 7) cooked dishes (including traditional dishes), 8) beverages, 9) sweets, 10) pulses and nuts, and 11) miscellaneous (which include frika, maftuul, pasta, breakfast cereal, etc). Food groups consumed over a day were recoded by counting food frequency for each item in each meal; food group frequency ranged from 0 (not consumed) to 9 (consumed nine times per day).

A food frequency list for 13 items included, fruits, vegetables, white cheese, yellow cheese, meat, poultry, fish, eggs, yogurt, labaneh, fried food, Arabic sweets, chocolates and bonbon. Each item in the list of food frequencies was originally divided into four groups: consumed almost daily, 2-3 times a week, 2-3

times a month and 1-2 times a year. These four frequencies were re-grouped into two groups: frequently (consumed two or more times per week) and less frequently (two to three times per month or less). Finally, items in the list of food frequency were grouped according to their nutritional content. For example, white cheese, labaneh and yogurt, meat and poultry were grouped in the food rich in protein (see annex III). Certain food items which have more than one nutritional value, such as meat, which is high in protein and fat, were included in more than one group.

Bread and beverages including tea, coffee and soft drinks were recoded into three groups: not consumed, consumed one to two times per day, and consumed more than two times per day.

Serum lipid variables were recoded into binary variables using WHO cut off points. The abnormal level was set at >250mg/dl for total cholesterol, >39mg/dl for low density lipoprotein (LDL), >150mg/dl for Triglycerides and <35mg/dl for high density lipoprotein (HDL) among males and <39mg/dl among females¹⁰⁴.

Hypertension status was defined as systolic blood pressure more than or equal to 140mmHg and/ or diastolic blood pressure more than or equal to 90mmHg.

¹⁰⁴WHO. Op.cit.

3.3 Data analysis

Data analysis was performed using the Statistical Package for the Social Sciences for Windows (SPSSWIN) Release 7.5.1

BMI and WHR were treated in two ways. BMI and WHR were the dependent variables where examining the relation with wealth, education, smoking status and number of pregnancies, with age and sex as the determinants. On the other hand, BMI and WHR were also examined as the independent variables, with serum lipids and blood pressure as the dependent variables.

Analysis was conducted in two stages. First, for categorical variables statistical significance was assessed using the chi-square test, and for ordinal variables trend significance was assessed using Gamma (γ) correlation coefficient¹⁰⁵. Independent t-test was used to compare means for continuous variables of two categories. For continuous variables stratified by age groups, as ANOVA was used to test the significance between the consecutive age groups.

¹⁰⁵Agresti A. An introduction to categorical data analysis. John Wiley and Sons, INC: New York. 1996. P: 38.

The correlation between BMI and WHR was studied in two ways: partial correlation adjusted for age and sex, and cross-tabulation using chi-square and Gamma (γ) correlation to test for colinearity between the two indices.

Second, for each sex separately, a stepwise analysis of multiple linear regression was used to examine continuous independent variables with BMI and WHR as the dependent variables

BMI and WHR were entered as dependent variables with age, education, non-smoker, ex-smoker, current smoker, number of pregnancies and wealth index as independent variables. Logistic regression was used for serum lipids and blood pressure as the dependent variables with BMI and WHR as the independent variables, and controlling for age, sex.

Food frequency analysis was done on food items, which were consumed more than two times per week by 15% or more of the population. Food frequency items and 24-hr recall data were tested for the presence of a linear trend (linear trend for ordinal data) with age, wealth status, educational level and obesity, using Gamma (γ) correlation. Wealth, education and age were entered as the independent variables with food items as the dependent variable. Wealth was divided into three values: poor, middle and wealthy and the poor were the reference group. Educational level was divided into three groups: 0-6 years, 6-12 years and more

than 12 years, with 0-6 year as a reference. Obesity was entered as the dependent variable, and normal weight individuals were the reference group.

The relation between origin and sex with food frequency was studied using chi-square test.

CHAPTER FOUR: RESULTS

4.1 GENERAL CHARACTERISTICS OF THE STUDY POPULATION

4.1.1 Phase one results (Household Census)

4.1.1.1 Response rate

Out of an estimated 600 households located in the Old City, 569 (95%) were surveyed. In the surveyed households, there were 3028 individuals, 1494(49.3%) males and 1534(51.7%) females. The average family size was 5.3.

4.1.1.2 Study population characteristics

Age structure: about 37% of the study population was less than 15 years old, and about 4.8% of the population was 65 years and older. Females were relatively older than males. For those less than 15 years old, 38% were males and 35% were females, while 4% and 6% of those over 65 years old were males and females, respectively.

Education: Of individuals aged 10 years or more, 8.9% were illiterate, 57.4% were in the elementary (1-9) classes, 25.1% were in the secondary classes, and 18.9% had post secondary education or training. The mean household educational level was 8.1 years (± 4.7)

Origin: Ramallah City contains individuals of varying origins. Only 15.3% of the surveyed population were natives to the city. Refugees from the 1948 war (35%) and Hebron migrants (34%) comprised more than two-thirds of the population. Individuals from Ramallah villages, other Palestinian districts and other countries made up the remaining 18% of the population.

4.1.1.3 Living conditions

About 35% of the surveyed households owned their homes, while 65% were in rented houses. Almost all had an indoor bathroom. For the amenities owned by the study population, 89% had a washing machine (either full automatic or semi automatic), 97% had a television (either colored or black and white), 48% had a video, 24.4% had a satellite dish, 51% had a phone line and 45% had a private car.

Nearly all Old City residents have access to the city public infrastructure. Around 94% of households were connected to the public water network, and 99% had electricity.

4.1.2 Phase two results (Individual testing phase)

4.1.2.1 Response rate

The number of persons eligible to participate in phase two of the survey was 831 for those in the ages 30 to 65 years old. Out of those, 492 individual actually participated: 191(38.8%) males and 301(61.4%) females. Seven pregnant women were excluded from the study, leaving 297 females as the final population included in the analysis.

The overall response rate was 59.2%, with the females' response rate being 71% and that of males being 47%. Response rates per age group varied between the two sexes. Among men, the highest response rate was 52% in the 50-59 age group. The lowest response rate was 30% in the oldest age group (60-65 years). For women, the response rate peaked at 87% in the oldest age group.

4.1.2.2 Females group

For females between 15 to 29 years, the number eligible to participate was 412, and the actual number of participants was 234. The total response rate for this group was 56.8%.

4.1.2.3 Non- respondents

Although, men comprised over 60.2% of non-respondents, there was no significant difference between the mean age of the responding and non-responding males. The same was true for non-responding females. The mean age for the responding and non-responding females was not significantly different.

With respect to the place of residence, the response rates in the eight blocks were almost similar except in two blocks. The average response rate was 51%. The lowest response rate (46%) was in a block considered to be of higher socioeconomic status, and the highest response rate (76%) was among another block of lower socioeconomic status.

4.1.2.4 Study population characteristics

Females were significantly older than males. The mean age (SE) was 42.7 (± 0.71) years for males and 44.9 (± 0.61) years for females' ($P=0.014$).

4.2 PREVALENCE OF OBESITY

4.2.1 Weight and BMI distribution

The mean weight for male subjects was significantly higher than for female subjects throughout all age groups as shown in **Table 2**. The mean (SE) weight for male subject was 79.7 (± 1.03) kg compared with 73.5 (± 0.89) for female subjects ($P < 0.0001$). Weight seemed to increase with age, but the difference between the mean weight for a given age group and the mean weight for the consecutive age group was not statistically significant for all age groups in both sexes ($P = 0.116$).

The mean (SE) BMI for male subjects was significantly lower at 27.4 (± 0.32) compared with 30.2 (± 0.35) for female subjects ($P < 0.0001$), and this trend was seen throughout all age groups. There was a progressive increase with age in mean BMI for male and female subjects. In both females and males, the difference between the mean BMI for a given age group and the mean BMI for the consecutive age group was significant for all groups ($P < 0.001$ for females and $P = 0.007$ for males)

Table 2: Mean weight and BMI for both sexes.

Age group	Male			Female			Total		
	Weight		BMI	Weight		BMI*	Weight		BMI
	N	Mean	Mean	N	Mean	Mean	N	Mean	Mean
30-34	44	76.8	25.6	61	70.4	28.0	105	73.1	27.0
35-44	80	79.3	27.4	83	72.2	29.5	163	75.7	28.5
45-54	39	81.0	28.3	78	75.6	31.3	117	77.4	30.3
55-65	28	83.7	28.8	75	75.1	31.8	103	77.5	31.0
30-65	191	79.7	27.4	297	73.5	30.2	488	75.9	29.1

*BMI: body mass index kg/m².

4.2.2 Prevalence of overweight and obesity

The prevalence of overall obesity as measured by BMI ≥ 30 for both males and females was 42.6%. After age-standardizing the prevalence using the WHO “world” standard population structure, the prevalence was 45.1%. On the other hand, the prevalence was 40.3% when adjusted to the Palestinian population structure. This is because the study population is relatively younger than the “world” standard population but older than the Palestinian population (**Table 3**).

Table 3: Age-standardized prevalence for males and females using the WHO “world” standard population structure and the Palestinian population structure.

	Males	Females	Total
Study population prevalence	31.4%	49.8%	42.6%
Age-standardized with WHO world structure	35.6%	49.9%	45.1%
Age-standardized with Palestinian structure	30.6%	44.8%	40.3%

The difference in prevalence between males and females is shown in **Figure 2** and **Table 4**. The prevalence of overweight (BMI 25-29.9) was 40.8% and 33.7% for males and females, respectively ($P < 0.001$), whereas, the prevalence of general obesity ($BMI \geq 30$) was higher for females than males at 49.8% and 31.4%, respectively. There is a small percentage of females with normal weight compared to males.

