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The Relationship between Body Composition, Anthropometric Measures and Cardiovascular Risk Factors among Children

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Declaration

I certify that this thesis submitted for the degree of Master is the result of my own research except where otherwise acknowledged and that this thesis (or any part of the same) has not been submitted for a higher degree to any other university or institution.

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Signature: 

Date: 15/6/2019

Dedication

In the name of Allah praises and thanks to Allah for granting me health and strength to complete the research successfully and realize my dream.

Words can’t express my sincere love and thanks:

To my heart and the source of love: My mum, for supporting me with her prayers.

To my inspiration, the one who stood by me and lighted my way: My father.

To my rock and ambition: My brothers and sisters.

To all the people who have supported me during my study.

May Allah bless you and bring us together in paradise.

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I would like to express my deepest gratitude and love to my research supervisor Dr: Ahmad Batran, for being a brother ,a friend , a mentor and a teacher every step of the research, and for guiding me with every word I wrote

I also thank Dr. Salam Al-Khatib for giving us hope, love and knowledge for being an eternal spring of giving.

Finally, I express my sincere thanks to the one who left a mark on me, Dr: Ahmed Aydi, for his continuous support

Abstract:

Background

Obesity is a multi-factorial disease that is developed from an interaction between heredity, environment and behavior. It is a major public health concern which causes serious social, physical and psychological problems. The prevalence of overweight and obesity among children is rising to alarming levels in developed and developing countries.

Aim of the study

To assess the relationship between the Body composition, anthropometric measurement and cardiovascular risk among children aged 10-13 years attending Governmental Schools in Jenin and Tubas, and to provide comprehensive anthropometric and Body composition data of children in schools.

Method of study

A cross-sectional study design, with a convenience sample of five hundred and nine students aged 10-13 years from 4 different governmental schools in Jenin and Tubas.

Result

The study revealed that 32 (12%) of the males were overweight, and 25 (9.49%) were obese, while 28 (11.6%) of the female participants were overweight and 9 (3.7%) were obese. About 36 (13.5%) of the males and 70 (28.9%) of the female failed to engage in sufficient physical activity. In addition, the study presented a weak relationship between weight, waist circumference, hip circumference, waist to height ratio, body mass index (BMI)and systolic and diastolic blood pressure ($P<0.05$). Moreover, linear regression presented systolic and diastolic blood pressures were affected by BMI ($p< 0.05$).

Conclusion:

The current study provides comprehensive data which correlates anthropometry and Body Composition with cardiovascular disease (CVD) among children make it possible to permitting predictions of the complication of obesity and CVD in the future, by using simple instrument to evaluate and predict future cardiovascular disease.

In the current study, the prevalence of obesity and overweight among children in governmental school aged 10-13 years increasing, mostly in boys more than girls, also the body mass index (BMI) measurement provided the best correlation with cardiovascular diseases rather than other measurements, so it's very important to keep children of this age 10-13 years under observation to prevent further complication later. The Ministry of Education and Higher Education (MoEHE) must implement necessary intervention that securing safety of children through awareness lectures for teachers and students on the complication of obesity and how to minimize it and get healthy body by physical activity and eating healthy foods.

العلاقة بين تكوين الجسم والموشرات و القياسات البشرية وعوامل الخطر القلبية الوعائية بين الأطفال

اعداد: نورس عدنان حسين فشافشة

اشراف : الدكتور احمد البطران

ملخص الدراسة :

السمنة هي مرض متعدد الفصائل يتم تطويره من التفاعل بين الوراثة والبيئة والسلوك. إنه مصدر قلق كبير للصحة العامة والذي يسبب مشكلة اجتماعية وجسدية ونفسية خطيرة. يرتفع معدل فرط الوزن والسمنة بين الأطفال إلى مستويات تنذر بالخطر في البلدان المتقدمة والنامية.

الهدف من الدراسة :

لتقييم العلاقة بين تكوين الجسم والقياس الأنثروبومترية ومخاطر القلب والأوعية الدموية بين الأطفال الذين تتراوح أعمارهم بين 10–13 سنة الملتحقين بالمدارس الحكومية في جنين وطوباس ، ولتوفير بيانات شاملة عن التكوين البشري للجسم للأطفال في المدارس.

منهجية الدراسة:

اجريت دراسة مقطعية وصفية باستخدام عينة من خمسمائة وتسعة طلاب تتراوح أعمارهم بين 10–13 سنة من 4 مدارس حكومية مختلفة. في جنين وطوباس

النتائج:

وكشفت الدراسة أن 32 (12 ٪) من الذكور يعانون من زيادة الوزن ، و 25 (9.49 ٪) كانوا يعانون من السمنة المفرطة ، في حين أن 28 (11.6 ٪) من المشاركين من النساء يعانون من زيادة الوزن و 9 (3.7 ٪) يعانون من السمنة المفرطة. حوالي 36 (13.5 ٪) من الذكور و 70 (28.9 ٪) من الإناث فشلت في ممارسة النشاط البدني الكافي أيضا ، قدمت

الدراسة علاقة ضعيفة بين الوزن ومحيط الخصر ومحيط الورك ونسبة الخصر إلى الطول ومؤشر كتلة الجسم (BMI) وضغط الدم الانقباضي والانبساطي .(P <0.05) وعلاوة على ذلك، قدم الانحدار الخطي ضغوط الدم الانقباضي والانبساطي تأثر مؤشر كتلة الجسم.(P <0.05)

الاستنتاج :

توفر الدراسة الحالية بيانات شاملة تربط بين قياس الجسم البشري وتكوين الجسم بأمراض القلب والأوعية الدموية (CVD) بين الأطفال ، مما يجعل من الممكن السماح بتنبؤات مضاعفات السمنة وأمراض القلب والأوعية الدموية في المستقبل ، باستخدام أداة بسيطة لتقييم أمراض القلب والأوعية الدموية المستقبلية والتنبؤ بها.

في النتائج التي توصلنا إليها ، فإن انتشار السمنة وزيادة الوزن بين الأطفال في المدارس الحكومية الذين تتراوح أعمارهم بين 10 و 13 عامًا ، ومعظمهم من الأولاد أكثر من الفتيات ، كما وفر مؤشر كتلة الجسم (BMI) أفضل علاقة بأمراض القلب والأوعية الدموية بدلاً من القياسات الأخرى ، لذلك من المهم جدًا إبقاء الأطفال في هذه الفئة العمرية 10–13 سنة تحت الملاحظة لمنع حدوث مزيد من المضاعفات لاحقًا. من قبل وزارة التعليم والتعليم العالي (MoEHE) يجب أن تنفذ التدخل اللازم لضمان سلامة الأطفال ، من خلال محاضرات توعية للمعلمين والطلاب حول مضاعفات السمنة وكيفية الحد منها والحصول على الجسم السليم من خلال النشاط البدني وتناول الأطعمة الصحية.

Contents

List of Table

List of Abbreviation

Abbreviation	Meaning
AC	Abdominal circumference
BF%	Body fat percentage
BMI	Body mass index
BP	Blood pressure
CDC	Center for Disease Control and Prevention
CM	Centimeter
CV	Cardiovascular
CVD	Cardiovascular disease
DM	Diabetic mellitus
F	Frequency
HC	Hip circumference
HDL	High Density lipoprotein
ITFO	International Task Force Obesity
Kg	Kilogram
LV	Left ventricles
MoEHE	Ministry of education and higher education
MOH	Ministry of health
NASN	National Association of School Nurses
NCDs	non- communicable diseases
R	Correlation Coeffient
RF	Risk factor
ROC	Receiver operating characteristic
SD	Standard deviation

Spss	Statistical Package for Social Sciences
TV	Television
UNICEF	United Nations Children's Emergency Fund
US	United state
WC	Waist circumference
WHO	World health organization
WHtR	Waist height to ratio

Chapter One

Introduction

Obesity in general is a multi-factorial disease that forms from the interaction between genotype and the environment in the way those polymorphisms in many genes control appetite and metabolism promote to obesity when sufficient food energy is present (Poirier et al., 2006). So Obesity is a problem that most people today give attention to due to its effects on human life either from a medical or a social angle.

According to International Task Force Obesity (ITFO,2004) the increasing occurrence of overweight and obesity among children affects health issue and contributes to increase rates of morbidity and mortality.

