An-Najah National University

Medical and Health Science College

Nursing and Midwife Department

Graduation Project

Effect of Schoolbag Weight and Carrying Way on Neck, Shoulder, and Back on Primary School Students in Nablus City

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إهداء

إلهي لا يطيب الليل إلا بشكرك .. ولا يطيب النهار إلا بطاعتك .. ولا تطيب اللحظات إلا بذكرك .. ولا تطيب الآخرة إلا بعفوك .. ولا تطيب الجنة إلا برؤيتك.

إهداؤنا

إلى من بلغ الرسالة .. وأدى الأمانة .. ونصح الأمة .. إلى نبي الرحمة ونور العالمين ..
سيدنا محمد صلى الله عليه وسلم

إلى من جرع الكأس فارغاً ليسقيني قطرة حب
إلى من كلّت أنامله ليقدم لنا لحظة سعادة
إلى من حصد الأشواك عن دربي ليمهد لي طريق العلم
إلى القلب الكبير

(والدي العزيز)

إلى من أرضعتني الحب والحنان
إلى رمز الحب وبلسم الشفاء
إلى القلب الناصع بالبياض

(والدتي الحبيبة)

إلى سندي وقوتي وملاذي بعد الله
إلى من آثروني على أنفسهم
إلى من علموني علم الحياة
إلى من أظهروا لي ما هو أجمل من الحياة

(إخوتي)

إلى من كانوا ملاذي وملجئي
إلى من تذوقت معهم أجمل اللحظات
إلى من سأفتقدهم ..... وأتمنى أن يفتقدوني
إلى من جعلهم الله أخوتي بالله ..... و من أحببتهم بالله

(زملائي في كلية التمريض)

Table of Contents

List of Abbreviations

No.	Abb.	Meaning
1-	MSD	Musculoskeletal disorders
2-	BW	Body weight
3-	Kg	Kilogram
4-	Wt	Weight

CHAPTER 1

1.1 Abstract

Objectives: The purpose of this study was to determine the relationship between schoolbag weight, schoolbag type, duration of carrying bag, way to carrying bag, gender and age with neck, shoulder and back pain in Palestine's schools. The weights of schoolbags were measured and percentage bodyweight were determined, to explain the affect on current and future health like chronic neck, back, and shoulder pain, and spinal deformities such as kyphosis and lordosis, to put recommendations for get the right way to detect and commit with the ideal weight, type, and way to carry it.

Methods: This cross-sectional study was performed, among a sample of 200 primary school students in Nablus city. Data were collected using a questionnaire and from measurement of the schoolbag weight and BW of each participant. Data were analyzed using SPSS software**.**

Results: Two hundred students, mean age 9.5 years, successfully completed the questionnaire. The mean schoolbag weight was 3.6kg. The mean schoolbag weight as a percentage of mean BW carried by the students was (10.3%). Ratio of schoolbag to student weight >15% was 7.5% We found 96% students use bags with two straps, but only 91.5% carried them on two shoulders. The females recorded the highest prevalence of shoulder discomfort (72%) more than boys (47%). Back pain was reported by females (36%) more than by males (6%). Neck pain were reported by females (15%) less than by males (17%).

Conclusion: The shoulder and other bodily pain experienced by the sample of scholars are strongly related to the bag weight and the grade of the students. Girls reported more discomfort due to carrying a schoolbag than boys. Preventive and educational activities should be implemented in this age group.

Keywords: Schoolbag, pain, primary students.

CHAPTER 2

2.1 Introduction

We all believe & know that children are the future. Thus the children should be groomed and educated properly. Today many children face psychological problems, for example, Anxiety disorders, Attention-deficit/hyperactivity disorder (ADHD)…etc, also children facing physical problem. There is ongoing concern regarding the weight of children's' schoolbags and some physical problems from carrying heavy schoolbags every day. Schoolchildren always use schoolbags to carry their school materials. Carrying heavy schoolbags can cause several problems such as musculoskeletal problems among school children. We want to get the message out there that parents and teachers need to consider the health implications of small bodies carrying heavy weights .

Children can suffer back, neck and shoulder pain if their backpacks are too heavy. The pain often comes from the weight of the backpack pulling the child backward and the child bending forward or arching his back to keep the backpack centered, Kids Health says. Such actions make the spine compressed, pushing the vertebrae down on the discs in between them. This often results in pain. [1]

Children's skeletons are still growing so carrying heavy bags can cause lasting damage. [2] Heavy bags can put pressure on the discs between the vertebrae which can cause long-term back pain in small and still-developing bodies and children can suffer muscular pain, headaches, tingling and numbness in the arms and legs and even mobility problems. [3]

Health Children's Medical Center, explains that 6,000 children are injured yearly from a heavy backpack. Heavily loaded backpacks can also lead to future injuries of the spine because of overuse of muscle groups. Using heavy backpacks day after day can also cause back strain and pulled muscles in the upper body. [4]

In Palestine there are a large percentage of primary school students which presently 86.5% of total students and 23.2% of total population. [5] Also, there is a lack in studies related to this subject except one in Tulkarm (The Influence of Backpacks on Students backs A Cross-Sectional Study of Schools in Tulkarm District). [6]

The mean schoolbag weight reported in previous studies in other countries has a range between 4.7 kg and 9.3 kg. Effectively, according to Kids Health and Healthy Children, the total weight of the backpack should only be between 10 percent and 15 percent of child's body weight. [7]

In our project, we test our hypothesis which supposes a direct relationship between neck, shoulder and back pain with schoolbag weight, schoolbag type, duration of carrying bag, way to carrying bag, gender and age in primary school students in Nablus.

Parents are warned that excessive load bearing on immature spines, such as carrying a heavy, poorly designed bag for example bags from UNICEF to and from school, could increase a child's risk of suffering with back problems in the future.

At a young age, a child's spine is still developing, so having a heavy bag thrown over one shoulder can exert harmful forces on the spine and muscles and can actually affect the natural curve of the spine, possibly leading to scoliosis, and other problems such as kyphosis and lordosis. Research has shown that if you experience back pain as a child, you are four times as likely to experience back pain in your adult life. [8]

2.2 Background

2.2.1 Neck Anatomy

The neck is the part of the body that separates the head from the torso. The Latin-derived term cervical means "of the neck." The neck supports the weight of the head and is highly flexible, allowing the head to turn and flex in different directions.

The midline in front of the neck has a prominence of the thyroid cartilage termed the laryngeal prominence, or the so-called "Adam's apple."

Between the Adam's apple and the chin, the hyoid bone can be felt; below the thyroid cartilage, a further ring that can be felt in the midline is the cricoid cartilage. Between the cricoid cartilage and the suprasternal notch, the trachea and isthmus of the thyroid gland can be felt.

The quadrangular area is on the side of the neck and is bounded superiorly by the lower border of the body of the mandible and the mastoid process, inferiorly by the clavicle, anteriorly by a midline in front of the neck, and posteriorly by the trapezius muscle. [9]

This shows the arrangement of the major structures of the neck (the trachea, the esophagus and the vertebral column)
showing:

1. Trachea
2. Esophagus
3. Vertebrae
4. Discs
5. Spinal cord. [10]

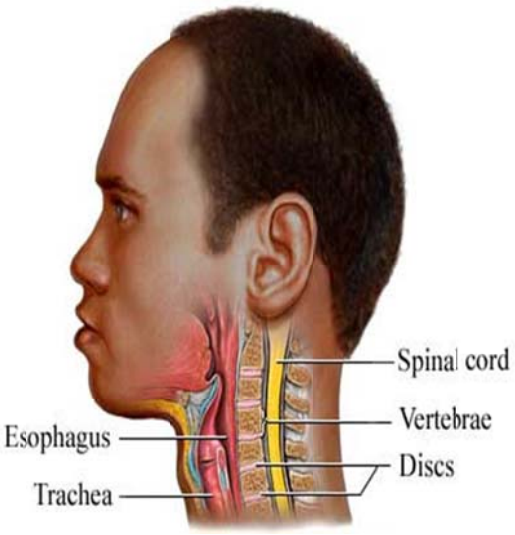
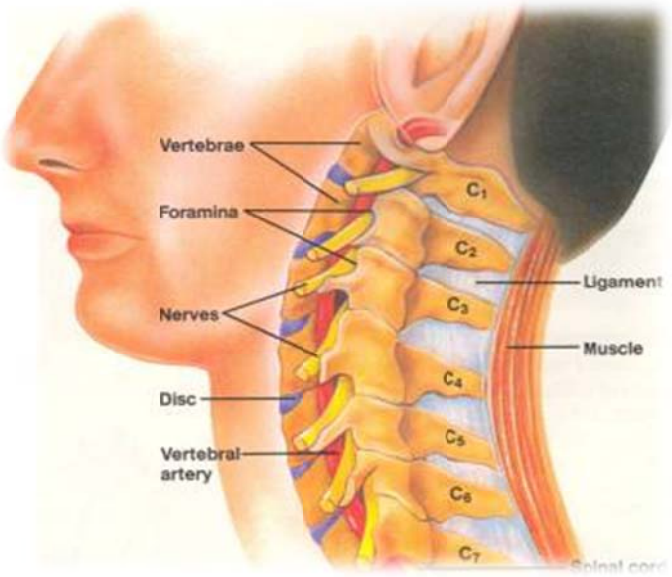


Figure.1 : Neck anatomy.

Bone of the Neck

The neck, or cervical spine, is formed by seven square-shaped bones (cervical vertebrae), which are stacked one on top of another. The vertebrae are named for their position in the neck, beginning at the top with C1, C2, C3, down to C7. Together with the supporting ligaments and the overlying long neck muscles, the cervical vertebrae form a strong spinal canal that surrounds and protects the spinal cord.

Between the neck bones are discs, which function as shock absorbers, cushioning one bone from another. [11]



Fígure.2 : Bone of the neck.

Muscles of the Neck

Muscles of the neck either support and move the head or are attached to structures within the neck region such as the hyoid bone and the larynx.

The posterior muscles of the neck include the **sternocleidomastoid, trapezius, splenius capitus, semispinaliscapitus and longissismuscapitus.** [12]

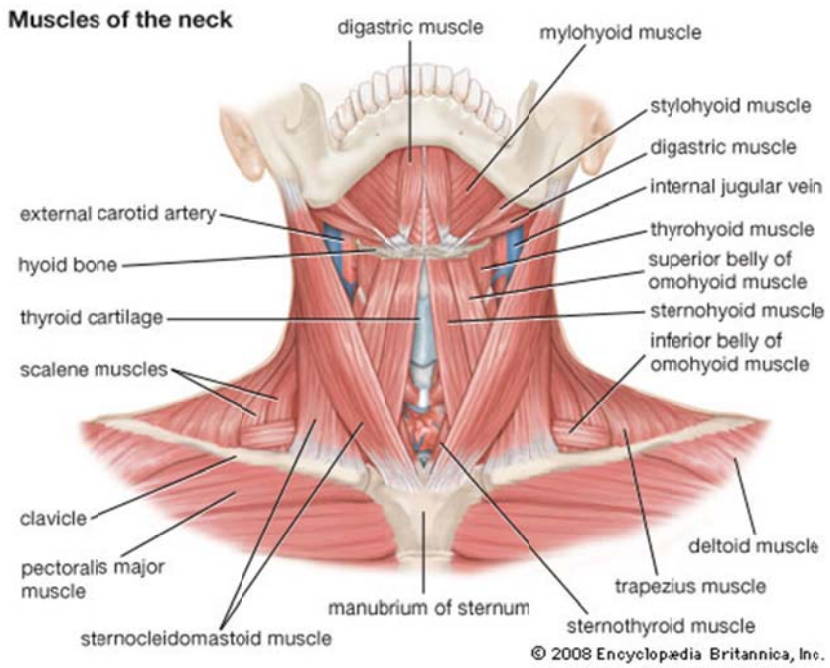


Figure.3 : Muscle of the neck.