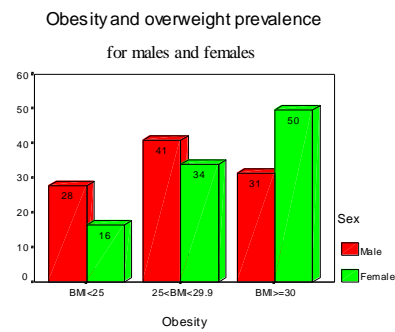
Table 4: Obesity and overweight prevalence among the two sexes

	Male	Female	Total
Obesity*: Normal	27.7%(53)	16.5%(49)	20.9%(102)
Overweight	40.8%(78)	33.7%(100)	36.5%(178)
Obese	31.4%(60)	49.8%(148)	42.6%(208)
P < 0.001			

*Normal ($BMI < 25$), overweight ($BMI 25-29.9$), obese ($BMI \geq 30$).

The prevalence of overweight was higher among males (overweight-to-obesity ratio was 1.3), while the prevalence of obesity was higher among females (overweight to obesity ratio was 0.7).

Figure 2



4.2.3 Obesity distribution by age

As shown in **Table 5**, the highest prevalence of overweight was found in the 30-34 years and groups, with a relatively small proportion of obese individuals. After this age group, obesity starts to increase sharply until the age of 55 years ($P < 0.001$).

Table 5: Prevalence of obesity and overweight by age.

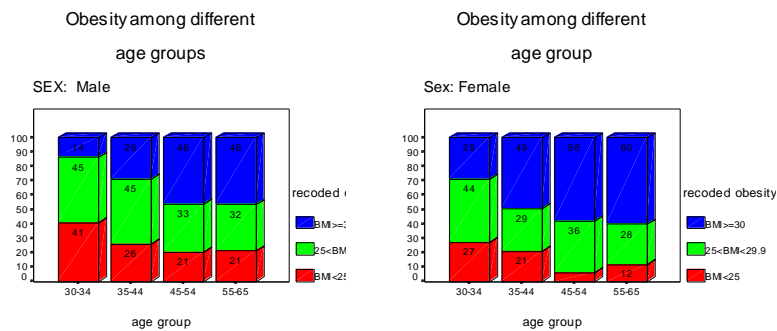
Age group	Total population		
	Normal % (N)	Overweight % (N)	Obese % (N)
30-34	34.3 (36)	43.8(46)	21.9 (23)
35-44	23.3(38)	37.4(61)	39.3(163)
45-54	11.1(13)	35.0 (41)	53.8(117)
55-65	14.6(15)	29.1(30)	56.3(103)
Gamma (γ) = 0.333, P < 0.001.			
P (chi-square) <0.001			

Table 6 shows that there is decrease in overweight and a sharp increase in obesity prevalence among males between the ages of 44 and 54. Among females, this increase occurs after the age of 35 years and continues to increase with age (**Figure 3**). The pattern of obesity occurrence between male and female age groups at different cut-off is shown in Annex IV.

Table 6: Prevalence of obesity and overweight by age and sex.

Age group	Male			Female		
	Normal*	Overweight	Obese	Normal	Overweight	Obese
	%(N)	%(N)	%(N)	%(N)	%(N)	%(N)
30-34	40.9(18)	45.5(20)	13.6 (6)	27.3(18)	43.9(29)	28.8(19)
35-44	26.3(21)	45.0(36)	28.8(23)	21.2 (18)	29.4(25)	49.4(42)
45-54	20.5 (8)	33.3(13)	46.2(18)	6.4(5)	35.9(28)	57.7(45)
55-65	21.4(6)	32.1(9)	46.4(13)	12.0(9)	28.0(21)	60.0(45)
Gamma (γ)= 0.317, P < 0.001			Gamma (γ)= 0.302, P < 0.001			
P (chi-square)= 0.021			P (chi-square)= 0.001			

*Normal (BMI<25), overweight (BMI 25-29.9), obese (BMI \geq 30).

Figure 3

The prevalence of morbid obesity (BMI ≥ 40) was 6.9% of obese persons (BMI ≥ 30). **Table 7** shows obesity classes and the prevalence of morbid obesity among the two sexes. Morbid obesity (BMI ≥ 40) was higher in females.

Table 7: Prevalence of obesity classes.

	Males (BMI ≥ 30) (N=57)	Females (BMI ≥ 30) (N=146)	Total (BMI ≥ 30) (N=203)
BMI: Class I(30-34.9)	78.9% (45)	65.1% (95)	66.4% (140)
Class II (35-39.9)	17.5% (10)	26.7% (39)	24.1% (49)
Class (III ≥ 40)	3.5% (2)	8.2% (12)	6.9% (14)

The total number of obese individuals was 203.

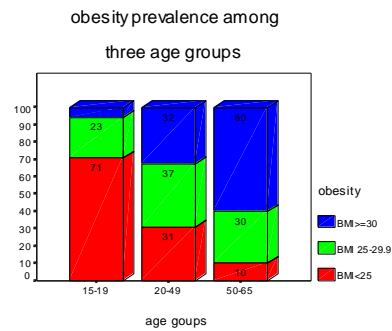
4.2.4 Prevalence of obesity for three generations of females

The prevalence of obesity increases throughout all ages for females. As shown in **Table 8**, the majority of females in the ages 15-19 years had normal BMIs, and a small percent were overweight and obese. For the ages 20 to 49 years, which represent the reproductive ages, only one-third of women had normal BMIs, and the other two thirds were divided almost equally between overweight and obesity. Finally, in the ages between 50 to 65 years, which include the menopausal age, the majority of females were obese, and 26.7% were overweight.

Table 8: Obesity prevalence among three age groups

Age groups	Normal	Overweight	Obese
15-19 years	72.0%	22.0%	6.0%
20-49 years	31.0%	33.8%	35.2%
50-65 years	9.9%	26.7%	63.4%
Gamma (γ)= 0.549, P < 0.001			
P (chi-square) < 0.001			

*Normal (BMI<25), overweight (BMI 25-29.9), obese (BMI \geq 30).

Figure 4

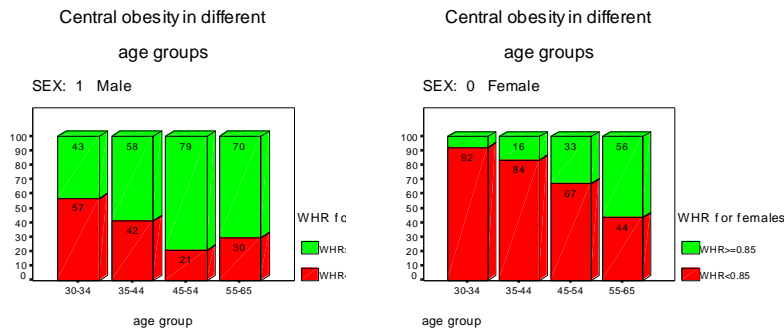
4.2.5 The prevalence of central obesity

The mean (SE) WHR for males was $0.92 (\pm 4.9 \times 10^{-3})$ and $0.81 (\pm 3.8 \times 10^{-3})$ for females. Consistent with the literature, the mean WHR for male subjects was significantly higher than for female subjects, throughout all age groups (data not shown). The prevalence of central obesity for males ($\text{WHR} \geq 0.9$) was 60.9%, while the prevalence for females ($\text{WHR} \geq 0.85$) was 28.7%.

As shown in **Table 9** and **Figure 5**, the prevalence of central obesity increases with age for both sexes ($P < 0.001$). The highest central obesity prevalence was among males aged 45-54 years and females over 55 years.

Table 9: Central obesity prevalence by age and sex.

Age group	Male	Female	Total
	WHR ≥ 0.9 %(N)	WHR ≥ 0.85 %(N)	Obese %(N)
30-34	42.9 (18)	7.6 (5)	20(20)
35-44	58.4 (45)	15.3 (13)	36.1(56)
45-54	78.9 (30)	30.8 (24)	46.8(52)
55-65	70.4 (19)	53.3 (40)	59.6(59)
30-65	60.9 (112)	28.7 (82)	
	Gamma (γ)= 0.371	Gamma (γ)= 0.688	Gamma (γ)=0.412
	P = 0.001	P = 0.001	P < 0.001
	P (chi-square)= 0.007	P (chi-square)< 0.001	P (chi-square)< 0.001

Figure 5

4.2.6 BMI and WHR correlation

BMI and WHR were strongly correlated ($P < 0.001$) with a correlation coefficient equal to 0.194, after age and sex adjustment.

The percentage of those with central obesity increases with the increase of their BMI ($P < 0.001$) (**Table 10**). There were 55.6% of obese persons who were centrally obese as well.

Table 10: The correlation between BMI and WHR.

		WHR	
		Normal	High
BMI	Normal	93.9%	6.1%
	Overweight	58.0%	42.0%
	Obese	44.4%	55.6%
Gamma (γ)= 0.577, $P < 0.001$			
P (chi-square) < 0.001			
Normal (BMI<25), overweight (BMI 25-29.9), obese (BMI \geq 30)			
Obese males (WHR \geq 0.9), obese females (WHR \geq 0.85).			

4.3 FACTORS ASSOCIATED WITH OBESITY

4.3.1 Smoking

Out of the total sample population, 33.5% were smokers. 58.4% of men and 18% of women are current smokers. Smoking rate (number of cigarettes smoked) is shown in **Table 11**. Males were heavier smokers than females: 49.8% of males smoke >10 cigarettes per day compared to only 8.5% of females, and only 9% of females smoke more than 10 cigarettes per day.

Table 11: Smoking rate for males and females.

	Males	Females
Non-smoker	21.1%	76.9%
Ex-smoker	20.5%	5.1%
Current smoker	58.4%	18%
(% of current smoker)		
<10 cigarettes per day	13.9%	52.9%
10-20 cigarettes per day	26.9%	37.7%
20-30 cigarettes per day	23.1%	1.9%
>30 cigarettes per day	36.1%	7.5%

Association between overall obesity and smoking status was observed in men and not in women. The mean (SE) BMI for male smokers was significantly lower than that for non-smokers (**Table 12**). Both means are in the overweight category. No association was seen in either sex between smoking and central obesity.