The ITFO (2004) reported that the children's physical growth rate and development are increasing fast at the pubertal phase, and children have the tendency to collect fat when total energy intake exceeds the total energy expenditure. This energy imbalance can result from excessive energy intake and/or reduced energy expenditure for body metabolism, thermoregulation and physical activity. Regularly consuming food rich in high calories by children more than their bodies' need will increase weight and develop obese over time making obesity of children, which is one of the most widespread medical problems in the world.

Obesity, an extra of body fat, is a complex and chronic disease which continues to increase in prevalence among adults, adolescents and children. Obesity has become one of the most health problems. The increase in prevalence of obesity involves an increase in the prevalence of several obesity-related co morbidities (Hastuti, 2013;Musaiger, 2012).

In Arab countries, the most risk factors for overweight and obesity includes poor eating habits, insufficient physical activity, decrease of level of health education and low family income (Al-Saeed, Al-Dawood, Bukhari, & Bahnassy, 2007)

The obesity among children and adolescence will develop and become a major health problem. As a result of childhood's and adolescent's obesity, cardiovascular disease (CVD) risk factors during childhood and adolescence in continuous increase, cardiovascular disease is the leading cause of global mortality. Around 17.5 million deaths in 2005, and it will be increasing to 23.6 million deaths by 2030(Umer et al., 2017)

The prevalence of overweight and obesity among children is alarming in the world (Caius & Benefice, 2002). The WHO Fact Sheet (2010) indicated that obesity during childhood has become a major worldwide problem; more than 40 millions of children under the age of five were overweight in 2011, and 65% of the world's population live in countries were overweight and obesity kill more people than those who are underweight. In 2010 approximately 26 million children in European Union countries were overweight including 6.4 who are obese (Kosti and panagiotakos, 2006)

The overweight and obesity are associated with other disease and contribute harmfully toward people overall health also intra-abdominal fat accumulation was considered as a major risk for development the HTN (Kopelman, 2007). Furthermore, WHO (2018) reported that most people are victims to un healthy behaviors like tobacco exposure, alcohol, unhealthy diet, physical inactivity that increased risk for developing obesity, and other non- communicable diseaseslike cardiovascular disease and hypertension. Also, it is estimated that each year arround15 million are died by NCD. However, over 85% are death in middle and low income countries.

Additionally, Obesity is associated with cardiovascular (CV) risk factors, insulin resistance, dyslipidemia and hypertension empirically documented as 'The Metabolic Syndrome' is sharing with develop CV risk, so presence of the cardiovascular risk factors in children and adolescents increase tendency to be complication in adult lifespan(Sung et al., 2007).

Obesity among childhood is continuously increasing worldwide, so the relationship between obesity and CVD is significant. In addition to that, obesity harmfully influences on many types of CV risk factors and this requires further investigations for its health consequences among children. However, the relationship between body fat and CV risk factor in early childhood in the first period of life span is less clear(Watts, Bell, Byrne, Jones, & Davis, 2008). To distinguish obesity as a concept of extra body fat accumulation, different measures are used to assess the body composition. The most common measures used (BMI), while the (WC) and (WHTR) are used to describe the abdomen fat. However, the BMI may have disadvantages over the WHTR because WHTR provides information about body fat distribution (Sijtsma et al., 2014).

In Sardinha et al. (2016) the risk of cardiovascular disease among children is increasing and associating with different body composition measures, so there is a strong relationship between increase of measure of abdominal fat and risk for several CVD.

The major risk factors related with CVD are including: DM, smoking, hypertension, overweight and obesity. Nearly all these risk factors are predictable through changing in lifestyle, so eating healthy food and sufficient physical activity are decreasing the risk for CVD (Valentino et al., 2015).

BMI articulated as weight/height2 (kg/m2) is a public and easily obtained measure of adiposity that can stratify the risk for overweight and obesity among children and adults, also waist

circumference (WC, measured in centimeters) is particularly linked with metabolic syndrome among adults, children and adolescents (Messiah et al., 2012). Moreover, the most broadly used tool to determine overweight and obesity in clinical and epidemiological studies is Body Mass Index (BMI). However, using BMI to sort overweight and obesity has limitations as the index cannot discriminate between lean and fat mass (Hastuti, 2013). So (Valentino et al., 2015) the waist circumference (WC) is strongly associated with visceral fat rather than BMI to determine the risk for CV.

The studies indicated that the percentage of overweight male adolescents aged from 15 to 18 years was highest in Kuwaiti (25.6%), followed by Jordanian (21.6%), and Syrian (19.7%). However, the percentage of highest prevalence of overweight female adolescents was reported in Libyan (26.6%), followed by Kuwaiti (20.8%), and Syrian (19.7%). On the other hand, the percentage of adolescents' obesity in Kuwaiti was the highest prevalence in both male (34.8%) and females (20.6%) (Musaiger, 2012).

Children spend most of the time in school setting, so the school nurses are often fighting against the childhood overweight and obesity (Ogden & Carroll, 2010). The National Association of School Nurses (NASN) discussed the role of the school nurse regarding the obesity and concerned this big problem, the nurse should be acknowledgeable about the obesity and overweight and how to promote and prevent them, also the school nurse needs to collaborate with students and families to identify the main causes of obesity and to educate them how to get healthy weight and healthy body (NASN, 2013). However, there are several barriers that faced school nurse practices and interventions related to childhood obesity (Hendershot et al., 2008; Kubik, Story, & Davey, 2007).

1.1 Problem statement:

There is a lack in the studies that estimate the prevalence and influencing factors of overweight and obesity among children in Palestine. Furthermore, reports on the prevalence of obesity and overweight in Palestine are scarce; the only data found in the Ministry of Health is the report of at Directorate of nutritional department in the National Nutritional Surveillance System (2011). The report found that the overall prevalence of overweight of school children from 5-10 years was 15.12% (14.7% in the West Bank and 15.17% in the Gaza strip) the highest prevalence was in Nablus, north Gaza and Bethlehem (20.89%- 18%- 17.59%), respectively and the occurrence of obesity among school age from 5-10 years was 0.67% and again the highest was in Nablus indicating a large difference among overweight and obesity. Also, another study was conducted in western Gaza city among primary male school children as aged 10-12 years old to assess obesity, as a result, the prevalence was reached 4.3% related to eating during TV watching, low physical activity, exercise, and playing football (Siam, 2011). However, these studies focused on prevalence and factors of obesity. Therefore, this study was aimed to assess the relationship between Anthropometric measures and cardiovascular risk factors among children aged 10-13years in Jenin and Tubas Governmental Schools.

Anthropometric measurement is taken by MOH only for grade one children; where the prevalence of obesity reaches 1.1% among them (MOH,2005, WHO,2005 & UNICEF, 2005).

1.2 Significance of the study:

Overweight and obesity have been identified as key risk factors of preventable morbidity and mortality of many diseases, such as hypertension, cardiovascular disease and non-insulin-dependent Diabetes Mellitus. As the health, psychological and economic costs of overweight and obesity are very high, effective general prevention of overweight, including among young

people is essential; where this strategy requires studies identifying the problems which ultimately will lead to health risk like obesity and overweight that influence of health and decrease risk for cardiovascular disease among children. So depending in our result of the study, the result could assist the health educator to improve and develop strategies and polices to minimize and prevent the overweight and obesity among children.

Palestinian studies show that the most common cause of obesity during adulthood is eating unhealthy food and depending on starch. There is a lack in information about childhood and adolescents regarding to body composition and anthropometric measurement to decide their morbidity and health situations. There for this study was conducted to assess the relationship between body composition, anthropometric measures and cardiovascular risk factor among children aged 10-13 years in Tubas and Jenin governmental schools.

1.3 Research objectives:

This study aimed to assess the relationship between the Body composition, anthropometric measurement and cardiovascular risk factor among children aged 10-13 years attending Governmental Schools in Jenin and Tubas.

1.4 Specific objectives:

1. To measure body mass index (BMI) of targeted children.

2. To assess the anthropometric measurement as predictor of cardiovascular disease risk among children in Jenin and Tubas Governmental Schools.

3. To provide comprehensive data of anthropometry and body composition of

Children in schools.

1.5 Research questions

Based on a review of the literature and information available from the original survey, the following research questions were addressed in this study:

1. What is the prevalence rate of overweight and obesity among children in Jenin and Tubas Governmental Schools?
2. What is the relationship between cardiovascular disease risk (systolic and diastolic blood pressure) and anthropometric measurement among children in Jenin and Tubas Governmental Schools.?
3. Are there differences between anthropometric measurements scores and diastolic blood pressure as cardiovascular disease risk?
4. What is the predictor of cardiovascular disease risk among children in Jenin and Tubas Governmental Schools.?