Nerve of the Neck

There are seven cervical vertebrae (C1-C7), there are eight cervical nerves (C1-C8). All nerves except C8 emerge *above* their corresponding vertebrae, while the C8 nerve emerges *below* the C7 vertebra. (In the other portions of the spine, the nerve emerges *below* the vertebra with the same name.)

Dorsal (posterior) distribution includes the suboccipital (C1), greater occipital (C2) and third occipital (C3).

Ventral (anterior) distribution includes the cervical plexus (C1-C4) and brachial plexus (C5-T1). [13]

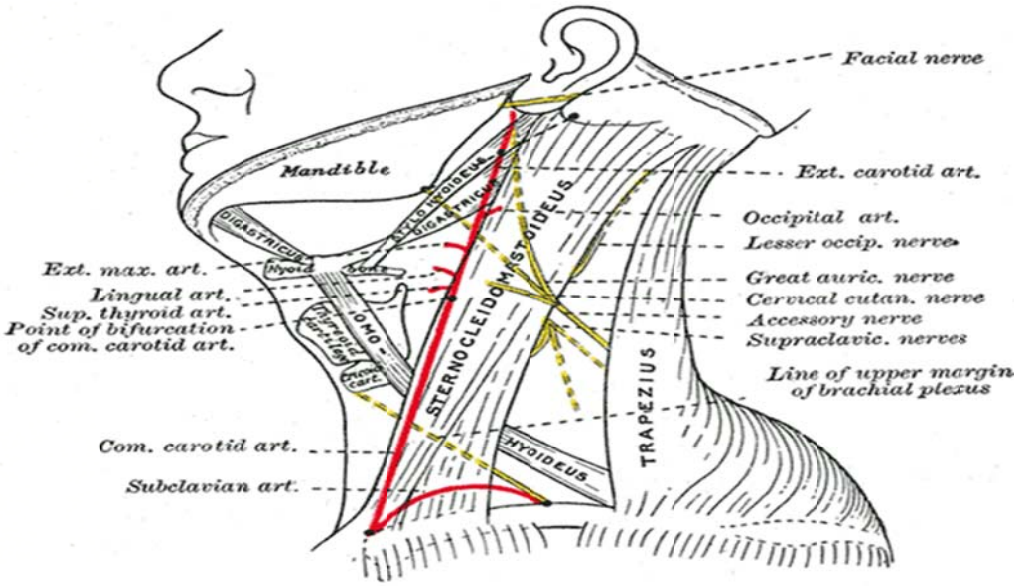


Figure.4 : Nerve of the neck.

2.2.2 Shoulder Anatomy

The shoulder is one of the most sophisticated and complicated joints of the body:

- It has the greatest range of motion of any joint in the body allowing complete global movement allowing you to position the hand anywhere in space.
- The coordinated activity of numerous muscles working together in set patterns is required to produce this motion
- It is made up of FOUR joints and FIVE linked bone groups which are related and work together.
- To allow so much movement the joints need to be 'free' to move, therefore the shoulder should be unstable; However a series of complex ligaments and muscle keep it in joint. [14]

Bones & Joints of the Shoulder

The bones of the shoulder consist of the **humerus**(the upper arm bone), the **scapula** (the shoulder blade), and the **clavicle** (the collar bone).

There are four joints making up the 'shoulder joint':

- The shoulder joint itself known as the **Glenohumeral joint,** (is a ball and socket articulation between the head of the humerus and the glenoid cavity of the scapula).
- The **acromioclavicular (AC) joint** (where the clavicle meets the acromion of the scapula).
- The **sternoclavicular (SC) joint** (where the clavicle meets the chest bone [sternum]).
- The **scapulothoracic joint** (where the scapula meets with the ribs at the back of the chest). [14]

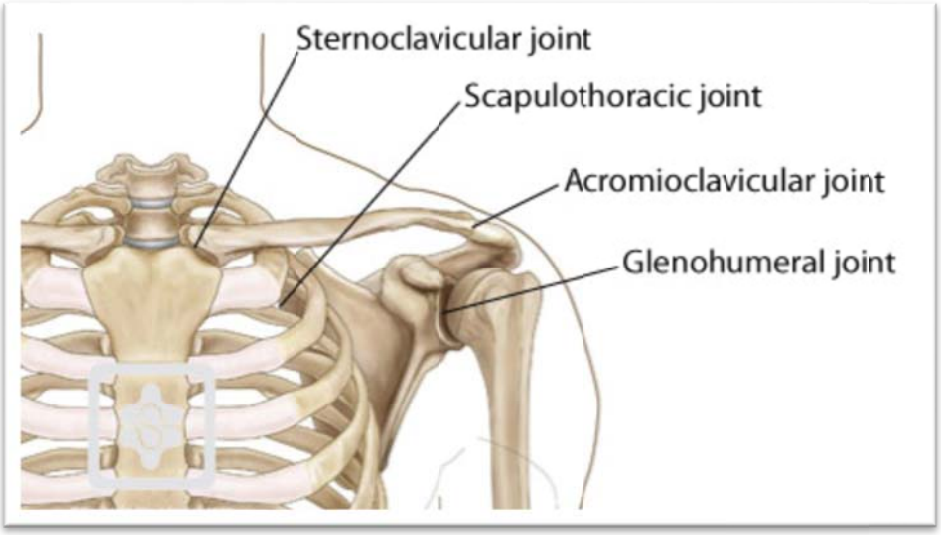


Figure.5 : Joint of the shoulder.

Shoulder Ligaments

ligaments are soft tissue structures that connect bones to bones. There are several important ligaments in the shoulder. [14]

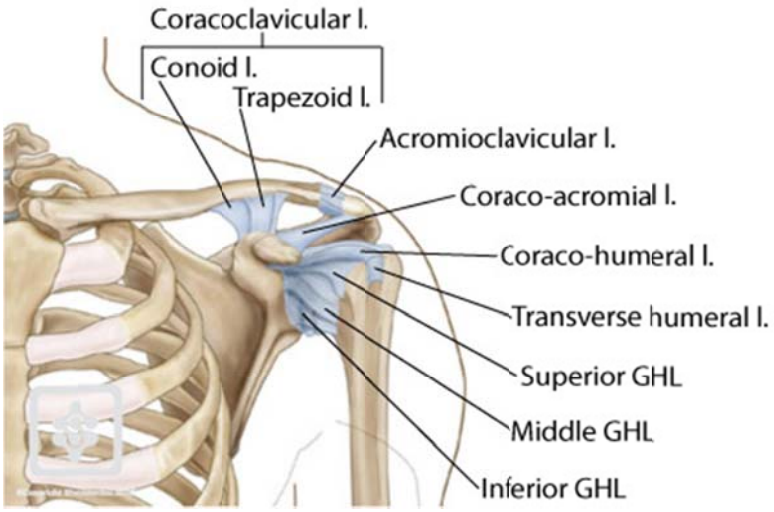


Figure.6 : Shoulder ligaments.

Shoulder Tendons

Tendons are extensions of muscles that attach muscles to bone. Muscles move the bones by pulling on the tendons. [14]

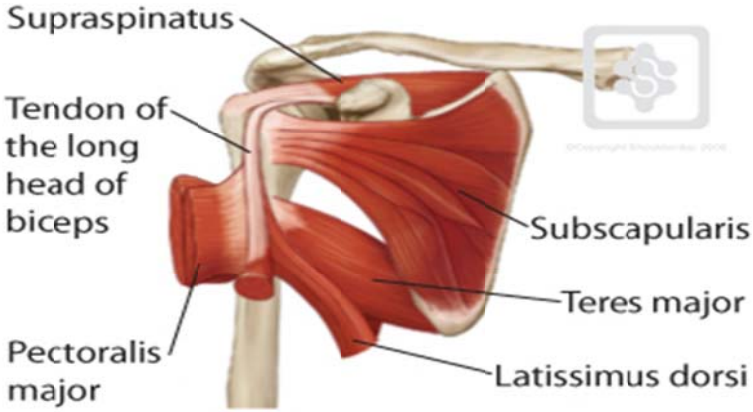


Figure. 7 : Shoulder tendons.

Nerves of the Shoulder

All of the nerves that travel down the arm pass through the axilla (the armpit) just under the shoulder joint and are known as the ***Brachial Plexus*** before dividing into the individual nerves. These nerves carry the signals from the brain to the muscles that move the arm. The nerves carry signals back to the brain about sensations such as touch, pain, and temperature. [14]

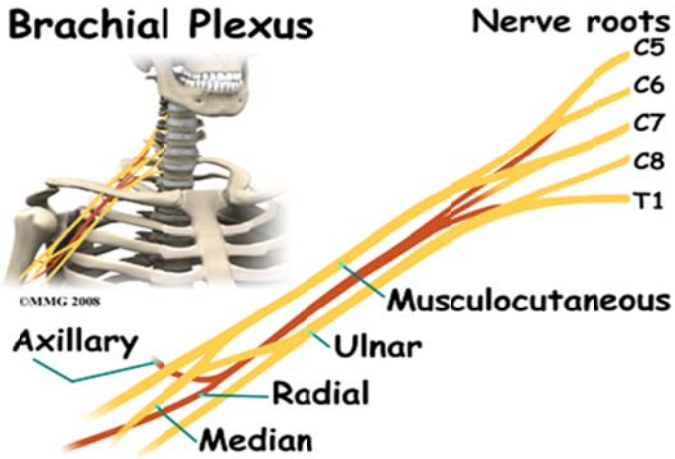


Figure. 8 : Shoulder nerves.

Shoulder Muscles

The muscles of the shoulder either connect the scapula and clavicle to the trunk, or connect the clavicle, scapula and body wall to the proximal (top) end of the humerus. The **trapezius, levator scapulae**, and **rhomboids** originate from the base of the skull and/or spine and connect the scapula and clavicle to the trunk of the body. The **pectoralis major, pectoralis minor, latissimusdorsi, teres major** and **deltoid** connect to the proximal end of the humerus and anchor it to the body.