Table 12: Mean BMI and WHR for smoker and nonsmokers by sex

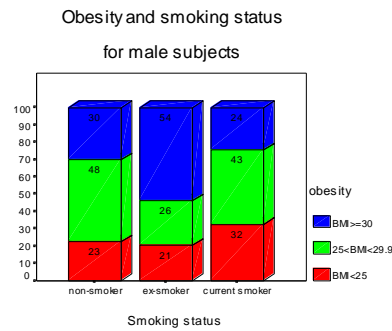
	Male			Female		
	Non-smoker	smoker	P-value	Non-smoker	smoker	p-value
BMI Mean(SE)	28.4(0.52)	26.6(0.39)	0.005	30.0 (0.38)	30.9(0.98)	0.38
WHR Mean(SE)	0.92(0.008)	0.91(0.006)	0.11	0.81(0.004)	0.81(0.008)	0.45

Table 13, shows obesity distribution between smokers, non-smokers and ex-smokers. About half of ex-smoker were obese compared to 24.3% of current smokers and 30% of non-smokers. Current smokers were less likely to be overweight or obese than either non- or ex-smokers as shown in **Figure 6**. Smoking status was evenly distributed among different origins, wealth and educational status. Further, smoking rate (number of cigarettes smoked) did not have any significant relation with either type of obesity.

Table 13: Obesity prevalence divided by smoking status.

	Male			Female		
Smoking	Normal	Overweight	Obese	Normal	Overweight	Obese
	% (N)	% (N)	% (N)	% (N)	% (N)	% (N)
non smoker	22.5(9)	47.5(19)	30.0(12)	16.7(38)	6.7(84)	17 (105)
ex-smoker	20.5 (8)	25.6(10)	53.8(21)	37.0(1)	20.0(3)	24.5(11)
current smoker	32.4(36)	43.2(48)	24.3(27)	46.3(9)	73.3(13)	58.5(31)
Gamma (γ)= - 0.209, P = 0.035			Gamma (γ)= 0.209, P = 0.076			
P (chi-square) = 0.012			P (chi-square) = 0.146			

*Normal (BMI<25), overweight (BMI 25-29.9), obese (BMI \geq 30).

Figure 6

Central obesity was not associated with smoking status for both sexes (see annexV).

4.3.2 Number of pregnancies

About 88.5% of the females in the study population are married. The mean (SD) for age at marriage was 19.7(4.9), with age 11 years as the lowest age and 43 years as the maximum age.

The mean (SD) for the number of pregnancies was 6.7(3.7). **Figure 7** and **Table 14** shows that the prevalence of obesity increases with the increase of number of pregnancies. About 75% of the females with more than seven pregnancies were obese, while females with 5 to 7 pregnancies were more likely to be overweight ($P<0.001$).

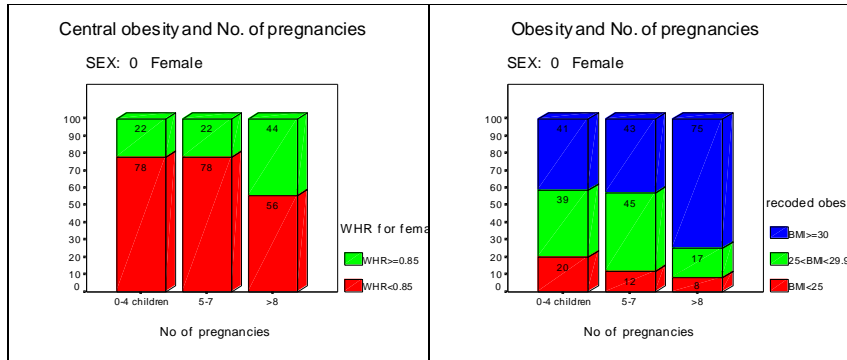
Table 14: Obesity prevalence and number of pregnancies.

No. of pregnancies	Mean BMI	Normal	Overweight	Obese
0-4	29.0	22% (16)	38.2% (29)	40.8% (31)
5-7	29.4	12.0% (11)	44.5% (41)	43.5% (40)
>7	33.1	7.4% (7)	17.0% (16)	75.6% (71)
Gamma (γ) = 0.414, P < 0.001				
P (chi-square) < 0.001				

In addition, the prevalence of central obesity increases with the increasing number of pregnancies ($P < 0.001$). Those with four or less pregnancies have lower central obesity and the highest is for those with more than seven pregnancies as shown in **Table 15** ($P < 0.001$).

Table 15: Central obesity and number of pregnancies.

No. of pregnancies	Mean WHR	WHR < 0.85	WHR \geq 0.85
0-4	0.797	82.4% (56)	17.6% (12)
5-7	0.808	77.5% (69)	22.5% (20)
>7	0.845	55.7% (49)	44.3% (39)
Gamma (γ) = 0.429, P < 0.001			
P (chi-square) < 0.001			

Figure 7

There was a statistically significant difference between females who had never been pregnant and those who had ever been pregnant ($P < 0.001$). The odd ratio for obesity was 3.2 (CI=1.56-6.58) after controlling for age.

Number of pregnancies was significantly associated with educational level and origin, but not the wealth status. Females with less than 12 years of education were those with larger number of pregnancies. With regard to the origin, Ramallah natives had the least number of pregnancies (58% had four or less pregnancies), while Hebron villages migrants had the highest number of pregnancies (about 54% had eight or more pregnancies). The other communities had around five to seven pregnancies (see annex VI).

4.3.3 Wealth status

Those in the higher class are mainly the natives to Ramallah city and refugees from the occupied villages, while the majority of those in the lower class are migrants from Hebron ($P < 0.001$).

The originals to Ramallah formed 13.5% of the respondents, while Hebron village migrants (35%) and 1948-refugee (34.3%) form the majority. Ramallah village migrants were about 11.5% and the remaining 5.7% were individuals from other Palestinian areas. This distribution is similar to the distribution in the Old City.

It is interesting to note that those in the higher class are mainly Christians and those in the lower class are Moslems ($P < 0.001$). This makes sense as original Ramallah inhabitants and 1948 refugees who settled in Ramallah were Christians, while poor migrants from the Hebron villages were Muslims

There is no clear trend between general obesity and wealth status as in **Table 16**.

Table 16: General obesity for different wealth status.

	Wealth status		
	Low wealth status % (N)	Moderate wealth status % (N)	High wealth status % (N)
Normal (BMI <25)	28 (26)	23.9 (56)	12.4 (17)
Overweight (BMI 25-29.9)	30.1 (28)	32.5 (76)	45.3 (62)
Obese (BMI \geq 30)	41.9 (39)	43.6 (102)	42.3 (58)
Gamma (γ)= 0.087, P = 0.177 P (chi-square) = 0.012			

Table 17 shows that the percentages of individuals with normal WHR decrease with increasing wealth status while central obesity increase with wealth status ($P=0.041$).

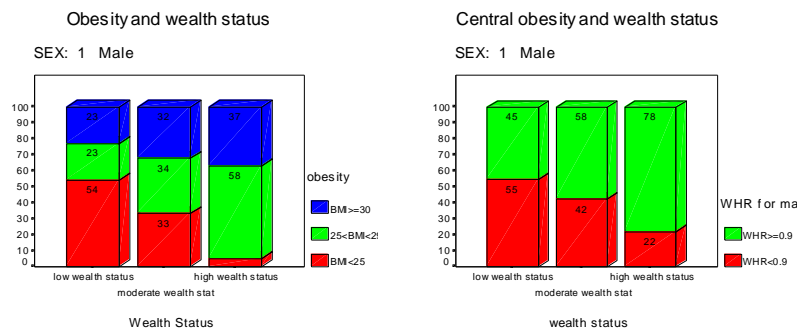
Table 17: Central obesity prevalence for different wealth status.

	Wealth status		
	Low wealth status	Moderate wealth status	High wealth status
	% (N)	% (N)	% (N)
Normal (WHR <0.85 for females and WHR <0.9 for males)	66.7 (58)	59.9 (133)	53 (70)
Obese (WHR \geq 0.85 for females and WHR \geq 0.9 for males)	33.3 (29)	40.1 (89)	47 (62)
Gamma (γ)= 0.168, P = 0.041			
P (chi-square) = 0.127			

Obesity prevalence was positively associated with the wealth index, as shown in **Figure 8** and **Table 18**, for men ($P<0.001$ for BMI and 0.004 for WHR) but not for women. About 78% of those in the high wealth class had WHR more than 0.9, and only 5% of the same class were normal. Although the association between wealth status and female's BMIs was not significant, the pattern of obesity distribution appears to be negatively related to the wealth status; that is, females in the lower class are more likely to be obese.

Table 18: General and central obesity by wealth status.

	Wealth status			significance
	Low wealth status	Moderate wealth status	High wealth status	
	% (N)	% (N)	%(N)	
Male				
WHR<0.9	54.5%(18)	42.2%(35)	22.0%(13)	$\gamma = 0.421, P=0.001$ P(chi-square) =0.004
WHR≥0.9	45.5%(15)	57.8%(48)	78.0%(46)	
Normal	54.3%(19)	33.3%(29)	5.0%(3)	$\gamma = 0.383, P<0.001$ P(chi-square) <0.001
Overweight	22.9%(8)	34.5%(30)	58.3%(35)	
Obese	22.9%(8)	32.2%(28)	36.7%(22)	
Female				
WHR<0.85	74.1%(40)	70.5%(98)	74.6%(53)	$\gamma = -0.019, P=0.87$ P(chi-square) = 0.77
WHR≥0.85	25.9%(14)	29.5%(41)	25.4%(18)	
Normal	12.1%(7)	18.4%(27)	18.2%(14)	$\gamma = -0.08, P=0.35$ P(chi-square) =0.80
Overweight	34.5%(20)	31.3%(46)	35.1%(27)	
Obese	53.4%(31)	50.3%(74)	46.8%(36)	

Figure 8

4.3.4 Education

There was no significant difference in the mean educational levels of either sex. . The mean BMI for females with lower education was significantly higher ($P<0.001$) than that for females with a higher level of education. The means were 31.2(0.46) and 28.5(0.52) for lower and higher education levels, respectively. About 61% of females with less than 9 years of education were obese (**Figure 9** and **Table 19**). The same is true for central obesity, where about 33.7% of females with central obesity have less than 9 years of education (**Table 20**).