1.6 Conceptual definition:

Body mass index (BMI): It's calculated as the weight in kilograms divided by the square of the height in meters (Kg /m^2) (WHO, 2011)

Overweight: is defined as a BMI at or above the 85th percentile and lower than the 95th percentile for children of the same age and sex. (WHO, 2011)

Obesity is defined as a BMI at or above the 95th percentile for children of the same age and sex. (WHO, 2011)

Hip circumference (HC): Hip circumference should be measured around the widest portion of the buttocks, with the tape parallel to the floor (WHO, 2011).

Waist circumference (WC): measured at the midpoint between the lower margin of the least palpable rib and the top of the iliac crest (WHO, 2011)

Waist-to-height ratio (WHtR): is the ratio between waist circumference and height of a person. Waist circumference and height should be in the same unit of measurement (WHO, 2011)

Waist–hip ratio: the waist circumference divided by the hip circumference was suggested as an additional measure of body fat distribution (WHO, 2011)

1.7 Operational definitions:

The weight was measured to the nearest 0.1 kg by using digital bathroom scales with the participant standing in light clothing and not wearing shoes. The height was measured by using Suitable metallic meter scale measuring to the nearest 0.5 cm, fixed on the wall. The researcher measured the heights of the subjects without shoes, taking into account that heals, buttocks, shoulders and head are closed to vertical wall surface, and ruler was used horizontally to take height.

The WC and hip circumference was measured by stretchable tape. Waist circumference was measured at the smallest girth between the costal margin and the iliac crest and Hip circumference was measured at the widest circumference between the anterior superior iliac crests and the ischial tuberosity (Vasan et al., 2011).

The WHtR was calculated by dividing WC in cm by height in cm, Hip circumference was calculated by dividing WC (waist circumference) in cm by HC (hip circumference). The blood pressure was assessed manually using a standard sphygmomanometer 3–5 min after the participants feel comfortable.

Body mass was measured barefoot, in light clothing, using a Tanita MC-980MA bioelectric impedance assessment electronic scale (Tanita Corporation, Tokyo, Japan). To compensate the mass of clothes, 0.5 kg was subtracted from the total mass. BMI, Muscle mass, bone mass, visceral fat and lean mass was reported through the Tanita scale depending on the measurement of body mass and water content in the body.

Chapter Two

Literature Review

Introduction

This chapter, provides global, regional and national studies levels related to the current study as concepts and variables. Then, the studies are divided into four parts: Prevalence of overweight and obesity among children, Association between anthropometric measurements with cardiovascular disease risk, eating habits, physical activity and socio-demographic.

Prevalence of obesity and overweight

Ogden (2006) assessed the prevalence of obesity and overweight in United stated between the years 1999-2004. He found that in the years 2003 and 2004,17.1% from children and adolescents were overweight and 32.2%of adult were obese. When compared between male and female, he found increase in prevalence rate of overweight in female children and adolescents from 13.8%in1999-2000 to 16% in 2003-2004. Similarity, he also found increase the prevalence rate of obesity in male from 14% in 1999-2000 to 18.2%in 2003-2004.Additionally, in 2016, Ogden assessed the prevalence of obesity and overweight among children in United stated between 1988-1994 and 2013-2014 , the obesity increased from 5.8%-8.8%) in period (1988-1994) , but increased from (6.8%-12.6%) in (2013-2014).

Vaska&Volkmer (2004) assessed the prevalence rate of obesity and overweight among South Australian children in period 1995-2002.They found that 12.8% of females were overweight in 1995, 3.5% were obese,10.2% of males were overweight of males in 1995 and 3.2% were obese but the figures in 2002showed that 21.4% of females were overweight, 5.8 of females were obese,17.3% of males were overweight while 5.8% of males were obese.

Recent statistics showed 16.9% of children and adolescents were obese, when combined with figures for overweight status, approximately one third of U. S. children are affected(Ogden, Carroll, Kit, &Flegal, 2014), while the national trends in North Carolina (NC) showed that 31.4% of children were considered overweight or obese (Alliance for a Healthier Generation, 2015).

Wang, Monteiro, & Popkin (2002)examined the trends of overweight among children aged 6 - 18 years from the United States, Brazil, China, and Russia using international references. Thus, nationally the data are representative from Brazil (1975- 1997), from (4.1% to 13.9%), United states in period (1971 to 1974 and 1988 to 1994) from (15.4% to 25.6%) and China (1991 and 1997) (from6.4 %to 7.7%).

Additionally, in Baskin & Frank et al. (2005) the prevalence of obesity has been significantly increased among the US population over the past 30 years, the data collected between 1999-2002 showed that there are scarcely one in every six obese or overweight children while, Lioret et al. (2007 assessed the level of obesity and overweight aged 3-14 among French children and examined how sport activity and sedentary behavior affected overweight status that found 15.2% of children are obese and/or overweight.

Moreover, Al-Haddad et al. (2005) study conducted in Emiratis school children aged 1-18years to assess the percentage of obesity and overweight. The figure showed that 12.1% of school children were overweight and also 21.5% were at risky to develop and become overweight.

Khader et al. (2009), conducted across-sectional study to estimate the prevalence of overweight and obesity among Jordanian children school aged 6-12 years old. they found a high level of overweight in girls (19.9%) and (18.8%) in boys and 5.6% of boys and 5.5%in girls wereobese.

Kosti&Panagiotakos (2006) study assessed the prevalence of overweight and obesity in the world among children in Asia and Africa. They found that prevalence of overweight below 10

% while from America and Europe above 20%, which means that increasing risk for obesity and overweight form developed countries is more than in developing countries

A descriptive cross-sectional study was conducted by Abu Baker &Daradkeh(2010) in Irbid among adolescents aged 13-16 years to assess the level of overweight and obesity by compared sex, residential area and socioeconomic status. The study found that 15.7% of adolescents were overweight and 8.7 % were obese.

Çalışır & Karaçam (2011) study in Turkey examined the prevalence of overweight and obesity among children aged 8-11 years and the result showed the prevalence rate of overweigh was12.8% and for obesity was 13.7.

Association between anthropometric measurements and the risk of cardiovascular disease.

1,950 volunteers' participants in Brazil among aged 7 to 18 years were evaluated for visceral fat which was assessed by WC, BP, WH ratio and (BMI). The subsample was selected randomly (n = 578) and they were assessed for total cholesterol, triglycerides and glucose levels. The study showed that WC is a predictor and risk of hypertension of the target aged group and it is associated with cardiovascular risk factors (Burgos et al., 2013).

Another study, in which WHtR, WC and BMI were measured to assess BF% in 61 children (3-7 years) from the general population, and bioelectrical impedance (Horlick equation) was used to assess BF% in 75 overweight/obese children (3-5 years). Cardio-metabolic risk factors, including blood pressure were assessed. The results of study showed BMI had strong alteration for Body fat% compared to WC and WHtR. Systolic blood pressure showed positive significant correlated with BMI, WC, WHtR, overweight and obesity in children(Sijtsma et al., 2014)

Additionally, a cross sectional study was examined the associations between BMI, WC, and WHtR with cardiovascular disease risk , 4255 (2191 girls and 2064 boys) participant from

age (8–17 years), mention the result of the study showed all anthropometric BMI, WC, and WHtR have a similar effect of CVD (Sardinha et al., 2016)

Moreover, a study showed that the age, sex, and ethnicity/race-specific threshold values for BMI and WC may have significant clinical usefulness in identifying adolescents and teenagers at risk for later CVD. The BMI and WC threshold values assessed to predict increased CVD risk in 12- to 19-year-old adolescents by using a multiethnic US population-based sample (Messiah, Arheart, Lipshultz, & Miller, 2008).

Furthermore, a study examined the Waist circumference and body mass index in Chinese children. HC, height, WC, and weight were measured in this study. The sample 2593 was selected randomly from Hong Kong school among children aged 6–12 years. The results showed the relationship between these variable six age-adjusted CV risk factors(Sung et al., 2007)

Systematic review study with meta-analysis which includes total 23 studies with 21 Meta – analysis with 4840 citations reviewed among Children obesity and adult CV disease risk factors. The findings show the obesity among childhood is more significantly and associated with systolic blood pressure in adult, then BMI is a probable mediator and increasing risk for cardiovascular disease (Umer et al., 2017).