The most important shoulder muscles are the four rotator cuff muscles - the **subscapularis, supraspinatus, infraspinatus** and **teres minor** muscles - which connect the scapula to the humerus and provide support for the glenohumeral joint. [14]

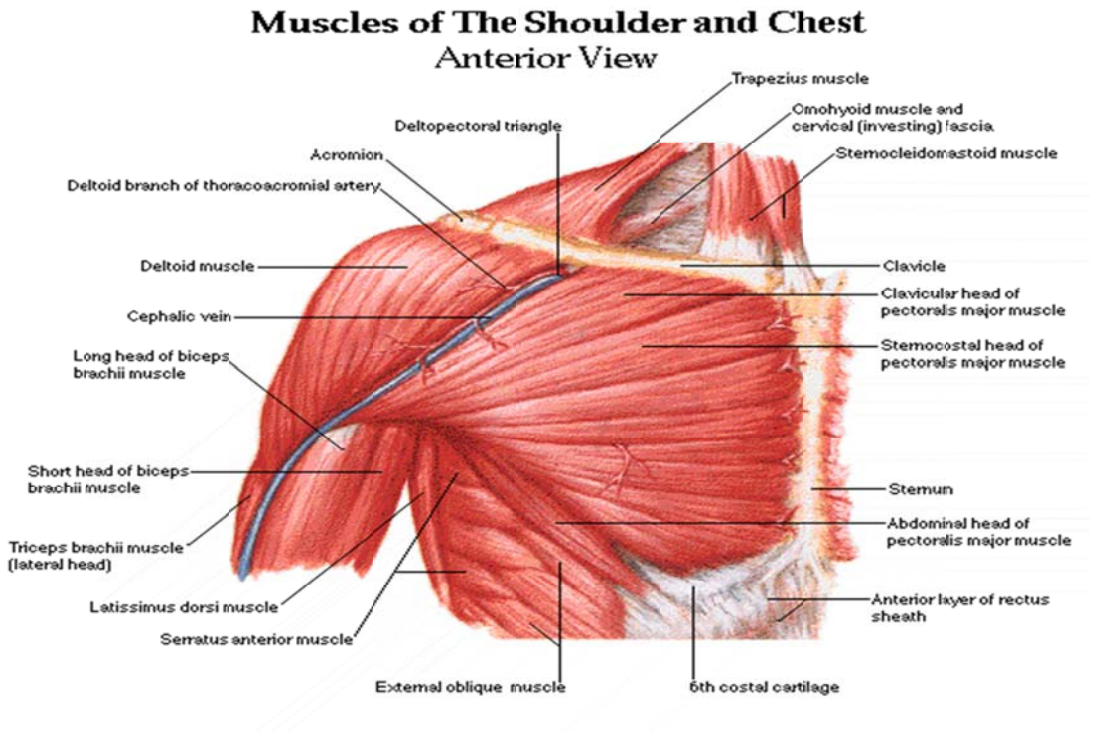


Figure. 9 : Shoulder muscles.

2.2.3 Back Anatomy

The human back is the large posterior area of the human body, rising from the top of the buttocks to the back of the neck and the shoulders. It is the surface opposite to the chest, its height being defined by the vertebral column (commonly referred to as the *spine* or *backbone*) and its breadth being supported by the ribcage and shoulders. The spinal canal runs through the spine and provides nerves to the rest of the body. [15]

Bone of the back

The central feature of the human back is the vertebral column, specifically the length from the top of the thoracic vertebrae to the bottom of the lumbar vertebrae, which houses the spinal cord in its spinal canal, and which generally has some curvature that gives shape to the back. The ribcage extends from the spine at the top of the back (with the top of the ribcage corresponding to the T1 vertebra), more than halfway down the length of the back, leaving an area with less protection between the bottom of the ribcage and the hips. The width of the back at the top is defined by the scapula, the broad, flat bones of the shoulders. [15]

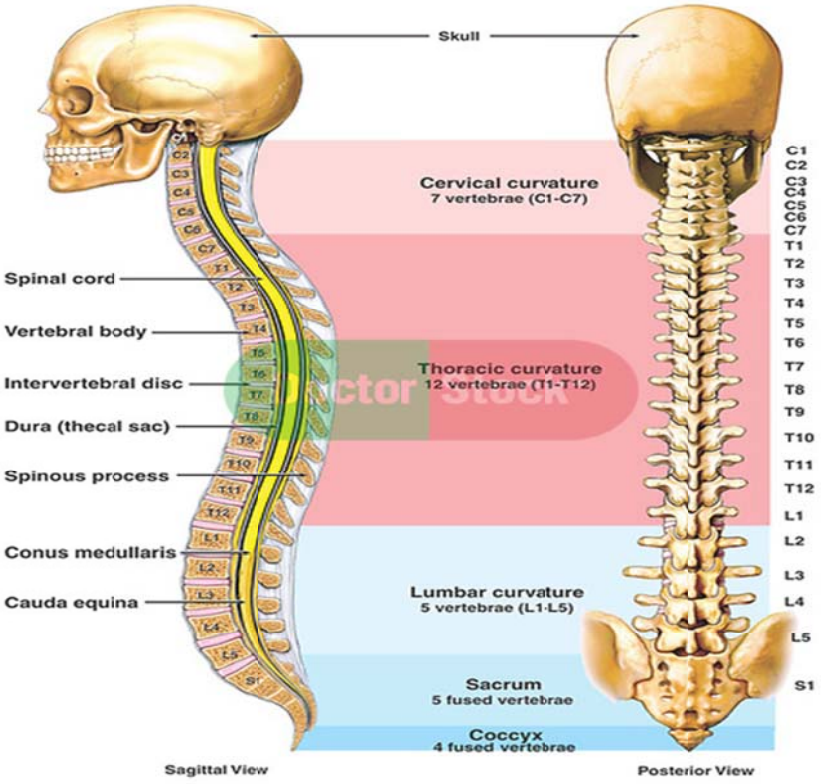


Figure. 10 : Back bones.

Muscles of the back

The spine is bordered by several groups of muscles, including the intertransversarii muscle which facilitate movement between the individual vertebrae, and the multifidusspinae, which facilitate the movement of the spine as a whole. Other muscles in the back are associated with the movement of the neck and shoulders. The trapezius muscle, which is named from its trapezium-like shape, runs between the neck, the anterior chain, the two shoulders, and the thoracic vertebra, T12. The large latissimusdorsi make a triangle from the shoulder to the hip. [15]

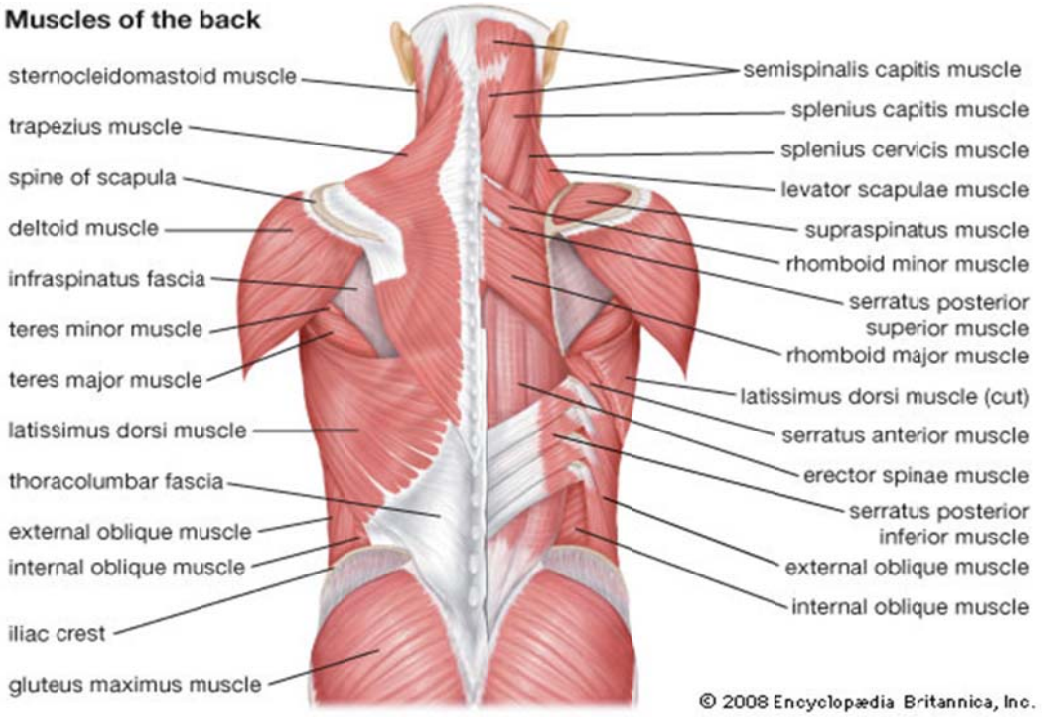


Figure. 11 : Back muscles.

Nerve of the Back

The spinal cord is a long, thin, tubular bundle of nervous tissue and support cells that extends from the brain (the medulla oblongataspecifically). The brain and spinal cord together make up the central nervous system (CNS). The spinal cord begins at the occipital bone and extends down to the space between the first and second lumbar vertebrae; it does not extend the entire length of the vertebral column. It is around 45 cm (18 in) in men and around 43 cm (17 in) long in women. Also, the spinal cord has a varying width, ranging from 1/2 inch thick in the cervical and lumbar regions to 1/4 inch thick in the thoracic area.

The enclosing bony vertebral column protects the relatively shorter spinal cord.

The spinal cord functions primarily in the transmission of neural signals between the brain and the rest of the body but also contains neural circuits that can independently control numerous reflexes and central pattern generators.

The spinal cord has three major functions: as a conduit for motor information, which travels down the spinal cord, as a conduit for sensory information in the reverse direction, and finally as a center for coordinating certain reflexes. [16]

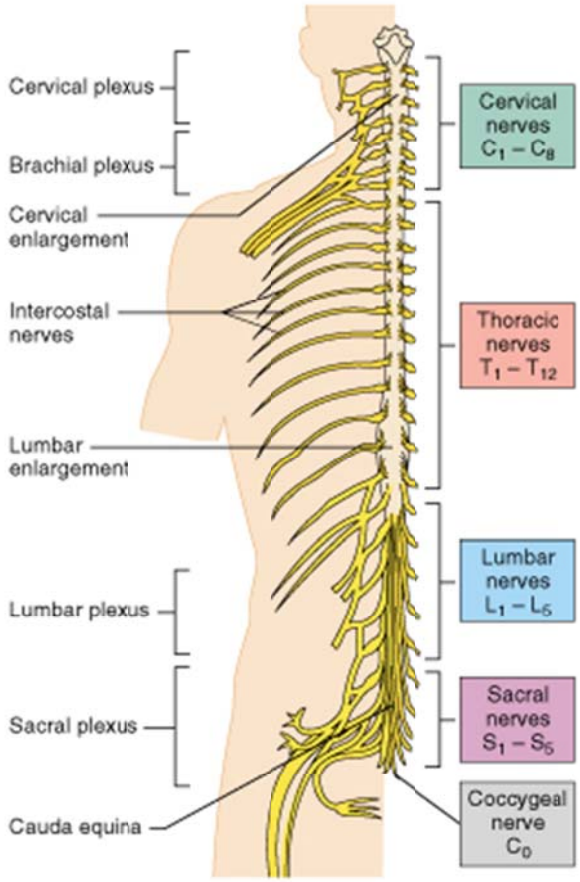


Figure. 12 : Back nerves.