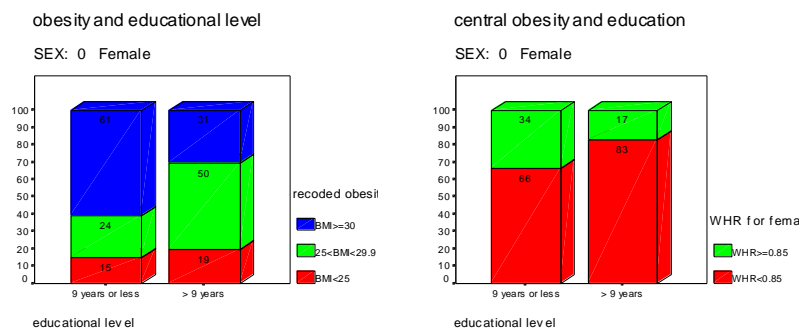
Table 19: Obesity distribution between lower and higher educational levels.

	Females		
	Normal %(N)	Overweight %(N)	Obese %(N)
0 – 9 years of education	14.8(28)	24.4(46)	60.8(115)
> 9 years of education	19.4(21)	50(54)	30.6(33)
Gama (γ) = - 0.416, $P< 0.001$			
$P(\text{chi-square}) < 0.001$			

Table 20: Central obesity distribution between lower and higher educational levels.

	Females	
	WHR<0.85	WHR ≥0.85
	%(N)	%(N)
0 – 9 years of education	66.3 (118)	33.7 (60)
>9 years of education	83.2 (84)	16.8 (17)
$\gamma = 0.431, P=0.001$		
P(chi-square) = 0.002		

Figure 9



There was no statistical significant association between male level of education and obesity, either general or central obesity.

Educational level of individuals was related to the wealth status (**Table 21**). Those with lower level of education were in the lower wealth class (79.6%), while those with higher level of education were in the higher class (56.9%).

Table 21: The relation between wealth and education.

	Low wealth status %(N)	Moderate wealth status %(N)	High wealth status %(N)
0-9 years of education	79.6 (74)	64.0 (152)	43.1 (59)
>9 years of education	20.4 (19)	35.0 (82)	56.9 (78)
Gama (γ) = 0.456, P < 0.001			
P(chi-square) < 0.001			

The level of education also varies with the individual's origin. The majority of the Hebron village migrants had primary education, 55% of the native to Ramallah City had secondary education. Individuals from Ramallah villages and 1948 refugees had secondary and post secondary education and the highest percentage of those with higher education were individuals coming from other Palestinian areas (48%).

4.3.6 The result of the multiple linear regression

The result of stepwise multiple regression analysis is shown in **Table 22** for females and **Table 23** for males. The BMI and WHR were treated as the dependent variables and age, smoking, number of pregnancies, wealth status and educational levels were treated as the independent variables.

Table 22: Results of multiple linear regression analysis of body mass index, waist-to-hip ratio and selected variables among females.

		R^2	β_i	P-value
BMI:	Age	0.087	0.295	<0.001
	No. of pregnancies	0.126	0.213	0.001
Controlling for education and wealth				
		R^2	β_i	P-value
WHR:	Age	0.223	0.405	<0.001
	No. of pregnancies	0.25	0.154	0.011
	Education	0.263	-0.116	0.038
Controlling for wealth				

For females, age and number of pregnancies appear as an independent associated factor with both general and central obesity after controlling for education and

wealth status. Education was negatively associated with central obesity independent of age, wealth and number of pregnancies.

Table 23: Results of multiple linear regression analysis of body mass index, waist-to-hip ratio and selected variables among males.

		R²	β_i	P-value
BMI:	wealth	0.084	0.289	<0.001
	Non-smoker	0.121	0.193	0.006
Controlling for education, age and ex-smoking status				
		R²	β_i	P-value
WHR:	Age	0.091	0.301	<0.001
	Wealth	0.130	0.198	0.005
Controlling for non- and ex smoking status, and education				

For males, wealth was positively associated with general and central obesity, independent of education, age and smoking status. Age was positively associated with central obesity and non-smoking status was associated with general obesity, independent of other factors.

4.3.6 Eating habits and food consumption patterns

4.3.6.1 Meal patterns

This study did not include food quantities and therefore, these results should be interpreted with caution. About 46% of the sample population reported usually having two and 41% reported usually having three meals, only 13% of the population eat one meal.

The most frequently consumed items were vegetables (97.7%), fruits (91.8%), rice (86.9%), white cheese (63.7%) and eggs (50.7%); these food items were consumed by more than half the population (see annex VII). The least frequently foods consumed were fish (9.2%), jam (11.5%) and halaweh (8.8%). Tea is the frequent drink consumed by about 92% of the population; about two cups were consumed everyday. About one cup was consumed daily of coffee and soft drinks such as juice and cola.

The relation between obesity and number of meals consumed per day was insignificant. The same was true for the number of meals with age, sex, origin, education and wealth status (see annex VIII).

4.3.6.2 Trends in food consumption

Testing for linear trend in the frequency of food consumption between males and females with age was almost the same. Both tend to have a significant decreasing

trend with age in the frequency of foods they consume. Males decrease yellow cheese, chocolates, and rice, and increasing fruits, while females decrease rice, arabic sweets and increasing the frequency of tea and wheat bread (see annex VIII).

As shown in **Table 24**, the wealthy consume more fruits, vegetables, white cheese, chocolate and meat than the poorest group. These items showed significant increasing trend with wealth. The poor group consumed eggs and tea more frequently than the wealthy group (these items showed significant negative trend with wealth).

Table 24: Proportion of all and test for linear trend between food and wealth

food item	proportion of all	test for trend with wealth*		
		Proportion difference b/w poor & wealthy (Poor- wealthy)	Gamma value	P value
fruits	0.92	-0.07	0.181	0.014
vegetables	0.98	-0.07	0.223	0.011
white cheese	0.63	-0.32	0.345	<0.001
yellow cheese	0.42	-0.06	-0.06	0.33
yogurt	0.52	-0.01	-0.042	0.54
fried foods	0.3	0.13	-0.09	0.18
chocolate	0.38	-0.05	0.037	0.56
labaneh	0.62	-0.03	-0.007	0.9
meat	0.8	-0.15	0.25	0.002
chicken	0.72	0.02	0.006	0.9
rice	0.87	-0.05	-0.02	0.74
eggs	0.54	0.12	-0.159	0.016
Arabic sweets	0.15	-0.01	0.05	0.47
tea	0.92	0.03	-0.232	0.001
coffee	0.8	0.05	0.043	0.58
Cola	0.84	0.02	0.036	0.58

*Trend over three wealth groups: low, middle and high wealth status. With the lowest wealth status as the reference.

For the obese group, the trend was consuming less yellow cheese, chocolate and arabic sweets as individuals become obese.

Table 25: Proportion of all and test for linear trend between food and obesity

food item	proportion of all	Proportion difference b/w normal & obese		test for trend with obesity**	
		Normal-obese	Gamma value	P- value	
fruits	0.92	-0.04	0.144	0.32	
vegetables	0.98	-0.04	0.491	0.06	
white cheese	0.63	-0.06	0.005	0.95	
yellow cheese	0.42	0.11	-0.173	0.02	
yogurt	0.52	0.04	-0.018	0.81	
fried foods	0.3	0.06	-0.09	0.28	
chocolate	0.38	0.08	-0.151	0.04	
labaneh	0.62	0.03	-0.08	0.2	
meat	0.8	0.03	-0.06	0.5	
chicken	0.72	0.03	-0.03	0.7	
rice	0.87	0.04	-0.094	0.38	
eggs	0.54	0.09	-0.121	0.11	
Arabic sweets	0.15	0.08	-0.199	0.05	
tea	0.92	0.01	0.112	0.1	
coffee	0.8	-0.04	0.026	0.18	
Cola	0.84	0.02	-0.085	0.18	

** Trend over three groups: normal, overweight and obese. Normal group was the reference.

For the different educational level, there was no significant trend observed in food frequency consumption.

Out of the 24-hr recall, only sweets and snacks (empty calories food) had a significant increasing trend with wealth status, educational levels and obesity status (**Table 26**). Food items mentioned by individuals showed increasing trend in the consumption of fruits and decreasing trend in beverages and sweets consumption.

Table 26: Proportion of all and test for linear trend between food (24- hr recall) and wealth.

food item	proportion of all	test for trend with wealth*		
		Proportion difference b/w poor & wealthy (Poor-wealth)	Gamma value	P- value
bread	0.6	0.11	-0.132	0.07
diary products	0.66	-.06	0.07	0.34
fats and oils	0.22	0.08	-0.147	0.1
vegetables	0.78	0.09	-0.01	0.88
fruits	0.39	-0.12	0.136	0.08
meat, poultry	0.75	-0.05	0.098	0.22
dishes	0.39	0.07	-0.073	0.35
beverages	0.92	-0.01	-0.098	0.17
sweets and snacks	0.28	-0.15	0.247	0.004

*Trend over three wealth groups: low, middle and high wealth status. With the lowest wealth status as the reference.

Table 27: Proportion of all and test for linear trend between food (24- hr recall) and obesity

food item	proportion of all	test for trend with obesity**		
		Proportion difference b/w normal & obese (Normal- obese)	Gamma value	P-value
bread	0.6	0.02	-0.005	0.94
diary products	0.66	0.04	-0.062	0.3
fats and oils	0.22	-0.03	0.04	0.67
vegetables	0.78	0	0.05	0.45
fruits	0.39	-0.09	0.086	0.23
meat, poultry	0.75	0.02	-0.029	0.7
dishes	0.39	-0.06	0.102	0.18
beverages	0.92	0.01	-0.045	0.52
sweets and snacks	0.28	0.1	-0.179	0.03

** Trend over three groups: normal, overweight and obese. Normal group was the reference.

4.3.6.3 Food groups

With regard to food groups, surprisingly the frequency of foods high in protein and fat were negatively related with obesity and older people (55-65 years). At the same time food rich in fiber was positively associated with wealth status. Food

high in fat was positively related to educational levels where the higher educational level the more high fat foods consumed (see annex IX).