There is another study to assess the WC and WHtR as predictors of cardiovascular disease in children than BMI. The study included 1037 boys and 950 girls with mean age 11.4_0.4 years. The children divided for two groups. The results showed that waist circumference was the most significant predictor for boys and girls, while BMI had the lowest predictive value for the detection of cardiovascular disease risk factors (Savva et al., 2000).

InPetkeviciene et al. (2015) study showed that there was a positive relationship between the increase of BMI during childhood and risk of obesity during adulthood. Moreover,

anthropometric measurements during childhood were associated with increased risk for metabolic syndrome and CVD.

A cross sectional study in Guanagzhou, China indicated that the waist circumferences is better than other anthropometric indices for predicting cardiovascular disease risk factors in Chinese children. A totals of 2563 children aged 8-12 years were recruited in the study. The result showed that the highest coefficients were found for WC in risk factors in both genders, also the receiver operating characteristic (ROC)analyses showed that WC was the best in predicting for B/P (Ma et al., 2016)

Additionally, there is a cohort study in Kaunas that assessed anthropometric measurements in childhood to predict CVD in adulthood .The total 1977 survey of children aged 12–13 years and 506 follow up survey in 2012 aged 35 years were recruited in the study .The weight, height, and triceps skin fold thickness are measured to assess risky for metabolic syndrome in childhood, and If DM, and hyperglycemia are affected by BMI and skin fold thickness. The results showed that hypertension, high triglyceride and low HDL are more significantly associated with body mass index gain from adulthood and childhood(Petkeviciene et al., 2015)

A study in Mexico was conducted to evaluate the relationship between body composition index and CVD among young adult in a sample of 1351 participants. They used different measures to evaluate the body composition and anthropometric measures to predicate cardiovascular disease. It concluded that BMI and BSA are correlated with cardiovascular disease risk factor more significantly than WC, WHtR, WHR, BF% (Kammar-García, Hernández-Hernández, López-Moreno, Ortíz-Bueno, & de Lurdez Martínez-Montaño, 2018)

Another study in Australia was done on 661 children at age 11 and 18 years old to assess the relationship between anthropometric measures and CVD risk. It concluded that height; leg length and trunk length were not significantly associated with CVD risk, as these measures showed very slight and non-changed increase in systolic blood pressure at both age points. On

the other hand, it concluded that higher body mass index (BMI) is correlated to higher SBP measures at the same age points(Gialamas et al., 2018)

However, in another study was conducted in Nigeria to assess the relationship between anthropometric measures and cardiovascular disease in young children, it concluded that weight is a predictor for systolic blood pressure while age is a predictor for diastolic blood pressure and abdominal circumference (AC) is better as a predictor for cardiovascular diseases (Abiodun, Egwu, & Adedoyin, 2011)

Eating habits

The dietary habits among children have been switched away from eating healthy foods such as fruit, vegetables, and whole prefer fast snacks and junk food, so these foods tend to be high in fat and/or calories and low in many other nutrients especially vitamins, minerals and fibers. Also, some eating patterns have been associated with such as eating with hunger and eating while watching TV or doing homework (Johnson and Birch., 1994). That means avoiding eat fruit and vegetables, as the important components of a healthy diet, which are increased risk for obesity and multiple chronic disease like cardiac problem and diabetic type II, so daily ingested sufficient quantities of healthy food that help bodies to protect against chronic diseases.

In India Parenting, 2010.The junk food as labeled that s foods with are high in fat and sugar and poor nutritional value , such as crisps, sweets, wafers, colas, fizzy drinks, pizza and burgers. In fact, the concept of junk foods are prepare immediate, delicious and convenient. Also, Junk foods have food additives and colors, making them appetizing in a way that makes them harmful for bodies. Additionally, junk foods include a high level of calories, and even though

they lack micro-nutrients such as, vitamins, minerals, amino acids, and fiber, and the high level of energy ingested is not useful, because it includes harmful carbohydrates, fats and cholesterol.

Bellisle & Rolland-Cachera,(2007)study, the eating of high amounts of saturated fat and carbohydrate, with low consumption of fruit and vegetables that increase risk for developing a serious disease like overweight, obesity elevated blood pressure and cardiovascular issues. Austin (2011)reported that eating habits can be modified and keep bodies away from diseases and obesity, almost meals were cooked fresh at home although in the current days eating pastries and frozen meals spend least time but increased susceptibility for bad eating habits and risk for weight gain.

Also, Gregory et al. (2014) study reported that there is a relationship between ingestion of potato chips and the increase risk of developing body weight among children aged 3-11 year in 9 countries; Argentina, Brazil, France, Georgia, Germany, Great Britain, India, Italy and Mexico.

Al-Assa (2012) study assesses nutrition habits and physical activity among school students in governmental schools in Bethlehem city. There was a slightly statistical ratio of choosing healthy types of food among students. Moreover, the results of the study show that the presence of healthy food in school in cafeterias and canteens help students to change the dietary habits because most of students depend on buying their meals from schools canteens during the break.

Finally, studies conducted in Palestine showed that the basic factors of increased risk of obesity in adults are the poor quality of food consumption and mostly dependent on food with higher starch and energy. In addition there is a lack of information among children and adolescents 'about nutrition, nutritional habits and anthropometric measurement like WC and BMI that used to determine their health situations. So, the Anthropometric measurement is

taken by MOH only for grade one children; where the prevalence of obesity reaches 1.1% among them (MOH, 2005WHO, 2005&UNICEF, 2005)

Physical activity

Jebb&Moore (1999) study found that there was a strong relationship between obesity and the lack of exercises. Physical activity was recognized as a major part in the management of overweight and obesity. Additionally, physical sport emerged as the most important factor that contributory to obesity status and to an increased energy expenditure(Chambliss, 2005).Significant relationship between the low participation in physical activity, lack of pleasures in doing exercise and increase the number of hours spent setting down with developing overweight and obesity (Martinez, Kearney, Kafatos, Paquet, & Martínez-Gonzélez, 1999).

Page et al. (2005) study determined the percentage and patterns of physical activity in a sample of obese and non-obese children in United Kingdom. In all 11 (16.9%) of the 65 girls and 14 (20.6%) of the 68 boys were classified as obese.

Also, Lioret et al. (2007) study examined the prevalence of overweight and obesity among childhood in French children aged 3-14 years and assessed how physical activity effect of the obesity, the result show 15.2% of children were overweight and obese .

Additionally, WHO (2004) study on the Global Strategy on diet and physical activity showed that physical activity was one of the important factors that determined energy exchange, and therefore it was a key factor in achieving stability between the energy expenditure and suitable weight. The report added that physical activity reduces the risk of developing chronic disease like cardiac problem and elevated blood pressure also protects against some types of cancer, and risk for diabetic type 2. In addition there was an association between overweight and obese

children with number of hours spent on sedentary activates like watching TV and playing video games rather than those normal or lower weight status (Vandewater, Shim, & Caplovitz, 2004)

In brief, healthy lifestyle habits, including sport activity and eating healthy food can be reduce the risk of developing overweight and becoming obese related to diseases in U.S. Department of Health and Human Services, 2010 (Committee, 2010)

Socioeconomic status factor

Alaimo et al. (2001) study determined the associations between family income, food insufficiency, and devolving obesity and overweight among US children aged 2 - 7 and 8 -16 years; the prevalence among older non-Hispanic white children, children in families with high income is more significant to be overweight than children in families with low income while there is no significant between non-Hispanic white children, non- Hispanic black children, or Mexican American children with your family income.

A study conducted in Turkey among adolescent and children were concluded that overweight and obesity were high in low socioeconomic status areas (Yoca et al., 2010). (Sánchez-Castillo et al., 2001) report considered that high prevalence of obesity and overweight among children was evident in poor rural communities of Mexico. Moreover in Klien-Platate et al. (2003) study showed that overweight among young French adolescents was more happened in low economic regions and in government schools than in private schools.

In, Lamerz et al. (2005) study assessed the association between socioeconomic status and childhood obesity among 2020 German children and which factor in particular stands out in relation to obesity. The indicators of parental education where there is a strong relationship with obesity in children. On circumstance, children who have lower social status had more three times risk for obesity rather than who had higher social status in the screening population.

Singh et al. (2010) study results revealed that obesity among all U.S. children aged 10-17 years old in period between 2003-2007 increased by 10 percent, but 23 percent increase in the same time of period for low-income children; these result were proved right by Drewnowski et al. (2009)report in California, which indicated that there is a strong relationship between the level of poverty rates in community with level of overweight and obesity rates which means higher community poverty rates, higher childhood obesity and overweight rates thus supported. Alaimo et al., (2001) indicated that children in families with low income were significantly more likely to be overweight than children in families with high income.