2.2.4 Pain

Pain is an unpleasant feeling often caused by intense or damaging stimuli, such as stubbing a toe, burning a finger, putting alcohol on a cut, and bumping the "funny bone" The International Association for the Study of Pain's widely used definition states: "Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage". [17]

Classification of pain

Duration

Pain is usually transitory, lasting only until the noxious stimulus is removed or the underlying damage or pathology has healed, but some painful conditions, such as rheumatoid arthritis, peripheral neuropathy, cancer and idiopathic pain, may persist for years. Pain that lasts a long time is called *chronic*, and pain that resolves quickly is called *acute*. [18]

Nociceptive

Nociceptive pain is caused by stimulation of peripheral nerve fibers that respond only to stimuli approaching or exceeding harmful intensity (nociceptors), and may be classified according to the mode of noxious stimulation; the most common categories being "thermal" (heat or cold), "mechanical" (crushing, tearing, etc.) and "chemical" (iodine in a cut, chili powder in the eyes). [19]

Neuropathic

Neuropathic pain is caused by damage or disease affecting any part of the nervous system involved in bodily feelings (the somatosensory system). [20] Peripheral neuropathic pain is often described as “burning,” “tingling,” “electrical,” “stabbing,” or “pins and needles.” Bumping the "funny bone" elicits acute peripheral neuropathic pain. [21]

Phantom

Phantom pain is pain felt in a part of the body that has been lost or from which the brain no longer receives signals. It is a type of neuropathic pain. Phantom limb pain is a common experience of amputees. [19]

Psychogenic

Psychogenic pain, also called *psychalgia* or *somatoform pain*, is pain caused, increased, or prolonged by mental, emotional, or behavioral factors. Headache, back pain, and stomach pain are sometimes diagnosed as psychogenic. [22]

Breakthrough pain

Breakthrough pain is pain that comes on suddenly for short periods of time and is not alleviated by the patients' normal pain management. It is common in cancer patients who often have a background level of pain controlled by medications, but whose pain periodically "breaks through" the medication. [19]

Incident pain

Incident pain is pain that arises as a result of activity, such as movement of an arthritic joint, stretching a wound, etc. [19]

Neck Pain

Neck pain (or cervicalgia) is a common problem, with two-thirds of the population having neck pain at some point in their lives. [23]

Neck pain, although felt in the neck, can be caused by numerous other spinal problems. Neck pain may arise due to muscular tightness in both the neck and upper back, or pinching of the nerves emanating from the cervical vertebrae. Joint disruption in the neck creates pain, as doe's joint disruption in the upper back.

Figure. 13 : Neck pain.

The head is supported by the lower neck and upper back, and it is these areas that commonly cause neck pain. The top three joints in the neck allow for most movement of your neck and head. The lower joints in the neck and those of the upper back create a supportive structure for your head to sit on. If this support system is affected adversely, then the muscles in the area will tighten, leading to neck pain. [24]

Shoulder pain

Shoulder pain , are one of the more common reasons for physician visits for musculoskeletal symptoms. The shoulder is the most movable joint in the body. However, it is an unstable joint because of the range of motion allowed. This instability increases the likelihood of joint injury, often leading to a degenerative process in which tissues break down and no longer function well.

Shoulder pain may be localized or may be deferred to areas around the shoulder or down the arm. Disease within the body (such as gallbladder, liver, or heart disease, or disease of the cervical spine of the neck) also may generate pain that the brain may interpret as arising from the shoulder. Conversely, pain felt in the region of the shoulder blade or scapula nearly always has its origin in the neck. [25]

Figure. 14 : Shoulder pain.

Back pain

Back pain is pain felt in the back that usually originates from the muscles, nerves, bones, joints or other structures in the spine.

Back pain may have a sudden onset or can be a chronic pain; it can be constant or intermittent, stay in one place or radiate to other areas. It may be a dull ache, or a sharp or piercing or burning sensation. The pain may radiate into the arms and hands as well as the legs or feet, and may include symptoms other than pain, such as weakness, numbness or tingling.

Back pain is one of humanity's most frequent complaints. In the U.S., acute low back pain(also called lumbago) is the fifth most common reason for physician visits. About nine out of ten adults experience back pain at some point in their life, and five out of ten working adults have back pain every year. [26]

The spine is a complex interconnecting network of nerves, joints, muscles, tendons and ligaments, and all are capable of producing pain. Large nerves that originate in the spine and go to the legs and arms can make pain radiate to the extremities. [27]

Figure. 15 : Back pain.

Figure. 16 : Neck, shoulder and back pain.

Musculoskeletal Pain

Musculoskeletal pain affects the bones, muscles, ligaments, tendons, and nerves. It can be acute (having a rapid onset with severe symptoms) or chronic (long-lasting). Musculoskeletal pain can be localized in one area, or widespread.

Lower back pain is the most common type of musculoskeletal pain. Other common types include tendonitis, myalgia (muscle pain), and stress fractures.

Causes of musculoskeletal pain

Anyone can experience musculoskeletal pain. It is most often caused by an injury to the bones, joints, muscles, tendons, ligaments, or nerves. This can be caused by jerking movements, car accidents, falls, fractures, sprains, dislocations, and direct blows to the muscle.

Musculoskeletal pain can also be caused by overuse. Pain from overuse affects 33% of adults. Lower back pain from overuse is the most common work-related diagnosis in Western society.

Poor posture or prolonged immobilization can also cause musculoskeletal pain.

Symptoms of musculoskeletal pain

Symptoms of musculoskeletal pain depend on whether the pain is caused by an injury or overuse and whether it is chronic or acute. The symptoms can also differ from person to person.

Common symptoms include:

- Localized or widespread pain that can worsen with movement.
- Aching or stiffness of the entire body.
- The feeling that your muscles have been pulled or overworked
- Fatigue
- Sleep disturbances
- Twitching muscles
- The sensation of "burning" in your muscles. [28]

Pain Assessment in children

Faces Pain Scale – Revised

The Faces Pain Scale – Revised (FPS-R) is a self-report measure of pain intensity developed for children. It was adapted from the Faces Pain Scale in order to make it possible to score on the widely accepted 0-to-10 metric. It shows a close linear relationship with visual analog pain scales across the age range of 4-16 years. It is easy to administer and requires no equipment except for the photocopied faces. The absence of smiles and tears in this scale may be advantageous. It is particularly recommended for use with younger children. Numerical self-rating scales (0-10) can be used with most children over 8 years of age, and behavioral observation scales are required for those unable to provide a self-report.

In the following instructions, say "hurt" or "pain," whichever seems right for a particular child:

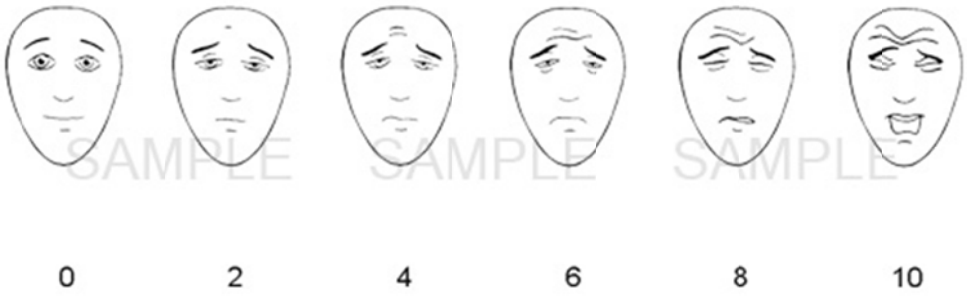


Figure. 17 : Faces Pain Scale – Revised, ©2001, International Association for the Study of Pain

"These faces show how much something can hurt. This face *[point to left-most face]* shows no pain. The faces show more and more pain *[point to each from left to right]* up to this one *[point to right-most face]* - it shows very much pain. Point to the face that shows how much you hurt *[right now]* ."

Score the chosen face 0, 2, 4, 6, 8, or 10, counting left to right, so '0' = 'no pain' and '10' = 'very much pain.' Do not use words like 'happy' and 'sad.' This scale is intended to measure how children feel inside, not how their face looks. [29, 30]

Marco's Complete Body Pain Scale

Marco's Complete Body Pain Scale coloring activity sheet is truly unique and original. Our talented, creative team have put their brains together and brought out their inner child to create this easy to understand version of a full body pain scale designed specifically for children.

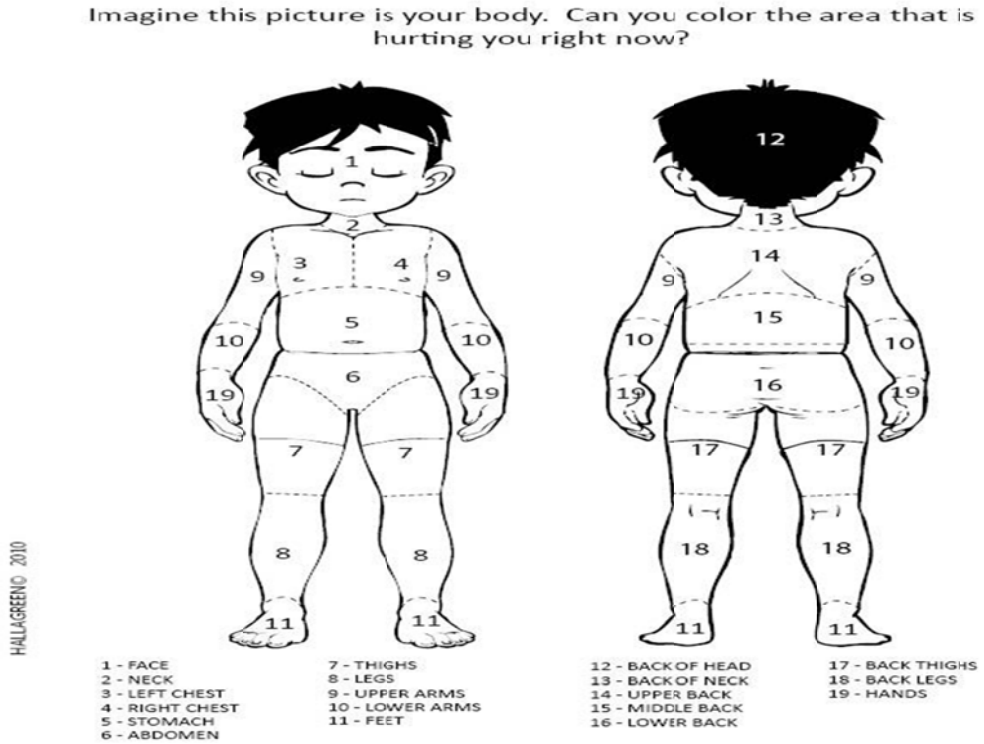


Figure. 18 : Marco's Complete Body Pain Scale

This coloring activity sheet is useful for children with large or small body surface area scrapes, burns, bruises, or internal organ pain. [31]

2.2.5 Gate control theory

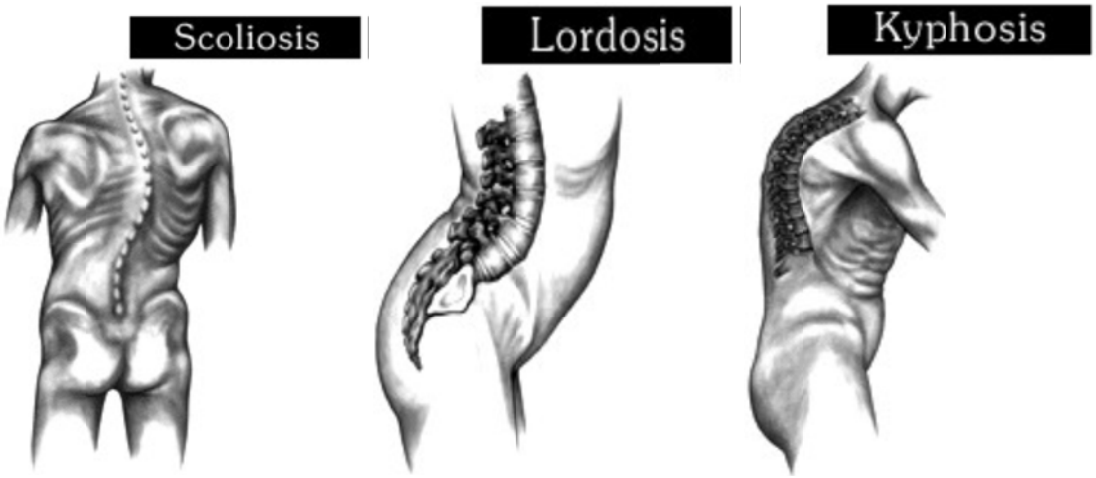
Gate control theory of pain

The gate control theory of pain, put forward by Ron Melzack and Patrick Wall in 1962, is the idea that physical pain is not a direct result of activation of pain receptor neurons, but rather its perception is modulated by interaction between different neurons. [32]