The pattern of food frequency consumption among the different communities was different. Food rich in sugar was common among the natives and 1948-refugees, food rich in fat was more frequent in the natives and Qaysiyah and food rich in fibers was common among 1948-refugees and individuals from Ramallah villages. Food high in carbohydrate content was frequently consumed by Qaysiyah and Ramallah villages migrants.

Food groups did not show any difference between different educational levels and sexes.

4.4 OBESITY AS A RISK FACTOR FOR CHRONIC DISEASES

After age and sex adjustment, blood pressure and serum lipids were associated with general obesity as shown in **Table 28**. High systolic blood pressure (OR=4.68 for overweight, 4.8 for obesity), high Triglycerides (OR= 6.13 for overweight and 3.37 for obesity) and low HDL for both males (OR=0.23 for overweight and 0.41 for obesity) and females (OR=0.23 for overweight and 0.28 for obesity). Diastolic blood pressure and total cholesterol did not show a significant association with obesity.

Table28: Age and sex adjusted odds ratio for blood pressure and serum lipids and obesity measured by BMI

	normal	Overweight	OR (95%CI)	Obese	OR (95%CI)
		BMI 25-29.9		BMI \geq 30	
SBP: <140	95.1%	82%	4.68 (1.55-14.0)	73.1%	4.8(1.75-13.3)
\geq 140	4.9%	18%		26.9%	
DBP: <90	94.1%	87.6%	2.28(0.81-6.39)	82.7%	2.32(0.89-6.1)
\geq 90	5.9%	12.4%		17.3%	
TCHOL: <250	95.1%	85.4%	2.87(0.998-8.25)	87.5%	1.81(0.63-5.2)
\geq 250	4.9%	14.6%		15.5%	
TG: <150	86.3%	65.2%	6.13(3.07-12.26)	53.4%	3.37(1.72-6.59)
\geq 150	13.7%	34.8%		46.6%	
HDL (F): <39	26.0%	56.3%	0.15(0.07-0.33)	66.2%	0.28(0.129-0.59)
\geq 39	74.0%	43.7%		33.8%	
HDL (M): <35	%54.7	74.4%	0.23 (0.09-0.55)	80%	0.407(0.19-0.86)
\geq 35	45.3%	25.6%		20%	

Odds ratio with normal weight as the reference. Controlling for age which was divided into the following groups: 30-34, 35-44, 45-54 and 55-56 years. The reference age group was 55-56 years.

Central obesity among females was associated with high systolic blood pressure and high Triglycerides after age and sex adjustment. The odd ratio for systolic blood pressure was 2.09 and for Triglycerides was 2.67 (**Table 29**). The same association was observed among males with odds ratio for systolic blood pressure 4.98 and Triglycerides 9.22.

Table 29: Age and sex adjusted odds ratio for blood pressure and serum lipids and central obesity measured by WHR.

	WHR <0.85	WHR ≥0.85	OR (95%CI) Females	WHR <0.9	WHR ≥0.9	OR (95%CI) Males
SBP: <140	86.8%	61.0%	2.09(1.06-4.13)	94.4	75	4.98(1.47-16.8)
≥140	13.2%	39.0%		5.6	25	
DBP: <90	90.7%	81.7%	1.1(0.49-2.47)	91.7	80.4	1.68(0.59-4.7)
≥90	9.3%	18.3%		8.3	19.6	
TCHOL: <250	89.2%	78.0%	0.9(0.41-2.03)	95.8	87.5	2.27(0.61-8.5)
≥250	10.8%	22.0%		4.2	12.5	
TG: <150	77.9%	42.7%	2.67(1.45-4.9)	86.1	39.3	9.21(4.2-20.2)
≥150	22.1%	57.3%		13.9	60.7	
HDL: <39	52.5%	62.2%	0.57(0.31-1.05)			
≥39	47.5%	37.8%				
HDL: <35				56.9	80.4	0.61(0.21-1.76)
≥35				43.1	19.6	

Odds ratio with normal WHR (WHR<0.9 for males and WHR<0.85) as the reference. Controlling for age which was divided into the following groups: 30-34, 35-44, 45-54 and 55-56 years. The reference age group was 55-56 years.

CHAPTER FIVE: DISCUSSION

This study is part of a larger cross sectional study conducted to investigate the prevalence of some chronic diseases in selected localities in Palestine, since there is a steady increase in the prevalence of chronic diseases in the region and worldwide.

5.1 Study population characteristics

In term of age, the study population was found to be almost similar to the population in Ramallah District, but slightly older than the Palestinian population in the West Bank¹⁰⁶. The structure of the study population was similar to that of the Palestinian population until the age of 50 years where the percentage of cohorts after this age become slightly higher among the study population. These changes in the age structure may be because of the improvement of standards of living in the urban areas. More public services are available for the study population such as electricity, water network and sewage network than other areas in the Ramallah district and other districts¹⁰⁷. Or it could be because younger people migrate, leaving their older persons.

¹⁰⁶PCBS. Op. Cit.

¹⁰⁷PCBS. Op. Cit.

In this study, the percentage of females was higher than that of males. This result was found to be consistent with results for Ramallah City as a whole, but different from that for Ramallah District and the general Palestinian population¹⁰⁸. This may be explained partly to the migration of men to the Americas leaving their wives and children in this country¹⁰⁹.

The educational level in Old Ramallah was slightly higher than in other urban areas¹¹⁰. The mean educational level for both sexes was almost the same in the study population. A similar pattern is seen in Palestine in general where both sexes have almost the same mean level of education. Basic education is accessible for almost all in Palestine, and since our sample is from an urban area, schools are more available than in rural areas. In old Ramallah City there are now three schools: two publics and one private¹¹¹. But at postsecondary levels it was found to be higher among males, a pattern that is similar to the general Palestinian population¹¹² and worldwide¹¹³.

¹⁰⁸PCBS. Op. Cit.

¹⁰⁹Younis N et al. Op. Cit.

¹¹⁰PCBS. The demographic survey in the West Bank and Gaza Strip: District by district comparative results. District Report Series No. 10. June 1997.

¹¹¹Filfil M. The housing environment and women's health: The case study of Ramallah At-Tahta. Birzeit University. 1999 (in press).

¹¹²PCBS. Op.Cit.

¹¹³UNISCO. Gender- sensitive education statistics and indicators: A protocol guide. Paris. 1995.

5.2 Response rates

Response rates were in favor of females. Females respondents were mostly housewives (about 79% of the females). A lower response rate was found among males, and especially among older males. Of the reasons given for not participating in the survey, some non-participants said they were healthy and found no need for tests. The proximity to health services and the accessibility to health insurance were also mentioned as reasons for not responding. Few of the non-participants did not participate because of their fear of blood drawing.

The low response rate among men can be explained partly by their presence at workplaces outside the Old City during the survey time. The survey time was from 8 to 10 o'clock morning. Men can not leave work for about two hours to participate in the diabetes testing. The older men of the Qaysiyah may have returned back to their village in Heron, and this may explain the low response rate among older men.

5.3.1 Prevalence

The prevalence of obesity is increasing in the developed¹¹⁴ and developing countries, mainly in urban and wealthy areas¹¹⁵. Palestine, as any developing country, is undergoing rapid development and urbanization, and this high prevalence of obesity was expected since the prevalence of obesity in Jordan, the neighboring country where a large proportion of the population is of Palestinian origin and where cultures, customs, and lifestyle are very similar to those in Palestine, was found to be even higher¹¹⁶. The prevalence in this study population was higher than the prevalence reported in developed countries such as the US¹¹⁷ and Britain, and even higher than that reported in affluent developing countries such as Saudi Arabia and Kuwait.

The estimated prevalence of obesity in the study population may be a slight overestimate of the true prevalence of obesity in the Palestinian population, partly due to age, as seen after standardization for age. The standards of living for the study population were slightly higher than the standards of living in the general Palestinian population. As a result, the study population may have a more sedentary life style. Obesity prevalence in one of the Palestinian villages was also

¹¹⁴Must A, Spadano J, Coakley E, Field A, Calditz G, Dietz W. Op. Cit.

¹¹⁵Olomons N, Gross R. Op. Cit.

¹¹⁶Ajlouni K, Jaddou H, Batieha A. Op.cit.

¹¹⁷Mokdad A, Serdula M, Dietz W, Bowman B, Marks J, Koplan J. The spread of the obesity epidemic in the United States, 1991-1998. JAMA 1999; 282 (16): 1519-1522.

lower than that for the study population, probably because they have a more active lifestyle and healthier eating habits. Also the estimated obesity prevalence might be affected by the high response rate of females than males. Females form about two thirds of the sample size.

There was a remarkable difference observed in the prevalence of obesity between males and females. Obesity prevalence in females was higher than that in males. Obesity prevalence among males must be interpreted with caution because of their small number.

Although males' obesity prevalence was lower than that of females', the prevalence of overweight (BMI 25-29.9) was very high among males. Studies from Kuwait, Saudi Arabia and Jordan found similar results. Although the reasons were not clear, it was suggested that the cultural norms that restrict the movement of women in social activity play a role.

The prevalence of obesity increased with age for both sexes. Usually, weight gain with age is accompanied with fat mass increase rather than muscle mass. In fact muscle mass start to shrink with aging and calories burned by the body is decreased. An average of 10 to 12 percent of muscle mass shrinks between the ages 30 and 65¹¹⁸. The results of this study show that men over the age of 40 are at high risk of developing obesity and central obesity until the age of 55 years.