Chapter Three

Methodology

Introduction

This chapter involves the steps of research methodology, study design, setting, population and sampling, inclusion and exclusion criteria, data collection and analysis procedures and ethical consideration.

3.1 Study design:

Cross-sectional study was conducted to assess the relationship between body composition and anthropometric measurement with cardiovascular disease among children aged 10-13 years old.

3.2 Setting:

This study was conducted in Jenin and Tubas Governmental schools for both males and females from 4 different schools (Abu- Thar Alghafar female school, Mostafa Abu Kazaran male school, Al-Malesia female school, Al-Karama male school).

3.3 Population and sampling:

Convenience sample offive hundred and nine students enrolled in 5, 6,7, and 8th grades aged (10-13) years old studying in 4 different schools in Jenin, and Tubas Governmental schools.

Yamane (1967) provides a simplified formula to calculate sample sizes. This formula was used to calculate the sample size

$n = N / [1 + N (e)^2]$

Where n is the sample size, N is the population size, and e is the error of tolerance (0.05)

$n = 2000 / [1 + 2000 (0.05)^2] = 333$ students

Therefore, to overcome the attrition rate, the total sample was 509 students

3.4 Inclusion criteria:

healthy male and female children, aged 10-13 years, from Jenin and Tubas Governmental Schools**.**

3.5 Exclusion criteria:

Participants who took insulin, anticonvulsants, glucocorticoids, or have past history of medical or surgical cardiac problem would alter. The blood glucose level was excluded from the actual study.

3.6 The Study Instruments:

The research instruments consisted of anthropometric measurement obtained by one-one interview and closed ended questionnaire done in classes.

The anthropometric measurements assessed by a standard procedure ensuring inter observer reliability.

Weight: The weight was measured to the nearest 0.1 kg by using digital bathroom scales with the participant standing in light clothing and not wearing shoes.

Height:

Suitable metallic meter scale measuring to the nearest 0.5 cm, fixed on the wall was used. The researcher measured the heights of the subjects without shoes, taking into account that heals,

buttocks, shoulders and head are closed to vertical wall surface, and ruler was used horizontally to take height (WHO, 2011).

Waist and Hip Circumference:

Measured to the nearest 0.1 cm using a plastic tape with the students in the standing position. Waist circumference was measured at the smallest girth between the costal margin and the iliac crest and the Hip circumference was measured at the widest circumference between the anterior superior iliac crests and the ischial tuberosity (WHO, 2011).

WHtR (Waist Height to Ratio):

Calculated by dividing WC (waist circumference) in cm by height in cm. TheWHtR classified as a cutoff of 0.5 used to differentiate low WHtR from high WHtR, (WHO, 2011))

WHR(Waist Hip Ratio):

Calculated by dividing WC(waist circumference) in cm by HC(hip circumference), classified according the WHO states that abdominal obesity is defined as a waist-hip ratio above 0.90 for males and above 0.85 for females(WHO, 2011).

Blood pressure

The blood pressure was measured manually using a standard sphygmomanometer with the appropriate cuff for the children's upper arm size, 3–5 min after the participants feel comfortable. Classified as Children with both systolic and diastolic blood pressure 95th percentile was defined as normotensive. Children with systolic or diastolic blood pressure above 95th percentile were defined as hypertensive. Sex, age, and height specific cutoff values for systolic and diastolic blood pressure were based on US references (Falkner et al., 2004)

Electronic scale (Tanita Corporation, Tokyo, Japan). To compensate for the mass of clothes, 0.5 kg will be subtracted from the total mass. BMI, Muscle mass, bone mass, visceral fat and Lean body mass was reported through the Tanita scale and is based on the measurement of body mass and water content in the body, BMI classified less than 25th percentiles children who are underweight , between 25th to less than 85th percentile children who are Normal or Healthy Weight and between 85th to 95th percentiles for age and sex to identify children who are overweight, and a BMI greater than or equal to the 95th percentile to identify children who are obese (WHO, 2011).

3.7 Questionnaire:

After reviewing literature related to topic of master, the researcher chose a questionnaire (**KRECEPLUS**) as an international tool for comparison of overweight and obesity prevalence in school-aged youth and their relationships with physical activity and dietary patterns.

The questionnaire wastranslated toArabic by (Alpha) an international organization of research and informatics (Serra, Aranceta, & Rodríguez Santos, 2003).

The tool of the study consists of three parts present in (appendix A), including the following parts:

The first part: dietary habits that included items on types of food, frequency and

eat or drink.

The second part: How many hours do you spend per day watching TV or electronic games?

The third part: How many hours do you spend a week doing sports? (Not including school activities)

3.8 The validity

Aiming to benefit from their experiences and suggestions about the accommodation of the study with the study goals and the validity of the tool, the researcher sent the questionnaire to the supervisor and panel of experts. Depending on their insights and views, the tools are approved and no need for modifications.

3.9 The Reliability

The researcher used a pilot sample which included 20 students from each targeted grades (5,6,7, and 8) were randomly selected. The students reported not having any difficulty with understanding and answering the questionnaires. At the same time, they didn't have any comments on the questionnaire. . CronbachAlpha was 0.88, so the instrument was reliable

3.10 Ethical Considerations:

Approval was obtained from MoEHE(Ministry of Education and Higher Education) The Governmental schools education department granted the permission to the researcher to conduct the study in Jenin and Tubas schools, also following the acceptance of the school's principals beside that the targeted children as confidentiality and volunteer participation, each participant had the authorization of his/her parents by signing the written informed consent.

Luckily, all families have agreed to that. A consent form explained study rationale, and the information's only used for scientific purposes without pointing to any participants' names.

3.11 Data collection procedure:

The permission was taken by the MoEHE, and the informed consent was obtained from all children's parents. Demographic, medical histories, and lifestyle information was obtained by one-to-one interviews using universal valid test **KRECEPLUS**.

All classes from the fifth to the eighth grade in each selected school were included in the study.

After having got the informed consent, the researcher measured the height, and weight for each targeted student in the examination room (counselor room) of the school. The study investigator with the assistant (school counselor) did all measurements and registration process was implemented in the students' during art or sport classes, and then the students were filled the simple questionnaire in classes. The researcher received all questioners.

BMI was done by using a Tanita MC-980MA bioelectric machine, also used a stretchable tab for measuring WC, hip C and head C, blood pressure was measured by a standard sphygmomanometer.

3.12 Statistical methods

All data was analyzed using SPSS version23. The baseline characteristics of the study subjects was presented using descriptive statistics including of mean ±SD, median and the frequency with the percentage. Analysis with the inferential statistics (independent t- test and Pearson r) were utilized to test the research hypotheses and One-way analysis of variance (ANOVA) also was used.

Chapter Four

Results

Introduction:

In this chapter, the results of the study are presented. The purpose of this study was to assess the relationship between body composition, anthropometric measures and cardiovascular risk factors among children aged 10-13 years in Jenin and Tubas Governmental Schools. The Statistical Package for Social Science (SPSS, version 23) was used to analyze the data. Descriptive and inferential statistics were used to test the study hypotheses. Descriptive statistics (mean, standard deviation, percentage) were used to describe the characteristics of the participants. The inferential statistics (independent t- test and Pearson r) were utilized to test the research hypotheses.

4.1 Participants' Characteristics

The study conducted on five hundred and nine participants, 135 (26.5%) of children were 10-years old; 115(22.6%) were 11 years old, 139(27.3%) were 12 years old; and 120 (23.6%) were 13 years old as shown in table (4-1).

More than half of the participants 267 (52.5%) were males with mean age of 11.4 ±1.13 years. Females had mean age 11.5 ±1.11 years.

4.1 Socio-economic status (N= 509)

Variable		Boys		Girls		Total	
		n	%	n	%	N	%
Age	10 years	74	27.7	61	25.2	135	26.5
	11 years	64	24.0	51	21.1	115	22.6
	12 years	67	25.1	72	29.8	139	27.3
	13 years	62	23.2	58	24.0	120	23.6
	Total	267	52.5	242	47.5	509	100
Class	Fifth	74	27.7	61	25.2	135	26.5
	Sixth	64	24.0	51	21.1	115	22.6
	Seventh	67	25.1	72	29.8	139	27.3
	Eighth	62	23.2	58	24.0	120	23.6

The anthropometric measurements for males were as follows: weight: 43.05 ± 13.41 kg; height: 1.52± 0.11 m; BMI: 18.45± 4 kg/m2; waist circumferences: 73.49 ±11.37cm; hip circumferences: 77.50±14.32 cm; waist height ratio: 0.49 ±0.07 m; waist hip ratio: 0.97± 0.19 m. The anthropometric measurements for females were as follows: weight: 43.72± 12.30 kg; height: 1.53± 0.95 m; BMI: 18.51± 4 kg/m2; waist circumferences: 70.72 ±8.86cm; hip circumferences: 83.83±9.93 cm; waist height ratio: 0.46±0.06 m; waist hip ratio: 0.85 ± 0.09 m as shown in table (4-2).