To explain why thoughts and emotions influence pain perception, Ronald Melzack and Patrick Wall proposed that a gating mechanism exists within the dorsal horn of the spinal cord. Small nerve fibers (pain receptors) and large nerve fibers ("normal" receptors) synapse on projection cells (P), which go up the spinothalamic tract to the brain, and inhibitory interneurons (I) within the dorsal horn. [33]

2.3 Definitions

- A primary school is an institution in which children receive the first stage of compulsory education known as primary or elementary education. [34]
- Schoolbag - a bag for carrying school books and supplies. [35]
- Pain — Pain's an unpleasant sensation which may be associated with actual or potential tissue damage and which may have physical and emotional components. [17]
- Acute back, neck and shoulder pain: it is defined as " a dull, constant ache to a sudden, sharp pain that makes it hard to move, acute pain starts quickly and lasts less than 6 weeks. It is the most common type of pain related to sudden overload or movement". [36]
- The MSD is a condition that affects the part of the body that is subjected to repeated stress, strain or both. The musculoskeletal system is an organ system that enables the body to move through the use of the muscle and skeletal systems in combination. [37]
- Lordosis. Also called swayback, the spine of a person with lordosis curves significantly inward at the lower back. [38]
- Kyphosis. Kyphosis is characterized by an abnormally rounded upper back (more than 50 degrees of curvature). [38]
- Scoliosis is a symptom, it is not a disease. Mechanically, scoliosis is a torsion of the basic elements of the spine developed according to an helicoidal axis. Scoliosis is called idiopathic when no inductive disorder like paralysis, congenital malformation, or metabolic disease, have been established. Idiopathic scoliosis arises during infancy or childhood and gives spontaneously as big deformity as earlier started. [39]



Abnormal curves of the spine

Figure. 19 : Abnormal curves of the spine.

2.4 Problem statement :

We concentrated on finding the reasons that lead to body pain in school children.

- Children's schoolbags may cause some physical problem burden in the form of carrying heavy schoolbags every day.
- Children’s skeletons are still growing so carrying heavy bags can cause lasting damage.
- There are no special school buses to carry these students to their schools.
- Research has shown that if you experience back pain as a child, you are four times as likely to experience back pain in your adult life .

2.5 Significance of study :

Children often are seen tottering to school with heavy schoolbags that can negatively influence their health especially with this transitional period of life to adulthood over many years.

We can clearly notice the growing weight of schoolbags and its effects on health of the children that has become a matter of serious concern for every parent, schools, and authorities. They have also been expressing their concerns of the issue but nothing is being done to resolve this problem.

We found an equal importance to determine children’s opinion on their individual daily schoolbag load. Also, we found there is no study in Palestine has evaluated the influence of backpack on student’s bodies except one in Tulkarm (The Influence of Backpacks on Students backs A Cross-Sectional Study of Schools in Tulkarm District), for these reasons we were encouraged to perform this study.

2.6 Study questions:

The purpose of this study was to answer 3 questions:

1- Are there relationship between schoolbag weight, schoolbag type, duration of carrying bag, way to carrying bag, gender and age with neck, shoulder and back pain?

2- Are there percentage of heavy schoolbag more than 15% was recorded?

3- What the effect of carrying heavy bags on primary school students?

2.7 Aims of this study were:

1) To determine the relationships between schoolbag weight, schoolbag type, duration of carrying bag, way to carrying bag, gender and age with neck, shoulder and back pain in Palestine's schools.

2) To measure the weights of schoolbags and determine percentage bag weight carried.

3) To explain the affect on current and future health like chronic neck, back, and shoulder pain, and spinal deformities such as kyphosis and lordosis.

CHAPTER 3

3.1 Literature review

In recent years, the media coverage as well as literature on backpack use in schoolchildren has increased around the world.

Back pain in children was once felt to be an uncommon symptom of organic pathology. [40] Heavy schoolbag weight is frequently considered to have negative effects on posture and hypothesized to induce pain. [41] In the literature backpack usage complications have been correlated with load amount [42], duration of load carrying [42], distance walked [43], inadequate distribution of weight [44], poor item placement in the backpack [45] and poor positioning of the backpack on the spine [46] which may provoke postural changes, producing pain and discomfort. Some studies have tried to moderate these factors by applying changes to the backpack design [44, 47] resulting in changes to primary designs and the evolution of specialized designs for different users. Experts recommend that school children should not carry loads exceeding 10% of their body weight. [48]

Title	Author	Purpose	Method	Result
The effect of Frontpacks, Shoulder bags and Handheld bags on 3D back shape and posture in young university students: An ISIS2 study	Bettany-Saltikov J 1* and Cole L 2	To evaluate the effect of carrying three different types of bag (shoulder, front and handheld), each containing a load of 15% body weight.	Materials: The Integrated Shape Imaging System 2 (ISIS 2) was used to evaluate 3 D back shape and posture. Participants: The study involved twenty-five university students. A repeated measures design was used to record the effects of four conditions using no load (reference), a front pack, a shoulder bag and a handheld bag	Showed an increase in extension and lumber lordosis angles for the front bag ($P<0.001$) and an increase in flexion and reduced lumber lordosis in the shoulder and hand held bags ($p<0.05$). Kyphosis curves were also significantly increased in the hand held bag ($p<0.006$). Right unilateral load carriage also demonstrated the greatest right volumetric asymmetry.[49]

Title	Author	Purpose	Method	Result
Weight varying effects of carrying schoolbags on electromyographic changes of trunk muscles in twelve-year old male students.2009	Abdolhamid Habibi	To determine the effect of backpack carrying with difference loads, on trunk muscles' EMG findings.	Twelve sedentary males with no history of neuromuscular or orthopedic disorder volunteered in the study	The current study showed that EMG findings are changing with increasing the loads; however, the activation of the pectoral major decreased while increasing the loads. The possible mechanism for this EMG change is an increase in spine curve with an increase in load that causes a decline in pectoral major stress. (23) The comparison between a load of 10 and 20 percent of BM showed a significant difference in EMG of RA. [50]

Title	Author	Purpose	Method	Result
Effects of backpack loads on neck-trunk muscle activation Among office workers	Chia-Sui Lin, Fang-Yi Chen, Yu-Shan Huang, and Chiung-Yu Cho	To investigate the effect of weight carriage on neck trunk muscle activation during standing and walking among office workers and to compare electromyography activation between healthy and symptomatic office workers	Twenty-one participants recruited by advertisement needed to use a computer for more than 6 hours daily and had to be aged between 20 to 40 years. Body height and mass were measured. Then, participants filled out the Musculoskeletal Symptom Questionnaire Participants stood for 30 seconds first and electromyography data were simultaneously collected.	Muscle activation of right trapezius significantly increased as the load of the backpack increased during walking condition. Significantly increasing activation of right abdominis as carrying 15% BW was found in current study, but significantly decreasing activation of bilateral lumbar erector spinae as carrying 10% BW. carrying a backpack over 10% BW resulted in significant differences of most muscles. [51]

Title	Author	Purpose	Method	Result
Backpack Weight and Musculoskeletal Symptoms in Secondary School Students, Tehran, Iran	*AR Shamsoddini, MT Hollisaz, R Hafezi	To investigate of relationship of musculoskeletal symptoms with weight of backpack in Tehran secondary school students.	This cross-sectional study was performed in the city of Tehran in 2009. Two hundred thirteen students participated in study. Nordic Musculoskeletal Questionnaire was used, asking about complaints of back, neck, and/or shoulders. Length and weight of the children were determined. Schoolbags were weighed, and the relative weight of the schoolbag was Calculated	Most prevalent musculoskeletal discomfort was in shoulders as 38.1%, neck 27.6% and back 16.7%. Average difference of weight of backpack in sample that had musculoskeletal with other samples was significant [52]

Title	Author	Purpose	Method	Result
Schoolbag carriage and pain in school children	T. PUCKREE, S. P. SILAL{ and J. LIN	To determine the relationship between pain and schoolbag carriage in scholars in Durban, SA.	The study was carried out at four school they use 176 student their ages between 11-14 years old, correctly filled out a questionnaire with open-ended and closed-ended questions. Each child also had his/her body and bag weight measured.	They found a strong relationship between shoulder and other bodily pain with the type of bag and the gender of the student. A significantly larger number of female scholars experienced pain.[53]

Title	Author	Purpose	Method	Result
Perceived schoolbag load, duration of carriage, and method of transport to school are associated with spinal pain in adolescents: an observational study	Clare Haselgrove1, Leon Straker1, Anne Smith1, Peter O'Sullivan1, Mark Perry1 and Nick Sloan2	To determine the association between spinal pain and use and perceived load of school bag, and to see if there was any variation between the genders.	A cross-sectional epidemiological survey was conducted. Participants: 1202 adolescents recruited from the 'Raine' Cohort Study.	The prevalence of back and neck pain was approximately 50%; 53% of females reported neck pain compared with 44% of males ($p < 0.01$). Half of participants carried their schoolbag for more than 30 minutes per day with 85% carrying their bag over both shoulders. Schoolbags were felt to be heavy by 54% and to cause fatigue by 51%. [54]

Title	Author	Purpose	Method	Result
Correlates of heavy backpack use by elementary school children	S.N. Forjuoha,*, J.A. Schuchmannb, B.L. Lanea	To assess demographic and other correlates of carrying backpacks that weigh at least 10% body weight of elementary students.	They use cross-sectional data on 713 students from three elementary schools in Central Texas. Data were obtained from an observational survey of 745 students conducted in 2000–2001, of which data on 32 students were excluded due to inaccurate information. Backpack weights were measured using calibrated scales and standardized methods, along with student weights and heights to compute body mass index (BMI)	They found that children in Schools A and B carried significantly heavier backpack loads. No association was found between heavy backpack use and race, gender or BMI However, children in school C was significantly associated independently with age, grade in school, race and type of backpack carried (with or without wheels), but not with gender or BMI.[55]

Title	Author	Purpose	Method	Result
Schoolbag Weight and the Occurrence of Shoulder, Hand/Wrist and Low Back Symptoms among Iranian Elementary Schoolchildren	*Iman Dianat1, Zeynab Javadivala 2, Hamid Allahverdi pour3	to investigate the association between the weight of schoolbags and the occurrence of low back, shoulder and hand/wrist symptoms among primary school children	This cross-sectional, descriptive-analytical study was conducted among a sample of 307 elementary school children in Tabriz, Iran. Data were collected using a questionnaire and from measurement of the schoolbag weight, body weight and height of each participant. Data were analysed using SPSS software.	The average load carried by schoolchildren was 2.9 kg, representing approximately 10% of the children's body weight. Girls and lower grade children carried a greater percentage of their body weights. Approximately 86% of the children reported some kind of musculoskeletal symptoms. The occurrence of shoulder, wrists/hands, and low back pain among schoolchildren was 70%, 18.5% and 8.7%, respectively.. Girls were more likely to complaint from low back pain than boys were. Age was significantly negatively associated with hand/wrist symptoms. Body mass index was also significantly associated with shoulder symptoms. [56]