¹¹⁸Medical economics. Family guide to nutrition and health. Montvale, New York. P:121-140

Men at younger ages, in this study 30 to 40 years, were already overweight and had high prevalence of central obesity. The same patterns were reported in Saudi Arabia¹¹⁹ and Iran¹²⁰. Studies from Jordan and Kuwait¹²¹ showed that obesity prevalence starts to increase among men in their thirties. Women were at risk of developing obesity after the age of 35, and they start to gain weight at earlier ages but central obesity start to increase in later ages. Similar results were reported in some Arab countries.

5.3.2 Obesity prevalence among women

By focusing on the pattern of obesity among different female generations we found that the prevalence of obesity starts at early ages and increases with age.

Most females below the age of twenty had a normal body mass index, and about one fourth of the females were overweight (BMI 25-29.9). These results were expected since obesity tend to increase with age, and this group is younger. It is also possible that this generation is more exposed to the “western” ideals of beauty and fitness than the older generations. Similar results were found among college female students in Saudi Arabia, and the factors associated with obesity

¹¹⁹ Al-Nuaim A, Al-Rubeaan S, Al-Attas O, Al-Daghari N, Khoja T. Op. Cit.

¹²⁰ Pishdad GR. Op. Cit.

¹²¹ Al-Isa AN. Op. Cit.

were age, social status (married or single) and daily dietary intake of energy (fat and carbohydrate contribution)¹²².

In the study population, about one-third of females in the reproductive age (20-49) were overweight and one-third were obese. The married females form about 81% of this group. Culture may be one of the factors affecting obesity development. It is expected that women after marriage get fat, as this will indicate that her husband is taking care of her¹²³. Another hypothesis says that women gain weight after marriage because they feel secure and feel there is no need to give attention to their appearance. On the other hand, it is thought that after marriage women as well as men should have more stable eating habits, which may reduce obesity¹²⁴.

Because of the high fertility rate of Palestinian women, which is about 6.6, parity and number of pregnancies may partly explain this high prevalence among females. In our study the number of pregnancies was positively associated with general and central obesity even after controlling for age. Having multiple pregnancies without spacing between them will not allow the women to lose the

¹²²Madani K, Khashoggi R. Op. Cit

¹²³Beardsworth A, Keil T. *Sociology on the menu: an invitation to the study of food and society*. Routledge: London. 1997.

¹²⁴Sobal J, Rauschenbach B, Frongillo E. Marital status, fatness and obesity. *Soc Sci Med* 1992; 35(7): 915-923.

weight gained during pregnancy. Further, in this study there was significant difference in the mean BMI for females who have one or more child and those who have none. Females who had never been pregnant had lower BMI than those who had at least one pregnancy. There is debate about this issue in the literature and the association observed in many cross-sectional studies may be a result of confounding factors. Further research is needed to investigate the association between pregnancy and maternal weight gain using different study designs. Three important points need to be studied carefully before estimating pregnancy effect on maternal obesity in longitudinal studies, An accurate measure of prepregnant body weight should be obtained, mother should be given enough time to recover from temporary changes in body composition due to pregnancy, and the effect of age on body weight should be taken into account¹²⁵.

Females in the menopausal age were almost all obese. This study indicated that age was positively associated with obesity in this age group. The reason for obesity increases at this age is not clear. It may be due to hormonal changes resulting from menstrual cycle loss¹²⁶, which may affect also fat distribution and increase abdominal obesity. In premenopausal females, lipoprotein lipase activity is higher in the femoral region than the abdominal region, but this regional difference does not remain in the menopausal females, which suggests the

¹²⁵Harris HE, Ellison GTH, Holliday M, Lucassen E. The impact of pregnancy on the long-term weight gain of primiparous women in England. *Int J Obes* 1997; 21:747-755.

¹²⁶WHO. Op. Cit.

importance of sex hormones particularly progesterone¹²⁷. But also physical inactivity is more prevalent among menopausal women.

5.4 Factors influencing the development of obesity

International literature indicated several factors that may be associated with obesity development such as smoking, alcohol consumption, increase energy intake and inactivity, in addition to other psychological factors such as stress, loneliness and marital status.

5.4.1 Genetics and obesity

The high obesity prevalence observed in our population as well as in the neighboring countries such as Jordan support the hypothesis that there is genetic predisposition. The thrifty gene may be one of the explanations of genetic and environmental interaction. This gene susceptibility is thought to be high in Native Americans, Asian Indians, Australian aborigines, Mexican Americans and Hispanics, and possibly some groups in the Middle East. This gene helps

¹²⁷Lönnroth P, Smith U. Intermediary metabolism with and emphasis on lipid metabolism, adipose tissue, and fat cell metabolism: A review. In Björntorp P and Brodoff B (editors). Obesity. London: J.B. Lippincott Com. 1992. P: 3-14.

individuals to survive under famine conditions¹²⁸, but at present time where excess food is available, it causes obesity. More investigations are needed to see if this genome is actually found in our population and preventive measures will be planned accordingly.

5.4.2 Smoking and obesity

Obesity occurs probably as an interaction between genetics and environmental factors such as smoking. The effect of smoking on appetite and energy metabolism is well known¹²⁹. In our sample, smoking and weight gain were inversely related among males. Consistent with other studies, current smokers have lower BMI than ex- and non-smokers. But current smokers in our study were overweight. This is may be due to including those men who are heavy smokers and were most likely to adopt other lifestyle behaviors leading to the increase in body weights such as inactivity¹³⁰. Although smoking was associated with low BMI, smoking predisposes to CVD, chronic lung disease and cancer.

The percentage of smoking women in the study population was slightly higher than the reported for smoking females in the Palestinian population, but these

¹²⁸Pearson T. Cardiovascular diseases as a growing health problem in developing countries: the role of nutrition in the epidemiologic transition. *Public Health Review* 1996; 24:130-146.

¹²⁹WHO. Op. Cit.

¹³⁰Klesges R, Klesges L. Op. Cit.

smoking females are considered light smokers. The result of this study did not show any association between females obesity and smoking status, that is because their numbers were too small for analysis and they were light smokers unlikely to affect weight.

5.4.3 Wealth, education and obesity

In the developing countries, it was indicated that the highest prevalence of obesity is found among the wealthy groups. In this study, general and central obesity were strongly associated with wealth status in males even after controlling for confounding factors such as age, and education. As the wealth status increases the overall obesity and central obesity increase. In our culture, as in many developing countries, obesity is perceived as a sign of wealth and status¹³¹. These groups usually own a private car, television, video, satellite and other machines that enhance lower physical activity, and have the ability to purchase energy dense food.

Despite an absence of a significant relation between obesity and wealth among females, a negative trend was nevertheless seen. High prevalence of obesity tends to be found in females with lower wealth status. Many studies have pointed the negative relation between wealth and obesity among females. It was found in a follow-up study that lower income Mauritian women were more obese than

¹³¹Gurney M, Gorstein j. Op. Cit.

women with high income¹³². Similar results were reported for females in lower socioeconomic classes in Britain¹³³.

On the other hand, education was negatively associated with obesity among females. Females with lower education have high prevalence of general and central obesity, while the association between obesity (both general and central) and education was not significant among males. For females the relation between general obesity and education disappeared when controlling for age. This makes sense because the older females usually have lower educational levels. But central obesity remained associated with education even after controlling for other confounding factors such as age and wealth. One possible reason is that females with lower educational level tend to have more children, and in this study the number of pregnancies was positively associated with obesity.

By taking a deep look at the relation between wealth, education and origin in the study population, we find that Ramallah City consists, mainly, of four different communities. Each community has its specific characteristics. Those who are wealthy are mainly the natives to Ramallah City, and their wealth status is not associated with a high level of education, it comes mostly from money from relatives in America, etc. Refugees of the 1948 war and individuals from Ramallah villages are relatively wealthy and their wealth status was significantly

¹³²Hodge AM, Dowse GK, Gareeboo H, Tuomilehto J, Alberti KGMN. Op. Cit.

¹³³James W, Nelson M, Ralph A, Leather S. Op. Cit.

associated with a high level of education. The Qaysiyah form the majority of those in the lower wealth status and have the lowest level of education among the other communities. Finally, there is a small proportion of highly educated individuals from different Palestinian areas who are, mainly, in the middle classes. This group came to Ramallah to work, since Ramallah has now become a center for commerce and jobs institutions.

By looking at obesity distribution in the four communities, the pattern appears as a combination of the effect of education and wealth together. The highest obesity prevalence was among the Qaysiyah (52.3%), 1948-refugees (43.4%), then among individuals from Ramallah villages (35.3%) and the natives to Ramallah (31.7%). However, the prevalence of overweight was high among the natives to Ramallah City (46.7%). In summary, obesity is affecting all communities in the study population. Wealth may affect obesity development in some communities such as Ramallah inhabitants. Low levels of education and a larger number of pregnancies may be affecting other communities such as the Qaysiyah. For the other communities, wealth, education and the number of pregnancies each contribute to different extents. It must be remembered that there are other factors contributing to obesity development, which were not investigated in this study.

5.4.4 Food consumption and obesity

Excess of energy intake is one of the causes of obesity. It is thought that the nutrition transition that accompanies urbanization is one of the factors increasing obesity prevalence¹³⁴. It was reported that during the last three decades, a rapid change in food consumption patterns has occurred in the Arab countries. The factors affecting the change in food consumption patterns varied between the Arab countries. Factors that affect consumption include economic factors such as food price and consumer income, environmental factors such as rainfall and its distribution, social and cultural factors such as level of education, family size and employment of women, physiological factors such as age and sex, psychological factors which affect appetites and moods, and finally food industries and advertisements¹³⁵.

In Palestine, to our knowledge only one study described the dietary habits in a rural Palestinian community. The rural area still had the three-meal pattern, with lunch as the main meal. The same study indicated that there were differences between wealth groups, sexes and age groups¹³⁶ in eating habits and the food they consume. However, there is no information about food consumption patterns in urban Palestinian communities.

¹³⁴Dewnowsk A, Barry M, Popkin M. Op. Cit.

¹³⁵Miladi S. Op. Cit.

¹³⁶Stene LCM, Giacaman R, Abdul-Rahim H, Hussein A, Norum KR, Holmboe-Ottesen. Food consumption patterns in a Palestinian West Bank population. *Euro J Clin Nutr* 1999; 53: 953-958.