Table4-2 The anthropometric measurements of the participants (N= 509)

Variable	Boys	Girls	Total
	M(SD)	M(SD)	M(SD)
Height	151.66(11.36)	152.73(9.54)	152.17(10.54)
Weight	43.05(13.41)	43.72(12.30)	43.37(12.88)
Waist circumference	73.49(11.37)	70.72(8.86)	72.17(10.34)
Hip circumference	77.50(14.32)	83.83(9.93)	80.51(12.81)
BMI	18.45(3.97)	18.51(3.84)	18.48(3.90)
WHR	0.97(0.19)	0.85(.09)	0.91(0.16)
WHtR	0.49 (0.07)	.46(0.06)	.48(0.06)

4.2 Prevalence of overweight/ obesity according to gender

Among the 509 participants, 32 (12%) of the males were overweight, and 25 (9.49%) were obese, while 28(11.6%) of the female participants were overweight and 9 (3.7%) were obese. At the same time, waist hip ratio, around 152(56.9%) for male and 100(41.3%) for female participants were abdominal obesity. Also, waist height ratio, around 97(36.3%) of male and 50 (20.7%) of the female participants were high risk for obesity, as shown in table (4-3).

Table (4-3): Distribution of participants according to body weight categories

Variable		Male	Female	Total
		Frequency (%)	Frequency (%)	Frequency (%)
BMI	Under Weight	113 (42.3)	81(33.5)	194 (38.1
	Normal Weight	97(36.3)	124 (51.2)	221 (43.4
	Over Weight	32 (12.0)	28 (11.6)	60 (11.8
	Obese	25 (9.4)	9 (3.7)	34 (6.7
Waist hip ratio	Abdominal obesity	152(56.9	100(41.3	196 (38.5
	Normal	115(43.1	142(58.7	313 (61.5
Waist height ratio	Normal	170(63.7	192(79.3	362 (71.1
	Higher risk of obesity	97(36.3	50(20.7	147 (28.9

Figure (4-1): Distribution of participants according to body weight categories

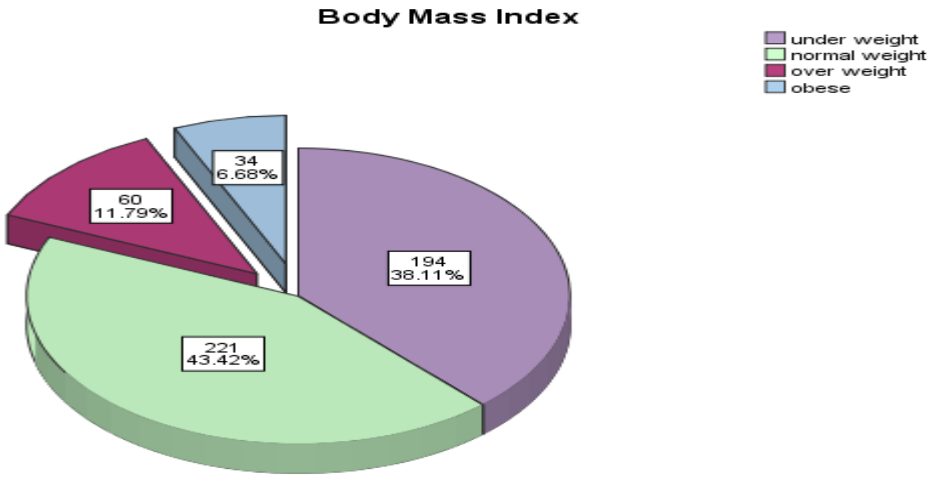

Figure 4-1 showed that among the 509 participants, 34 (6.7%) of participants were obese and 60(11.8%) were overweight.

4.3 Assessment of nutritional habit and activity

Among the 509 participants, 36 (13.5%) of the males had bad activity and 111 (41.6%) had very low nutritional habits, while 70(28.9%) of the female participants had poor activity and 80 (33.1%) had very low nutritional habits as shown in table (4-4)

Table (4-4): Distribution of participants according to nutritional habit and activity

Variable		**Boys**		**Girls**		**Total**	
		N	**%**	**n**	**%**	**N**	**%**
Activity level	Poor	36	13.5	70	28.9	106	20.8
	Average	131	49.1	134	55.4	265	52.1
	Good	100	37.5	38	15.7	138	27.1
Nutritional level	Very low	111	41.6	80	33.1	191	37.5
	Medium	147	55.1	142	58.7	289	56.8
	High	9	3.4	20	8.3	29	5.7

An independent t test was performed to assess if there was a significant difference between both male and female groups regarding age, height, weight, waist circumference, hip circumference, systolic blood pressure, diastolic blood pressure, BMI, waist hip ration, and waist height ratio. The results revealed no significant differences between the two groups except waist circumference, hip circumference, waist hip ratio and waist height ratio (P= 0.002, 0.001, 0.001, 0.001) respectively as displayed in Table 4-5.

Table 4-5Comparison of the sample characteristics according to background characteristics (N= 509)

Variable	Boys	Girls	Total	Statistical test	
	M(SD)	M(SD)	M(SD)	t test	P value
Age	11.4(1.13)	11.5 (1.11)	11.5(1.12)	0.871	.384
Height	151.66(11.36)	152.73(9.54)	152.17(10.54)	-1.147	.252
Weight	43.05(13.41)	43.72(12.30)	43.37(12.88)	-.583	.560
Waist	73.49(11.37)	70.72(8.86)	72.17(10.34)	3.044	0.002
Hip circumference	77.50(14.32)	83.83(9.93)	80.51(12.81)	5.739	0.001
Systolic blood pressure	116.07(15.57)	116.12(14.19)	116.09(14.91)	-.036	.971
Diastolic blood pressure	71.57(12.73)	72.68(11.00)	72.10(11.94)	-1.053	.293
BMI	18.45(3.97)	18.51(3.84)	18.48(3.90)	0.167	0.868
WHR	0.97(0.19)	0.85(.09)	0.91(0.16)	9.259	.001
WHtR	0.49 (0.07)	.46(0.06)	.48(0.06)	3.817	.001

Relationship between blood pressure and anthropometric measurement

However, according to systolic blood pressure, the total sample results showed that there was weak relationship between systolic blood pressure and weight (r=0.25, P=0.001), waist circumference (r=0.22, P=0.001), hip circumference (r=0.16, P=0.001), waist to height ratio (r=0.17, P=0.003), and body mass index (r=0.28, P=0.001).

Concerning boys, there was weak relationship between systolic blood pressure and weight (r=0.20, P=0.001), waist circumference (r=0.21, P=0.001), hip circumference (r=0.12, P=0.043),waist to height ratio (r=0.18, P=0.003), and body mass index (r=0.25, P=0.001).

According to girls, there was moderate relationship between…..and weight (r=0.32, P=0.001), waist circumference (r=0.26, P=0.001), and hip circumference (r=0.25, P=0.001), and body mass index (r=0.32, P=0.001). At the same time, there was weak relationship with waist to height ratio (r=0.17, P=0.007) as shown in table (4-6).

Table 4-6Relationship between systolic Blood Pressure and anthropometric measurements (N=509)

Variable	**Systolic blood pressure**					
Gender	**Boys**		**Girls**		**Total**	
	R	P	r	P	R	P
Weight	0.204	0.001	.317	0.001	.252	0.001
Waist Circumference	0.205	0.001	.259	0.001	.223	0.001
Hip Circumference	0.124	0.043	.251	0.001	.164	0.001
WHR	0.044	0.479	.051	.427	.040	0.372
WHtR	0.180	0.003	.172	.007	.174	0.001
BMI	0.252	0.001	.316	0.001	.280	0.001

However, according to diastolic blood pressure, the total sample results showed that there was a weak relationship with weight (r=0.20, P=0.001), waist circumference (r=0.15, P=0.001), hip circumference (r=0.09, P=0.036), waist to height ratio (r=0.10, P=0.021), and body mass index (r=0.19, P=0.001).