Title	Author	Purpose	Method	Result
Poor sitting posture and a heavy schoolbag as contributors to musculoskeletal pain in children: an ergonomic school education intervention program	AI Syazwan1 MN Mohamad Azhar1 AR Anita1 HS Azizan1 MS Shaharuddin2 J Muhamad Hanafiah3 AA Muhaimin4 AM Nizar5 B Mohd Rafee1,6 A Mohd Ibthisham7 Adam Kasani7	To evaluate a multidisciplinary, interventional, ergonomic education program designed to reduce the risk of musculoskeletal problems by reducing schoolbag weight and correcting poor sitting posture.	Data were collected twice before and twice following intervention using the Standardized Nordic Body Map Questionnaire, a rapid upper limb assessment for posture evaluation, and schoolbag weight measurement in children aged 8 and 11 years attending two schools within the central region of Malaysia.	Students who received the ergonomic intervention reported significant improvements in their sitting posture in a classroom environment and reduction of schoolbag weight as compared with the controls. [57]

Title	Author	Purpose	Method	Result
Schoolbag weight and the effects of schoolbag carriage on secondary school students	S. Dockrella, C. Kanea, E. O'Keeffea	To investigate the weight of schoolbags and the effects of schoolbag carriage on first year secondary school students.	A pilot study they used, Students in two Community Schools in Dublin completed an author-assisted questionnaire. Measurements of body weight and schoolbag weight were taken and completion of a daily Body Discomfort Chart (BDC) survey was conducted over the five-day period of one school week. Fifty-seven students, mean age 13.1 years, successfully completed the five days of objective testing	The mean schoolbag weight was 6.2kg, and over the course of the week, 68% of the schoolbags weighed >10% body weight. The mean percentage body weight carried in schoolbags was 12%. The majority of students used backpack-style schoolbags (95%), but only 65% carried them on their back over two shoulders. The reported discomfort was higher for girls (80%) than boys (63%) on the initial questionnaire, but over the study period, equal numbers of boys and girls reported discomfort due to carrying their schoolbags (59%). Girls reported fewer areas of discomfort but higher VAS intensities than boys. [58]

Title	Author	Purpose	Method	Result
The Influence of Backpacks on Students backs A Cross-Sectional Study of Schools in Tulkarm District	Alaa` Osaid khalil AL-Qato	To determine the relationship between musculoskeletal pain and/or fatigue and schoolbag carriage in Tulkarm schools.	A cross sectional study, using random sampling method was conducted during spring 2009. 800 students (males and females) grades 3-9 correctly filled out a questionnaire with closed-ended questions. Each student's weight and full backpack weight were measured.	The results revealed that the mean full schoolbag weight was 5.267 kg; the mean percentage of full schoolbag to body weight was 12.3%. Also, 73% of the students had a loaded bag weight 10% of body weight, For pain related to carrying schoolbag; 47.8% of students had shoulder pain, 21.6% had lower back pain, and 18.2% had neck pain. [6]

Title	Author	Purpose	Method	Result
An Association of Backpack Weight and Postural Habits in School Going Children of Amritsar, Punjab, India	Shyamal Koley and Navneet Kaur	to observe the association between backpack weight and postural habits taken in terms of lumbar flexion, lumbar extension and lumbar lateral flexion in school going children of Amritsar, Punjab, India.	A total of 300 randomly selected normal healthy school going children (150 boys and 150 girls) aged 6-15 years of Amritsar were considered as study population. The samples were collected between July to October, 2007 from Khalsa College Public School, Amritsar, Punjab, India. Height, weight, backpack weight, percent backpack weight, lumbar flexion, lumbar extension and lumbar lateral flexion were measured on all the subjects.	The results of the present study indicate statistically significant positive correlation between backpack weight and height (r=0.73), weight (r=0.57) and lumbar flexion (r=0.19) in boys and with height (r=0.65), weight (r=0.42) and lumbar extension (r=0.21) in girls. It may be concluded that backpack weight has some strong association with postural habits in the studied samples. The backpack weight carried by the school children was reported to be between 7.48% - 16.83% of their body weight. [59]

Title	Author	Purpose	Method	Result
A Preliminary Studies on the Effects of Varying Backpack Loads on Trunk Inclination During Level Walking	Sharifah Alwiah Syed Abd. Rahman, Azmin Sham Rambely, Rokiah Rozita Ahmad,	To examining the effects of load carriage on the trunk.	two boys with mean aged 6.5 years old while walking with four different load conditions; 0%, 10%, 15% and 20% of their body weight. The children were required to walk at their comfortable speed on an 8 m track a few times before their movements were recorded.	The result showed that carrying heavy load of 15% and 20% of body weight induced a significant increase in trunk inclination angle. [60]

Title	Author	Purpose	Method	Result
The effect of schoolbag design and load on spinal posture during stair use by children	Youlian Honga, Daniel Tik-Pui Fongb* and Jing Xian Lic	To study the effects of load carriage and schoolbag type on spinal posture during stair use by children.	30 male children ascending and descending stairs with loads that equalled 0%, 10%, 15% and 20% of their body weight were the subject of research: the boys were wearing an asymmetrical single-strap athletic bag or a symmetrical double-strap backpack during experiments with them. The maximum spinal tilt to the loading side and to the support side, and the range of spinal motions, were obtained by using a motion analysis system.	The results showed that symmetry of spinal posture was observed both when they ascended staircase with all loads and descended in a backpack. When carrying an athletic bag with 15% and 20% of their body weight while ascending the staircase, the lateral spinal tilt to the supporting side was significantly increased.[61]

Title	Author	Purpose	Method	Result
The Influence of Carrying a School Bag on the Developing Spine	Petronella A. Hough, Mariette Nel, Janetta E. Smit, Elmarie Malan, Madelyn van der Watt, Aletha F. Deacon, Lindi Grobler, and Anelle M. Bester	to investigate the influence of carrying a schoolbag on the developing spine of Grade 5 and Grade 11 students.	A cross-sectional study design was used. The population included Grade 5 and Grade 11 students, of both genders, from public schools in one city. Twenty schools were randomly selected to participate (12 primary and intermediate schools, 2 combined schools, and 6 secondary schools). A structured questionnaire, based on the assessment model used in the department where the work was done, was completed during an interview with each student.	Daily, 85% of Grade 5 students brought all their books to school, 12.9% brought books needed for the day, and 2.1% brought fewer books than needed. Grade 5 and Grade 11 students with normal posture and carrying school bags properly showed deviations in the posterior and lateral areas. This indicates that carrying a schoolbag, which is a significant external load, caused postural deviations. [62]

Most studies have examined schoolbag weight in pubertal children (Table) [48]

TABLE 1

Schoolbag Weight Characteristics Reported in the Literature

	Sample Characteristics			Schoolbag Weight	
Research Study	N	Mean Age (Range)	Nationality	Absolute, kg	Relative, % of BW
Negrini et al[6]	402	11.7 (10–16)	Italy	8.75	19.9
Whittfield et al[3]	140	3rd grade	New Zealand	7.0	13.2
		6th grade			
Puckree et al[3]	176	12.2 (11–14)	North Africa	4.0	8.84
Jones et al[11]	1043	11–14	England	4.7	9.9
van Gent et al[2]	745	12–14	Austria	7.4	14.7
Forjuoh et al[12]	713	5–12	United States	2.6	8.2
Goodgold et al[14]	354	11–14	United States	8.05	17.43
		5th grade		4.0	18.78
		6th grade		4.6	20.20
		7th grade		5.2	13.99
		8th grade		5.7	15.20
Siambanes et al[13]	3497	13 (11–15)	United States	4.8	19.02
Sheir-Neiss et al[10]	1126	12–18	United States	8.31	14.7
Skaggs et al[1]	1540	12.4 (11–14)	United States	4.0	7
Moore et al[17]	531	8–18	United States	—	10.7
		5th grade		—	12.1
		6th grade		—	12
		7th grade		—	12
		8th grade		—	12.1
		9th grade		—	9.5
		10th grade		—	10
		11th grade		—	8.6
		12th grade		—	9.8
Korovessis et al[19]	3441	12 (9–15)	Greece	4.6	—
Korovessis et al[18]	1263	15 (12–18)	Greece	—	10.6
Present study	703	10.2 (6–14)	Greece	5.30	12.7

Figure. 20 : Schoolbag weight reported in literature.

CHAPTER 4

4.1 Subject recruiting and selection

Two schools from Nablus are randomly selected for the study (Fadwa Toqan school for girls and Ebn Qutaiba school for boys), 200 primary students randomly, their ages from eight to eleven (3rd grade to 6th grade). Students were divided in two groups, group A included 100 girls and group B included 100 boys .

A letter was sent to the Fadwa Toqan and Ebn Qutaiba headmasters asking for permission to approach schools in the study area.

A cross-sectional study was conducted to detect ability to walk and wear schoolbag independently and to detect if the increasing or overload schoolbag weight and the wrong way to carrying it will lead to back, shoulder and neck pain.

After permission we arranged with individual schools and visited each participating school for data collection.

Students were selected from Fadwa Toqan and Ebn Qutaiba which governmental schools that were randomly selected from all primary schools located in Nablus city.

Data collection was carried out on an unscheduled day so that children could not alter their schoolbag weight.

Within each school selected, 100 students were selected randomly including 25 students from each class, we took students name schedule which include all classes' parts from 3rd grade to 6th grade and the number of students in each one, then went to classes and select the sample randomly.

4.2 Inclusion criteria were:

1- Students must be primary school from 3rd to 6th grade.

2- Ability to carry schoolbag by one shoulder and both shoulders.

3- Male and female students.

4- Generally healthy students.

4.3 Exclusion criteria were:

1- Who have disabilities and health problems.

   a- Having orthopedic, muscular, and rheumatoid disease.

   b- Having deformity in spine and joints of upper and lower extremities.

2- Who are unable to provide data sufficiently.

4.4 Bags weight

The bag weight measurement was performed to evaluate the schoolbag load status among the student. The weight of each student's schoolbag load (including everything that they was brought to school on the day of measurement such as water bottle, books, sportswear, stationeries and food) was measured using an electronic weighting scale (Tanita Model). The schoolbags were placed at the centre of the weighing scale with the loads evenly distributed over the surface.

4.5 Students weight

An electronic weighting scale (Tanita Model) was used to measure the student body weight (in kilograms).The percentage of the schoolbag load status was evaluated among the students BW which should be between10%-15%.

4.6 Questionnaires

The questionnaire was divided to two parts, first part recorded by students which included demographical data such as the age, gender and grade level of the students as well as the duration of schoolbag carried, and the second part recorded by investigators which included the student weight and schoolbag weight.

The questionnaire also contained questions about medical history, school activities and out of school activities. It contained pictures related to the type of schoolbag and the ways carried and the students tick on the type and way to carry .

Musculoskeletal pain in different body regions was assessed by using a body map with nine body regions (neck, shoulders, upper arms, lower arms, upper back, lower back, hips/thighs, knees, lower legs) and the students shaded the areas of musculoskeletal pain they feel.