In the urban areas of developed countries there is no clear pattern for meal or snack. The term “eating occasion” is more used than meal or snack¹³⁷. However, in this urban area, the traditional two to three main meals are present. Lunch is the main meal for about half of the population while dinner is the main meal for a smaller percentage.

Although this study did not include food quantities, the results of food frequency analysis indicated that food is available for all. There was no statistically significant difference between males and females or between old and young groups. The results of food frequency trends between young and old individuals indicate that as individuals become older they start avoiding food rich in fat, sugar and carbohydrate, while increasing fruit consumption. This is probably due to aging, as people start to gain weight and so avoid these types of foods. In addition, chronic diseases are becoming more prevalent among older people, and changing their eating habit may come as a result of this.

Food consumed by the wealthy was different from that consumed by the poor. The rich consume more foods associated with status and wealth, including fruits, vegetables, white cheese, meat, and Arabic sweets. Some of these foods are considered healthy such as fruits and vegetables, while meat and sweets if consumed in large amounts, are not. International literature reported that those in

¹³⁷FAO/WHO Consultation. preparation and use of food- based dietary guidelines. WHO: Geneva. 1998.

higher classes in the developing countries do consume food high in fat, sugar and protein, as was found on our study. In the Arab countries, an increase in meat, poultry, vegetables, fruits and sugar was observed in almost all countries but mainly in the wealthy ones such as Saudi Arabia and Libya¹³⁸.

Food consumption patterns among the study population were not homogeneous. Each community was found to have its own dietary habits. The natives to Ramallah City consume foods high in sugar and fat more frequently. 1948-refugee consume more food rich in fibers and sugar. Ramallah villages' migrants eat fiber and carbohydrate more frequently. Finally, Hebron villages' migrants eat foods rich in fat and carbohydrates more frequently. Apparently, each community has its food habits identity, which affect individual food intake, selection and preparation¹³⁹. Food consumption patterns for each community may explain partly the pattern of obesity distribution. Almost all communities consumed food rich in fat, which is known as a risk factor for obesity development. Only minorities consume food rich in fibers which is protective against obesity.

In general, obese individuals consume food high in fats and sugar such as yellow cheese, chocolate and Arabic sweets less frequently. They consume mainly white bread, and rarely wheat bread that is rich in fibers, The pattern for different food items consumed by the obese in the 24-hour recall were surprisingly the opposite.

¹³⁸Miladi S. Op. Cit.

¹³⁹WHO. Op. Cit.

Maybe those obese individuals are trying to reduce their weight though avoiding food rich in fat and protein or there was bias in reporting because they are obese and because this is a health survey, they don't want to report their practices.

The available data provide only qualitative frequencies, but the quantity of food consumed is not known, and it maybe people consume large quantities less frequently. Food frequencies can not reflect changes in dietary habits. Further detailed investigation focusing on the quantity of food and its frequency and energy contribution is needed to understand better the relation between obesity and dietary habits.

Energy intake is one factor affecting obesity, but physical activity is another important factor. Individuals in urban areas usually adopt a more sedentary life style. Older people are less active mainly because of the disease. Moreover, there is no place for jogging or walking. Although there are some sport clubs, they are not accessible for most people, especially females. These may not be accessible for men also because of work time. In addition, individuals in this country have gotten used to staying at home because of political and security reasons. This may be an additional reason for inactivity and adopting a sedentary life style.

Finally, studying the type of work, whether it required high or low physical activity, is important in understanding its relations with obesity development.

Investigation should also include physical activities involved in getting into or from work, since some jobs may require low physical activity.

5.5 Obesity as a risk factor

Consistent with other studies, general and central obesity both were associated with high blood pressure and serum lipids. Some were significantly associated with BMI while others were associated with central obesity measured by WHR.

Age was associated with the increase of total cholesterol, LDL and diastolic blood pressure for females, with systolic and diastolic blood pressures for males.

General obesity was associated positively with systolic blood pressure and serum triglycerides. These associations appeared when using overweight cut-off (BMI 25-29.9) and obesity cut-off ($\text{BMI} \geq 30$) compared to normal weight. HDL-cholesterol was negatively associated with overweight and obesity in both sexes. These results imply that obesity and its effects on serum lipid and blood pressure starts at BMI less than 30 kg/m^2 . Remembering that the mean BMI for our sample was about 29 kg/m^2 , we can say that about half of the study population are expected to have one of the obesity complications: either abnormal lipids or blood pressure which in turn are risk for other diseases.

Central obesity was associated with increase in systolic blood pressures and serum triglycerides for both sexes. The same associations remained after controlling for age and sex.

Studies found that WHR is a strong CVD risk factor, it reflects the strong relation between abdominal fat and metabolic risk factors. It is worth noting that WHR for women is different from that for men¹⁴⁰. It is usually smaller, probably because men, irrespective of obesity, have about 20% of the total fat in the abdominal region, and women have more gluteofemoral fat in the pelvic region.

In summary, the findings of this study support the hypothesis that obesity acts as a risk factor for CVD and type 2 diabetes mellitus through its effect on serum lipids blood pressures. Other factors were reported by some studies to be affected by obesity such as hyperinsulinemia, and these factors were not investigated in this study.

The relation between obesity and type 2 diabetes was investigated by Abdul-Rahim et al, in this Palestinian area and found that the BMI and WHR were significantly higher in diabetic than non-diabetic individuals.

5.6 Study limitations

¹⁴⁰Björntorp P. Op. Cit.

This study is a cross sectional study and this type of studies does not provide evidence of causality. Further, in the analysis, we did not control for other factors that may affect obesity prevalence such as physical activity, and occupation although these factors were investigated in the larger study. Food variables were studied in terms of frequencies, but the quantity of food and calorie contents were not investigated. Finally, we used BMI as a measure for overall obesity, but this measure alone does not differentiate between fat and lean tissue mass. The use of WHR, on the other hand, gave a better idea of fat distribution. Despite these facts, the consistency of our finding with the findings reported by many studies, suggest that the observed results and association are more likely reflecting the true situation.

5.7 Obesity prevention and management

Obesity seems to be common in the study population and reaching an alarming level. The results of this study show the need for planning preventive programs, since it appears that obesity is a preventable disorder. Preventing and managing obesity not only improve life quality of people but also reduces the economic burden on the health system. Obesity prevention and management reduces, as a result, other related chronic diseases such as hypertension and CVD.

Following the World Health Organization recommendations, the prevention program should be at three levels: universal/ public prevention directed at

everyone in the community, selective prevention directed at high-risk individuals and groups and targeted prevention directed at individuals who are not obese but have excess amount of fat¹⁴¹. In our case it is important to start with the public prevention and focus the work on decreasing the mean BMI of the population.

The traditional model for obesity prevention and management focus only on preventing weight gain and promoting weight loss¹⁴². The new approach for obesity prevention and management is seen as a spectrum of four key strategies, which ranges from prevention of weight gain through weight maintenance and management of obesity co-morbidities to weight loss. For effective long-term control more attention need to be given to the prevention element¹⁴³.

Prevention and management programs should be based on changing unhealthy behaviors mainly changing to healthy diets and increasing physical activity¹⁴⁴ starting at early ages¹⁴⁵. The pattern of physical activity in childhood and adolescence is becoming more sedentary since they spend more time watching

¹⁴¹WHO. Op. Cit.

¹⁴²Munro J, Stolarek I. Indications for Treatment. In Björntorp P and Brodoff B (editors). Obesity. London: J.B. Lippincott Com. 1992.

¹⁴³Ibid.

¹⁴⁴Björntorp P. Physical exercise in the treatment of obesity. In Björntorp P and Brodoff B (editors). Obesity. London: J.B. Lippincott Com. 1992.

¹⁴⁵WHO, diet, nutrition, and the prevention of chronic diseases. WHO technical report series 797. Geneva. 1990.

television and playing video games¹⁴⁶. It is worth noting that obesity prevention through education is feasible in our context. School health programs provided by the Ministry of Health and other NGO's could facilitate reaching school children and youth.

Increasing physical activity does not necessarily mean engagement in occasional vigorous exercise, but encouraging low intensity long duration activity that is incorporated in to daily life. Such activities include walking, gardening and even dancing¹⁴⁷. The Ministry of Planning and the Ministry of the Environment have a major role in providing suitable environment that encourages cycling and running.

Diet quality is another way for preventing and managing obesity by promoting the adaptation of healthy diets that are low in calories, fat and sugar, and high in complex carbohydrate and fibers¹⁴⁸. This can be achieved through population education, development and implementation of dietary guidelines, going back to the traditional diet, food labeling and nutrition education in schools. Developing a national nutritional policy where healthy foods are subsidized and their prices make accessible to all consumers regardless of wealth should also be considered.

¹⁴⁶Robinson T. Reducing children's television viewing to prevent Obesity: A randomized controlled trial. JAMA 1999; 282 (16): 1561-1567.

¹⁴⁷Ibid.

¹⁴⁸Leeds A. Dietary fiber and obesity. In Björntorp P and Brodoff B (editors). Obesity. London: J.B. Lippincott Com. 1992.

It is important to target females groups at all ages. Females start to gain weight at their early life, partly because their bodies undergo certain physiological changes including the reproductive stage and menopause. Each stage needs special care and health education. Women's health programs in the primary health care clinic including the physician, nurse and community health workers can work directly with the females through prenatal and postnatal care for females in the reproductive age and females in the menopause age. The community health workers and primary health care team through their regular field visits can reach the community and can provide all the information concerning obesity and its prevention as well as management.

Finally, as stated by the WHO report, obesity prevention and management is a shared responsibility between the governments, food industry, media, consumers and finally the health system.