At the same time, there was a weak relationship between diastolic blood pressure in girls with weight (r=0.24, P=0.001), waist circumference (r=0.129, P=0.045), hip circumference (r=0.23, P=0.001), and body mass index (r=0.24, P=0.001).

Concerning boys, there was weak relationship with weight (r=0.16, P=0.008), waist circumference (r=0.17, P=0.006), waist to hip ratio (r=0.16, P=0.011), waist to height ratio (r=0.16, P=0.011), and body mass index (r=0.14, P=0.018) as shown in table 4-7.

Table 4-7 relationship between diastolic Blood Pressure and anthropometric measurements (N=509)

Variable	**Diastolic blood pressure**					
Gender	**Boys**		**Girls**		**Total**	
	R	p	R	P	R	P
Weight	0.161	0.008	0.241	0.001	0.196	0.001
Waist Circumference	0.168	0.006	0.129	0.045	0.145	0.001
Hip Circumference	0.009	0.889	0.225	0.001	0.093	.036
WHR	0.155	0.011	0.114	0.078	0.057	0.198
WHtR	0.155	0.011	0.043	0.506	0.102	0.021
BMI	0.144	0.018	0.239	0.001	0.185	0.001

Association between cardiovascular risks and anthropometric measurements

By applying linear regression analysis, systolic blood pressure was examined with different anthropometric measurements of the total sample, it was found that it was affected by BMI (p=0.001). Specifically, it was revealed that for every increasing unit of BMI, systolic blood pressure was increased 1.014 times. Also, systolic blood pressure of boys was affected by BMI (p=0.002). Specifically, it was revealed that for every increasing unit of BMI, systolic blood pressure was increased 0.86 times. Moreover, systolic blood pressure of girls was affected by BMI (p=0.001). Specifically, it was revealed that for every increasing unit of BMI, systolic blood pressure was increased 1.365times.

On the other hand, linear analysis was examined in relation of diastolic blood pressure with different anthropometric measurements of the total sample, it was found that it is affected by BMI (p=0.001). Specifically, it was revealed that for every increasing unit of BMI, diastolic blood pressure was increased 0.59 times. Also, diastolic blood pressure of girls was affected by BMI (p=0.001). Specifically, it was revealed that for every increasing unit of age, diastolic blood pressure was increased 0.85 times as shown in table 4-8.

Table (4-8) Association between cardiovascular risks and anthropometric measurements (N=509)

Variable	Participants	Model	B	Std. Error	Beta	P. value
Systolic BP	Total participants	BMI	1.01	0.198	0.266	0.001
		WHR	-0.48	4.376	-0.005	0.913
		WHtR	6.38	13.044	0.028	0.625

	Boys	BMI	0.86	0.279	0.219	0.002
		WHR	-1.33	5.187	-0.016	0.798
		WHtR	14.67	16.470	0.066	0.374
	Girls	BMI	1.37	0.316	0.370	0.001
		WHR	13.38	14.056	0.081	0.342
		WHtR	-25.22	26.825	-0.100	0.348
Diastolic BP	Total participants	BMI	0.59	0.163	0.192	0.001
		WHR	3.13	3.586	0.042	0.383
		WHtR	-4.18	10.690	-0.023	0.696
	Boys	BMI	0.277	0.231	.086	0.232
		WHR	7.855	4.299	.117	0.069
		WHtR	12.67	13.65	.070	0.354
	Girls	BMI	.85	0.249	.297	0.001
		WHR	-11.130	11.06	-.087	0.315
		WHtR	-16.692	21.11	-.085	0.430

4.2.4 Differences between blood pressure and the anthropometric measurements

According to classification of systolic blood pressure, ANOVA test was performed with different anthropometric measurements of the total sample, it was found that it is significant with BMI (f(506)= 11.68, P=0.001), WHtR (f(506)= 6.04, P=0.003). Concerning boys, it was found that it is significant with BMI (f (264) = 3.6, P=0.029). According girls, it was found that it is significant with BMI (f (239) = 10.0, P=0.001), WHtR (f (239) = 4.14, P=0.017) as shown in table 4-9.

Table 4-9Results of ANOVA test with classification of systolic blood pressure (N=509)

Participants	Characteristics		N	M	SD	*F*	*P* - value
Total participants	BMI	Normal	328	17.9152	3.64745	11.158	0.001
		Prehypertension	50	18.8040	3.83113		
		Hypertension	131	19.7687	4.25589		
	WHR	Normal	328	.9043	.15368	1.895	0.151
		Prehypertension	50	.8966	.13946		
		Hypertension	131	.9346	.18489		
	WHtR	Normal	328	.4665	.06067	8.277	.001
		Prehypertension	50	.4881	.08498		
		Hypertension	131	.4913	.06213		
Boys	BMI	Normal	173	17.8896	3.74501	5.263	.006
		Prehypertension	24	19.0875	4.20200		
		Hypertension	70	19.6243	4.18671		
	WHR	Normal	173	.9603	.18031	.704	.495
		Prehypertension	24	.9715	.16223		
		Hypertension	70	.9922	.21819		
	WHtR	Normal	173	.4752	.06336	6.304	.002
		Prehypertension	24	.5206	.09918		
		Hypertension	70	.4982	.06885		
Girls	BMI	Normal	155	17.9439	3.54729	6.116	.003

		Prehypertension	26	18.5423	3.51786		
		Hypertension	61	19.9344	4.36279		
	WHR	Normal	155	.8417	.07977	2.947	.054
		Prehypertension	26	.8275	.05973		
		Hypertension	61	.8686	.10500		
	WHtR	Normal	155	.4568	.05614	5.238	.006
		Prehypertension	26	.4581	.05612		
		Hypertension	61	.4835	.05286		

According to classification of Diastolic blood pressure, ANOVA test was performed with different anthropometric measurements of the total sample; it was found that it is significant with BMI (f(506)= 11.7, P=0.001) and WHtR (f(506)= 6.0, P=0.003). Concerning boys, it was found that it is significant with BMI (f (264) = 3.6, P=0.029). According to girls, it was found that it is significant with BMI (f (239) = 10.0, P= 0.001), WHtR (f (239) = 4.14, P=0.017) as shown in table 4-10.

Table 4-10 Results of ANOVA test with classification of diastolic blood pressure (N=509)

Participants	**Characteristics**		**N**	**M**	**SD**	***F***	***P*–value**
Total	BMI	Normal	353	17.9374	3.49773	11.7	0.001
		Prehypertension	48	19.4833	4.79012		
		Hypertension	108	19.8056	4.35010		
	WHR	Normal	353	.9054	.15314	1.7	0.190
		Prehypertension	48	.8988	.11825		

		Hypertension	108	.9362	.19858		
	WHtR	Normal	353	.4686	.06462	6.0	0.003
		Prehypertension	48	.4840	.06645		
		Hypertension	108	.4920	.06111		
Boys	BMI	Normal	185	18.0319	3.60355	3.6	0.029
		Prehypertension	26	19.7462	5.14247		
		Hypertension	56	19.2393	4.32148		
	WHR	Normal	185	.9583	.17712	2.867	0.059
		Prehypertension	26	.9384	.12941		
		Hypertension	56	1.0220	.23891		
	WHtR	Normal	185	.4787	.07184	2.719	0.068
		Prehypertension	26	.4994	.06919		
		Hypertension	56	.5005	.06145		
GIRLS	BMI	Normal	168	17.8333	3.38506	10.0	0.001
		Prehypertension	22	19.1727	4.43677		
		Hypertension	52	20.4154	4.33944		
	WHR	Normal	168	.8473	.09151	.075	0.928
		Prehypertension	22	.8520	.08444		
		Hypertension	52	.8438	.06629		
	WHtR	Normal	168	.4575	.05365	4.14	0.017
		Prehypertension	22	.4657	.05946		
		Hypertension	52	.4828	.05996		

Chapter Five

Discussion

Introduction:

This chapter includes a discussion of the results regarding the prevalence of overweight/ obesity and influencing factors, eating habits, physical activity, and the association between anthropometrics with cardiovascular disease risk among male and female school children in the fifth, sixth, seventh, and eighth grade in governmental school in Jenin and Tubas.

This study was the first study that assesses the relationship between body composition, anthropometric measures and cardiovascular risk factors among children aged 10-13 years in Jenin and Tubas Governmental Schools.