Finally, the questionnaire contained pictures about happy-sad face scale, and the students ticked on the face related to them.

4.7 Validity and Reliability

The questionnaire was translated into Arabic language, then send to 10 instructors in medical and health science college to evaluate and document the content validity of it.

A pilot study was include 20 students to determine of the reliability, validity and the adequacy of the questionnaire, identify the time required for the data collection (the questionnaire took less than 10 minutes to complete), and the barriers that may occur during the data collection process.

The study language and grammar vetted by Miss. Cynthia Maziyed, and the reference vetted by Mr. Jihad Bani Odeh.

4.8 Statistical Analysis

Statistical analysis of the data was performed with SPSS soft ware 17 which was used to calculate measurements, and we analyzed the data .

4.9 Ethical issues

The study's IRB sent and the certification from National Institutes of Health (NIH) Office of Extramural Research and permission from schools' headmasters were taken, then the study started. In the beginning of study we explained the goal to the headmaster and teachers and explained the questionnaire for the students. The participants have the choice to enter the study. There is no harm. Privacy and security of participants was taken in considerate. Information will used for scientific research only.

4.10 Budget

The costs of our study were as follows:

Travels:	100 NIS
Printing (Questionnaires & The study copies):	120 NIS
Total:	220 NIS

CHAPTER 5

Results

Total number of students in this study was 200, including 100 females (50%) and 100 Males (50%).

All 200 schoolchildren, mean age 9.5 years, completed the questionnaire.

Table.1 : Demographic table

Case Processing Summary

		Cases					
		Inclusion		Exclusion		Total	
Gender	Grade	N	Percent	N	Percent	N	Percent
male	3rd grade	25	100.0%	0	.0%	25	100.0%
	4th grade	25	100.0%	0	.0%	25	100.0%
	5th grade	25	100.0%	0	.0%	25	100.0%
	6th grade	25	100.0%	0	.0%	25	100.0%
female	3rd grade	25	100.0%	0	.0%	25	100.0%
	4th grade	25	100.0%	0	.0%	25	100.0%
	5th grade	25	100.0%	0	.0%	25	100.0%
	6th grade	25	100.0%	0	.0%	25	100.0%

Table.2 : Relationship between variables and pain

Variables	Correlation	P-value
Grade	0.142*	0.045
Body weight	0.037	0.600
Bag weight	0.221**	0.002
Bag type	0.042	0.554
Carrying way	0.042	0.554

***. Correlation is significant at the 0.05 level (2-tailed).**

****. Correlation is significant at the 0.01 level (2-tailed).**

There is a strong relationship between grade and bag weight with pain.

5.1 Weight of schoolbags

Schoolbags average weight was 3.3kg in males and 3.9kg in females. We found the girls carried heavier schoolbags (2-6.8kg) than boys (1.9-5.5kg).

Table.3 : Average of schoolbag weight.

Grade	Average schoolbag weight
3rd	3kg
4th	3.3kg
5th	3.4kg
6th	3.85kg

5.2 Schoolbag weight as a percentage of body weight

The mean schoolbag weight as a percentage of mean BW carried by the students was (10.3%).

Table.4 : Average of body weight, schoolbag weight and percentage in each grade.

Gender	Grade	Average body weight (kg)	Average schoolbag weight (kg)	Average percentage %
M	3rd	30.2	2.7	9.7%
M	4th	33.7	3	9.3%
M	5th	36.7	3	8.6%
M	6th	40.4	3.4	9%
F	3rd	26.9	3.3	12.2%
F	4th	31.5	3.6	11.3%
F	5th	35	3.8	11.2%
F	6th	39.6	4.3	11.3%

The results showed that 51% of students usually carry schoolbag weighing <10% of their BW, 41.5% of students carry schoolbags weighing between 10%-15% of their BW and 7.5% of students carry schoolbags weighing >15% of their BW.

Table.5 : Ratio of schoolbag weight to student weight.

Ratio of schoolbag to student weight	Number of students	Percentage %
<10%	102	51%
10%-15%	83	41.5%
>15%	15	7.5%

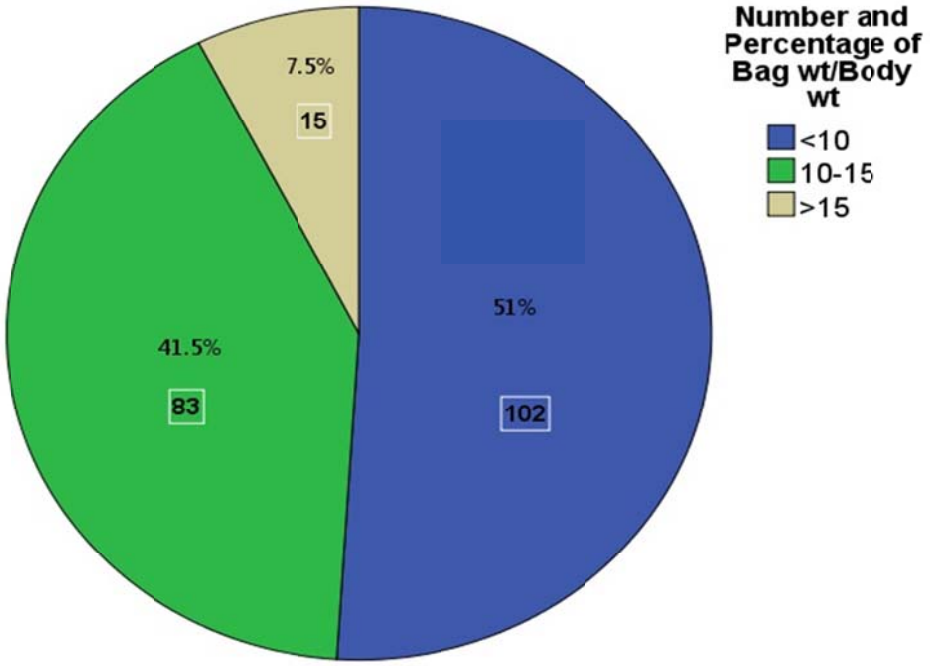


Figure.21 : Number and percentage of bag weight/body weight.

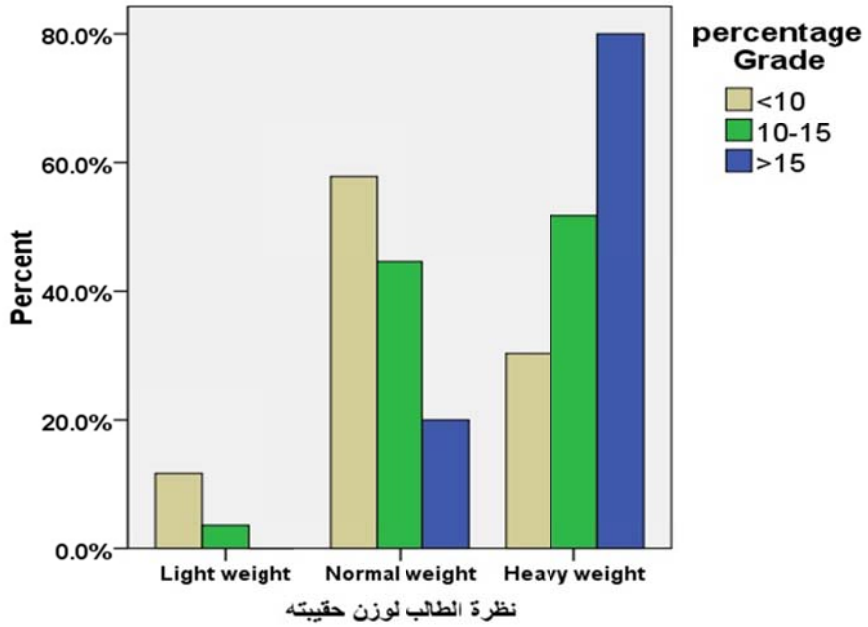


Figure.22 : percentage of body weight-students towards.

5.3 Types of schoolbags and Ways to carrying it

We found 96% students use bags with two straps, 2.5% use one strap bags, and 1.5% use rolling trolley bags.

Students that carried the schoolbag on two shoulders at school and during transport are 91.5%, on one shoulder 7%, and rolling by hand are 1.5%.

Table.6 : Average of each different school types.

Gender	Grade	Average of one strap	Average of two straps	Average of rolling trolley
M	3rd	0%	100%	0%
M	4th	12%	88%	0%
M	5th	0%	100%	0%
M	6th	0%	100%	0%
F	3rd	0%	96%	4%
F	4th	4%	96%	0%
F	5th	0%	92%	8%
F	6th	4%	96%	0%

Table.7 : Average of each different carrying ways.

Gender	Grade	Average of one shoulder	Average of two shoulders	Average of rolling trolley by hand
M	3rd	0%	100%	0%
M	4th	20%	80%	0%
M	5th	0%	100%	0%
M	6th	0%	100%	0%
F	3rd	12%	84%	4%
F	4th	8%	92%	0%
F	5th	8%	84%	8%
F	6th	8%	92%	0%

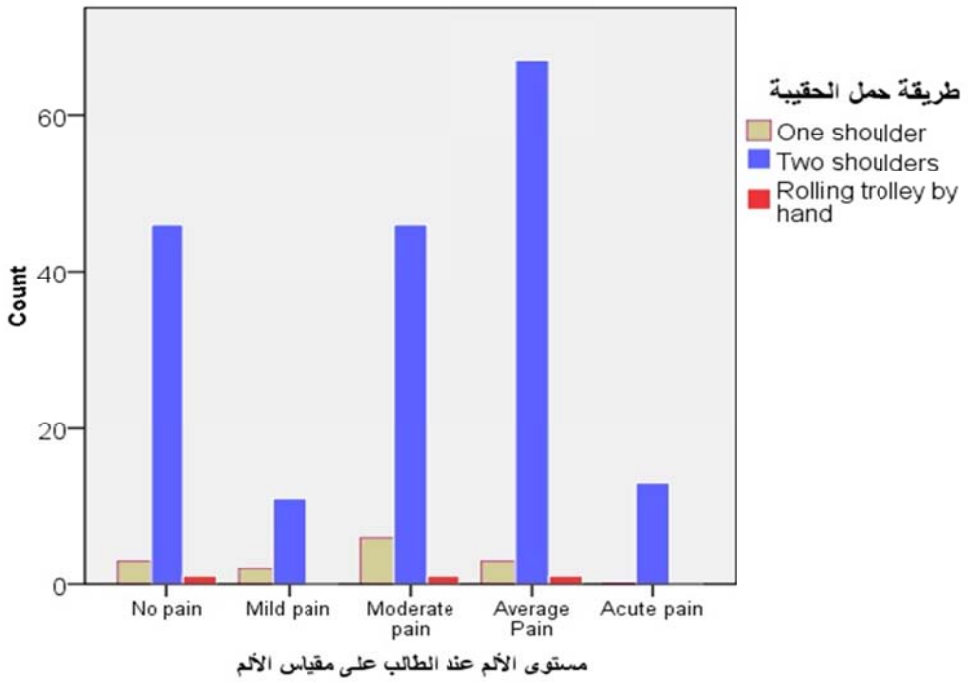


Figure.23 : Pain scale-carrying way.

5.4 Time to carry schoolbag

The time (in minutes) the students take to their carry schoolbags ranged from 5-120 minutes, and the average 25 minutes.