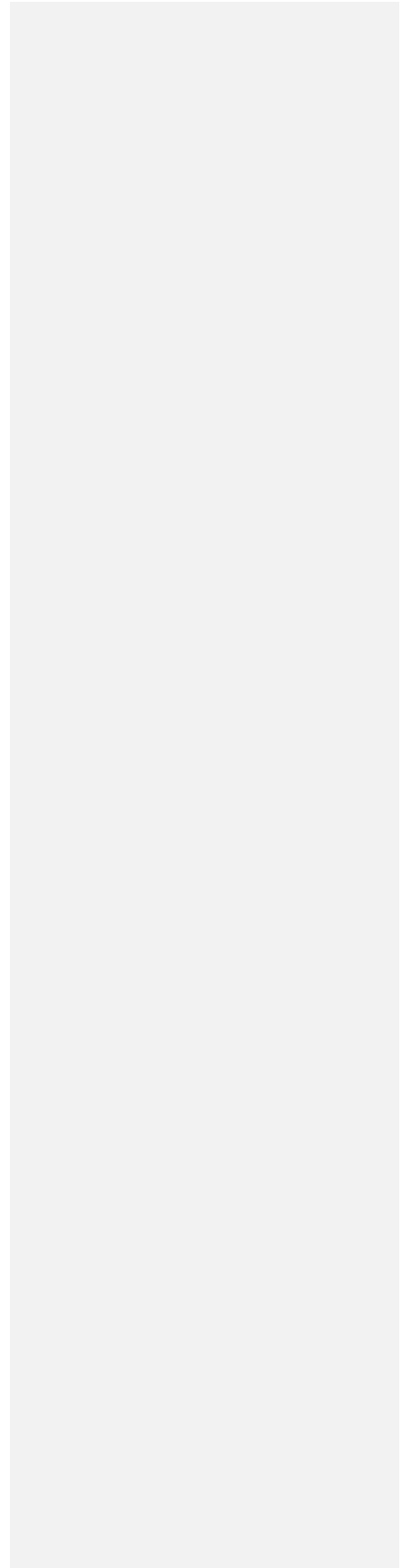
In summary, obesity prevention and management can be seen as multi leveled. The national level involves the development of national nutritional policy and a task force in physical activity. This level of intervention requires intersectional collaboration between all concerned sectors. The main aim of the prevention at this level is to shift the mean BMI of the population as a whole.

Prevention at the individual level can be divided into two stages. First prevention of obesity development through education in schools by school health programs, education for females through the women's health program, and finally community-based education through the primary health care teams and community health workers. Second management of obesity and prevention of its complication through health care professional training.

Obesity prevention must be seen as an investment because it actually prevents the development of other chronic diseases such as CVD, hypertension and dyslipidaemia.

Annexes

Annex I



Annex II

Selected question out of the questionnaire

Phase I

Family file

- V01 family name
- V06 number of family members
- V07 the name of your original village or town
- V09 do you own your house
- V10 house type
- V11 number of rooms
- V12 bathroom
- V13 water source
- V14 house water connections
- V15 electricity
- V16 washing machine
- V17 television
- V18 video
- V19 dish (satellite)
- V20 telephone
- V21 car
- V34 general house condition

Individual file

Q02 sex

Q03 age

Q06 education

Phase II

V3 date of birth in years.

V4 religion

V11 systolic blood pressure

V12 diastolic blood pressure.

V25 height

V26 weight

V27 hip circumference

V28 waist circumference

V51 sex

V54 age at marriage

V83 no of pregnancies

V84 years of education

V100 do you smoke:1-never

2-in the past

3-<10 cigarettes per day

4-10-20 cigarettes per day

5-20-30 cigarettes per day

6->30 cigarettes per day

V110 how many main meal do you eat per day

V111 how many times do you drink the following per day: tea

V112 coffee

V113 Nescaffee

V114 cola

V115 milk

V122 how many times do you eat the following per day: white bread

V123 wheat bread

V124 tabon

How many times do you eat of the following: daily, 2-3 times per week, 2-3 times per month, 2-3 times per year or less.

V126 fruits

V127 vegetables

V128 white cheese

V129 yellow cheese

V130 yogourt

V131 labaneh

V132 meat

V133 poultry

V134 fish

V135 rice

V136 fried food

V137 arabic sweets

V138 egg

V139 chocolate and bonbon

V140 jam

V141 halaweh

Foods eaten in the last 24 hour: food1, food2, ..., food27.

V175 total cholesterol

V176 HDL

V177 LDL

V178 TG

Annex III

1- Obesity variable was recoded into:

World Health Organization Criteria for BMI classification

Underweight	<18.5
Normal	18.5-24.9
Overweight	≥ 25.0
Pre-obese	25.0-29.9
Obese class I	30.0-34.9
Obese class II	35.0-39.9
Obese class III	≥ 40.0

2- Food frequency items were recoded into:

- High sugar content includes chocolate and Arabic sweets.
- High protein content includes white cheese, yellow cheese, yogurt, labaneh, and meat, chicken and egg.
- High fat content includes yellow cheese, fried foods, meat, chocolates and Arabic sweets.
- High fiber content includes fruits, vegetables and wheat bread.
- High carbohydrate content includes rice, white bread and wheat bread.

Annex IV

Obesity distribution for males among different age groups.

Age group	Normal	Overweight	Obese
30-34	40.9%(18)	45.5%(20)	13.6%(6)
35-39	26.3%(21)	45.0%(36)	28.8%(23)
40-49	20.5%(8)	33.3%(13)	64.2%(18)
>50	21.4%(6)	32.1%(9)	64.4%(13)

Obesity distribution for females among different age groups.

Age group	Normal	Overweight	Obese
30-34	29.5%(18)	42.6%(26)	27.9%(17)
35-39	20.5%(17)	30.1%(25)	49.4%(41)
40-49	6.4%(5)	35.9%(28)	57.7%(45)
>50	12.0%(9)	28.0%(21)	60.0%(45)

Annex V

The relation between the number of pregnancies and educational level.

	0-12 years of education	More than 12 years
0-4 pregnancies	23.1% (50)	56.5% (26)
5-7 pregnancies	35.2% (76)	34.8% (16)
>7 pregnancies	41.7% (90)	8.7% (4)
P < 0.001		

The relation between the number of pregnancies and origin.

	Ramallah originals	48 refugee originals	Ramallah villages migrants	Hebron villages migrants	Other areas
0-4 pregnancies	58.3% (21)	28% (21)	33.3% (9)	18.8% (16)	28.6% (4)
5-7 pregnancies	27.8% (10)	38.7% (29)	44.4% (12)	27.1% (23)	50% (7)
>7 pregnancies	13.9% (5)	33.3% (25)	22.2% (6)	54.1% (46)	21.4% (3)
P < 0.001					

Annex VII

Food frequency for the study population.

Food item	2-3 times/ week or more	2-3 times/ month or less
Fruits	91.8%	8.2%
Vegetables	97.7%	2.3%
Whit cheese	63.7%	36.3%
Yellow cheese	41.8%	58.2%
Yogurt	52.5%	47.5%
Labaneh	61.5%	61.5%
Meat	79.7%	20.3%
Chicken	71.9%	28.1%
Fish	9.2%	90.8%
Rice	86.9%	13.1%
Fried foods	29.9%	70.1%
Arabic sweets	15%	85%
Egg	53.7%	46.3%
Chocolates	38.3%	61.3%
Jam	11.5%	88.5%
Halaweh	8.8%	91.2%

Frequency for food items consumed per day.

Food item	Not consumed	1-2times/day	>2 times/day
Tea	8.0%	49.2%	42.8%
Coffee	19.7%	54.9%	25.4%
Cola	15.6%	74.9%	9.5%
White bread	92.4%	5.7%	1.8%
Wheat bread	19.9%	37.1%	43.0%

Annex VIII

Table 21: obesity distribution by the number of meals

Number of meals	One meal		Two meals		Three meals		total	
	N	%	N	%	N	%	N	%
Normal	18	28.6%	42	18.9%	41	20.5%	101	20.8%
Overweight	15	23.8%	80	36.0%	81	40.5%	176	36.3%
Obese	30	47.6%	100	45.0%	78	39.0%	208	42.9%

*Normal (BMI<25), overweight (BMI 25-29.9), obese (BMI≥30).

Annex IX

Test for linear trend between food frequency and age for the two sexes.

food item	proportion of all	Males		Females	
		test for trend with age*		test for trend with age*	
		gamma value	significance	gamma value	significance
fruits	0.92	0.49	P=0.008	0.035	P=0.827
vegetables	0.98	0.168	P=0.633	-0.125	P=0.687
white cheese	0.63	-0.116	P=0.314	0.169	P=0.060
yellow cheese	0.42	-0.224	P=0.043	-0.141	P=0.107
yogurt	0.52	0.097	P=0.391	-0.058	P=0.501
fried foods	0.3	-0.044	P=0.71	-0.174	P=0.06
chocolate	0.38	-0.373	P=0.001	-0.21	P=0.019
labaneh	0.62	-0.015	P=0.891	0.056	P=0.523
meat	0.8	-0.167	P=0.232	-0.027	P=0.787
chicken	0.72	0.0	P=0.99	-0.127	P=0.173
rice	0.87	-0.398	P=0.019	-0.467	P=0.001
eggs	0.54	0.128	P=0.25	-0.117	P=0.17
Arabic sweets	0.15	0.053	P=0.68	-0.398	P=0.004
wheat bread	0.08	-0.211	P=0.374	0.486	P=0.004
tea	0.92	0.045	P=0.68	0.167	P=0.05
coffee	0.8	0.016	P=0.87	0.074	P=0.41
Cola	0.84	-0.058	P=0.67	0.018	P=0.86

Annex X

Proportion of all and test for linear trend between food groups and obesity

food item	test for trend with obesity**	
	gamma value	P- value
High sugar content	-0.087	0.15
High protein content	-0.102	0.049
High fat content	-0.179	0.001
High fiber content	0.105	0.32
High carbohydrate content	0.056	0.27

Proportion of all and test for linear trend between food groups and wealth

food item	test for trend with wealth**	
	gamma value	P- value
High sugar content	0.102	0.1
High protein content	0.065	0.23
High fat content	0.031	0.61
High fiber content	0.278	0.01
High carbohydrate content	0.095	0.27

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