Anthropometric measurement is important in the definition of overweight and obesity among children and adolescents. Researchers are pointing to the fact that overweight and obesity in childhood stayinto adulthood. Defining overweight and obesity helps to predict health risks and to provide comparisons between populations (Jackson et al., 2007; Lobstein et al, 2004)

Prevalence of overweight and obesity among children

In the current study the overall prevalence of overweight was 60 (11.8%) and obesity 34 (6.7%) among children. However, the prevalence of overweight was 32 (12.0%) among boys and 28 (11.6%) among girls, and that of obesity was 25 (9.4%) among boys and 9 (3.7%) among girls. The current results were slightly similar to Khader et al (2009) study results which conducted among male Jordanian children aged 6-12 years, the results showed the prevalence of overweight 8.85% and 5.6% obese. Also, the current results were similar to Isbiah study (2009)

conducted in Nablus city among boys school children aged 6-12 years old. The results of obesity and overweight prevalence were 7.9% and 13.3% respectively.

However, these results were lower than other studies. Hedly et al. (2004) reported that 31.5% of the USA children and adolescents were at risk of overweight, and that 16.5% were actually overweight, so the risk for overweight and obesity from developing country is more. This difference illustrated that female are more worried about their shape and weight than male counter parts. Palestinian females are more likely take care of their weight and dieting than males to look attractive and beautiful. The current study results were consistent with previous studies, where the prevalence of obese Chinese boys were higher than girls (Cui et al, 2010).

Eating habits and physical activity

According to physical activity and eating habits in current study, among the 509 participants, 36 (13.5%) of the males had bad activity and 111 (41.6%) had very low nutritional habits, while 70 (28.9%) of the female participants had poor activity and 80 (33.1%) had very low nutritional habits. In Sibia et al. (2003) study indicated a significant relationship between the obesity and insufficient exercise, so less active child increase risk for developing overweight and obesity.

A study in the United Arab Emirates (2005) showed that 38.8% of students from both male and female had spent three or more hours per day doing sitting activities during a typical or usual day. Likewise from Khader et al (2009) study which was conducted on Jordanian children aged 6-12 years old in the north of Jordan to assess the prevalence of overweight and obesity and determine their associated factors. The results showed the Jordanian children spent more than two hour/day watching TV. Therefore, this habit is more significantly associated with overweight and obesity. Another a cross sectional study conducted by Liebman et al (2003) to assess the relation between body mass index (BMI) levels and various lifestyle variables related to physical activity and specific characteristics of a healthy eating pattern. A total

sample consist of 928 males and 889 females aged 18-99 years old. The results showed the prevalence of overweight was 70% in men and 59% in women. So, increase the risk of overweight and obesity are associated with poor eating habits like drinking sweetened beverages such as soft drinks/soda pop, and also, eating while watching TV increase risk for obesity.

Association between anthropometric measurements with cardiovascular disease risk

The results of the study indicated an association between cardiovascular diseases in terms of classifications of systolic and diastolic blood pressure with BMI (P=0.001) and WHtR (P=0.003). The results consistent with other studies according to WHtR as an indicator for cardiovascular but inconsistent according to BMI.

In a cross sectional study conducted on children aged 6-10 years to examine waist-to-height-ratio (WHtR) as an indicator for cardiovascular disease. The results showed that the WHtR is sensitive predictor for CVD; and there is a significant correlation between BMI and WHtR(Kuba, Leone, & Damiani, 2013). Additionally, Ashwell and Hsieh (2005) proposed the use of WHR as a simple screening tool, considering it is fast and effective measurement. They suggest that WHR is more sensitive, less expensive, and easier to measure and calculate than BMI.

Also, the study revealed that boys had higher WC, WHR and WHtR than girls. This probably reflects gender-specific influences on waist circumference and can be explained by the fact that in boys' central fat distribution is more predominant than in girls. Adipose tissue is distributed mainly in the upper body (nape of neck, shoulders, and epigastrium) in boys, whereas, in girl's peripheral fat accumulation in the lower body predominates. This findings are inconsistent with previous studies. In a study conducted by Sebanjo et al (2009) on 570 Nigerian children and

adolescents between the ages of 5 to 19 years reported that females had higher WCs than males. Another results of cross sectional study conducted by Johnson and colleagues (2017) on Nigerian children and adolescents from age 5 to 19 years reported that females had higher WHR and WtHR ratios despite in the prevalence of obesity was low, and WC is sensitive indicator for obesity .

The result of this study is however consistent with a study by McCarthy et al. (2001). McCarthy, et al assessed the BMI and waist circumference of 8355 children and adolescent's British children of ages 5-17. They concluded that males generally were taller, heavier and had higher WC value at all ages compared to their female counterparts

A comparison of the ability of different anthropometric markers to predict the risk of major cardiovascular diseases in children. Positive, linear and continuous associations were observed between BMI and cardiovascular risk. By comparison, BMI performed the highest well out of all three measures at predicting cardiovascular risk in this population. Using the linear regression statistics, BMI exhibited enhanced predictive capability compared to both WHR index and WHtR.

Many studies among people have indicated a positive association between indices of abdominal obesity, either WHR or WC, and cardiovascular disease events (de Koning, et al, 2007; Pischon et al., 2008). With the exception of one study (Sone et al., 2009)

Chapter six

Conclusion and recommendations

Conclusion:

The results of the study have showed that the prevalence of overweight and obesity in boys is more than girls and the difference may be related to that females are more worried about shape and weight than males.

As anthropometric measures the boys had more WC, WHRandWHtR than girls; they probably reflect as a gender that influence on WC and can be explained as boys central fat distribution is more than girls and adipose tissues distributed in upper part but in girls the adipose tissues accumulation in the lower of the body. Also, when comparison between different anthropometric that leads to CVD that found the BMI is a more significant and predictor for CVD rather than WHR and WHtR.

Recommendations:

1. Additional studies in Palestine to stand on the obesity and underweight problem among school children

2-Raise awareness of Palestinian children regarding the quality and quantity of food intake and physical activity to decrease the cardiovascular disease in the future

3- Intensive programs and presentations in schools about the complication of obesity especially in cardiovascular system

4-Further comprehensive researches are required to study the lifestyle of the families of obese children and how to prevent obesity.

5-Regular physical activity is highly recommended.

6-Family based interventions should encourage maintaining healthy dietary habits

7- Encourage nurses and healthcare provider to conducting more specialized studies related to anthropometric measurements, body composition with health status among school children

8-Health Care provides an educational service consulting in schools and in places frequented by students.

9- Distribution of pamphlets by the health office at schools to children and advise them on their eating habits as much as possible.

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Appendix (A)

Questioner

Section one:

Personal information:

(student) No._____ Date _____

1-Student name: _____ 2-School name: _____

3-Grade : _____ 4-Male _____ Female _____

5-Age _____ yr. _____ month

Physiological measurements :

6-Height _____ m 7- Weight _____ kg

8-Waist circumferences _____ cm 9-Hip circumferences _____cm

10-Head circumferences _____cm 11-Bp_____mmhg

Section two :

اختبارKreceplusللعادات الغذائية والأنشطة البدنية

	نعم	لا
لا يتناول وجبة الفطور		
يتناول الحليب او مشتقاته		
يتناول رقائق فطور (مثل الكورن فلكس		
يتناول كعك الفطور التجاري		
يتناول فالكهة أو عصير فاكهة يوميا		

يتناول الفاكهة مرتين يوميا		
يتناول الحليب او مشتقاته مرتين يوميا		
يتناول الخضار الطازجة او المطبوخة يوميا		
يتناول الخضار الطازجة أو المطبوخة اكثر من مرة يوميا		
يتناول الوجبات السريعة اكثر من مرة في الاسبوع		
يشرب المشروبات الكحولية مرة واحدة على الأقل في الأسبوع		
يحب البقوليات		
يتناول الحلو و الحلويات اكثر من مرة يوميا		
يتناول الأرز او المعكرونة بشكل شبه يومي		
تستخدم زيت الزيتون في البيت		

عدد الساعات التي تقضيها يوميا في مشاهدة التلفاز او الالعاب الالكترونية؟

ساعة 0

ساعة 1

ساعة 2

ساعات 3

ساعات 4

كم عدد الساعات التي تقضيها اسبوعيا في ممارسة الانشطة الرياضية ؟ (لا تشمل الأنشطة المدرسية)

ساعة 0

ساعة 1

ساعة 2

ساعات 3

ساعات 4