5.5 Schoolbag related musculoskeletal discomfort

In all primary students, most of the musculoskeletal discomforts were in the shoulder area**.** The females recorded the highest prevalence of shoulder discomfort (72%) more than boys (47%). Back pain was reported by females (36%) more than by males (6%). Neck pain were reported by females (15%) less than by males (17%).

Table.8 : Average of region discomfort in both gender.

Region of discomfort	Average in Male	Average in Female
Neck	**17%**	**15%**
Shoulder	**47%**	**72%**
Back	**6%**	**36%**

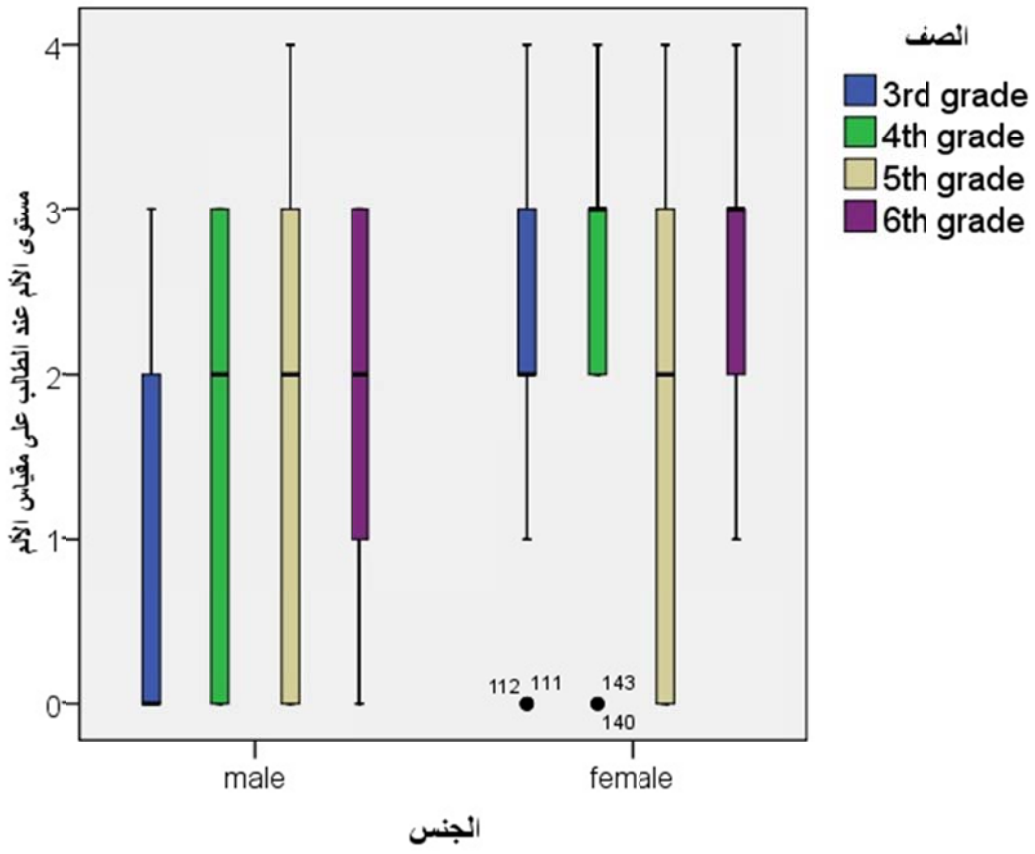


Figure.24 : Pain scale in both gender in each grade.

Girls reported more discomfort due to carrying a schoolbag than boys.

In both gender the 6th grade recorded highest prevalence of pain (in male between 1-3 and in female between 2-3 on the pain scale).

The highest prevalence of students who recorded no pain on pain scale was in male (3rd, 4th, and 5th grades) rather than in female (only 5th grade).

CHAPTER 6

Result Discussion.

In Palestine there are a large percentage of primary school students which presently 86.5% of total students and 23.2% of total population. [5] Also, there is a lack in studies related to this subject except one in Tulkarm (The Influence of Backpacks on Students backs A Cross-Sectional Study of Schools in Tulkarm District). [63]

In our project, we test our hypothesis which is suppose direct relationship between schoolbag weight, schoolbag type, duration of carrying bag, way to carrying bag, gender and age with neck, shoulder and back pain in Nablus.

Bodily pain either in the back, shoulders or neck, in school children has received considerable attention in the literature. Some studies have specifically looked at the effects of various schoolbag variables on back, neck and shoulder pains in school children.

6.1 Method discussion

Subject recruiting and selection

Two schools from Nablus are randomly selected for the study (Fadwa Toqan school for girls and Ebn Qutaiba school for boys). 200 primary students randomly, we took this small number of sample because we have a short term to complete the study. We chose students from primary level for many reasons: 1- small bodies carrying heavy schoolbags. 2- Children's skeletons are still growing so carrying heavy bags can cause lasting damage. 3- Research has shown that if you experience back pain as a child, you are four times as likely to experience back pain in your adult life .

We included sample ages from eight to eleven (3rd grade to 6th grade) and excluded first and second grades because they less cooperation and won't understand the questionnaire.

Also, we took equal number of students (100) from both genders to find relationships between gender and other variables.

6.2 Result discussion

Total number of students in this study was 200, including 100 females (50%) and 100 Males (50%).

All 200 school students completed the questionnaire.

Related to statistical analysis we found a strong relationship between grade and bag weight with pain.

The results of this study showed that :

Weight of schoolbags

Schoolbags weight average (3.3kg) in male and (3.9kg) in female. We found that girls carried heavier schoolbags (2-6.8kg) than boys (1.9-5.5kg). Previous study (Dianat, et al. 2001) support this result: showed that girls carried a greater percentage of their body weights.

Average schoolbag weight in the 3rd grade students was 3kg, in 4th grade students was 3.3kg, in 5th grade students was 3.4kg and in 6th grade students was 3.85kg. The average of schoolbag weight in the 6th grade students is higher range rather than other grades related to the curriculums for them requires to carry heavier books. The average of schoolbag weight in the 3rd grade students is lower range because the curriculums for them are little, the books are small and light weight. Unlike a previous study (Dianat, et al. 2001) were reported that lower grade children carried a greater percentage of their body weights.

Schoolbag weight as a percentage of body weight

The mean schoolbag weight as a percentage of mean BW carried by the students was 10.3%

The results showed that 51% of students usually carry schoolbag weighing <10% of their BW, 41.5% of students carry schoolbags weighing between 10%-15% of their BW and 7.5% of students carry schoolbags weighing >15% of their BW, related this result we found most students are compatible with normal stander of percentage of schoolbag weight and students weight (10%-15%), but we don't forget the 7.5% is big range comparison with sample number (200). Previous study (Dockrella, et al. 2012) showed that there are 68% of the schoolbags weighed >10% of their body weight that support our study result.

Types of schoolbags and Ways to carrying it

We found 96% from all students use bags with two straps (similar to that found by (Dockrella, et al. 2012) which recorded the majority of students used backpack-style schoolbags (95%)), 2.5% use one strap bags, and 1.5% use rolling trolley bags. High range for using bags with two straps in the school students because it's the more common and comfort, most student have UNICF bags which already with two straps, because students imitate their friends kind of bag, on the other hand students don't use bags with one straps because they feel discomfort related to many and heavy books, rolling trolley bags more expensive and the nature of the roads are not suitable to drag the bag.

Students that carried the backpack on two shoulders at school and during transport are 91.5%, on one shoulder 7%, and rolling by hand are 1.5%. This results have similar reasons like the preceding reasons that we are explain .

Time to carry schoolbag

The time (in minutes) that students take to carry schoolbags 5-120 minutes, and the average 25 minutes. Short time that student takes for carrying their bags is related for many reasons such as, students homes near the school and some come to school by cars.

Also, long time is related for many reasons such as, homes of these students far from the school, low economic status of student so they walk rather than using car and some students spend time in the walk, talk and play with their friends while going to school or home.

Schoolbag related musculoskeletal discomfort

In both gender the 6th grade recorded highest prevalence of pain (in male between 1-3 and in female between 2-3 on the pain scale),because the classrooms for them is present in the last floor of the school and they need more effort to carrying it on the stairs, also the schoolbags weight in this grade are record high range because the curriculums for them requires to carry heavier books.

Understanding of the pain concept are the other factor effect on the result. with aging, the child become able to definition and understand the pain, so the 6th grade students recorded high level of pain rather than others.

The highest prevalence of students who recorded no pain on pain scale and low schoolbags weight was in 3rd, 4th, and 5th grades rather than 6th grade, because the classes present in the ground floor of the schools and the curriculums for them are little with small, light books.

Girls reported more discomfort due to carrying a schoolbag than boys, (similar to that found by (Puckree, et al. 2004), and (Dockrella, et al. 2012)), because the girls do not wear sports clothes, but they are placed in the bag, compared with males, which increases the weight of the bag, Girls imitate friend with some private material is not required.

In all of primary students, most of musculoskeletal discomforts were in the shoulder area, because most of students use bags with two straps which make pressure on shoulder muscles, tendons, nerves and bones, especially pressure on the Brachial Plexus. This nerve carry the signals from the brain to the muscles that move the arm, and it carry signals back to the brain about sensations such as touch, pain, and temperature, so the result recorded pain in shoulders more than in back and neck. High level of discomfort were also reported by (Shamsoddini, et al. 2010) where 38.1% of their subjects complained of shoulder pain and by (Al-Qato 2012) where 47.8% of their subjects had shoulder pain.

The females recorded the highest prevalence of shoulder discomfort with 72% more than boys 47%, previous study support this finding (Puckree, et al. 2004). Back pain was reported by females (36%) more than by males (6%). Neck pain were reported by females (15%) less than by males (17%), unlike a previous study (Haselgrove, et al. 2008) were reported that 53% of females reported neck pain compared with 44% of males.

6.3 Limitations of the study

The limitations of our study were:

1- Short term to complete our study, so we were chosen a little sample (only 200 students).

2- The difficulty of choosing students because of the midterm exam.

3- Delayed in data collection related to teacher strike and the students not take all lectures and they not brings all books in the schedule.

4- The difficulty of coordination with the teachers in girls school whom prevent us to take the sample from their lectures.

5- Self budget and expensive study needs which prevent us to use other materials and take more sample.

6.4 Recommendations

- Alteration of timetabling that allow students bring to school only those textbooks, exercise books and stationery items which are definitely required.
- Advise teachers to give clear instructions for what books to bring for the next lesson before the end of sessions to avoid students from bringing any unnecessary textbooks, exercise books or stationery items to school.
- Demonstrate to students the correct manner and posture in carrying schoolbags and explain the adverse effects that over-weight schoolbags will bring about.
- Obtain co-operation of parents: Parents should be urged to select schoolbags and items which are made of light-weight materials, to discourage their children from bringing magazines, toys and unnecessary items to school.
- Choose appropriate textbooks: Schools should avoid using too many supplementary workbooks or additional exercises.
- Conducting random check on the weight of schoolbags and informing parents if bags are found overweight.
- Using other learning materials to replace textbooks in the learning of some topics.
- Scheduling Physical Education and Art lessons for different days.

- Increase awareness for the parents to select correct schoolbag design.
- Recommendations for authors of books: Consider the weight of schoolbags when writing textbooks
- Encourage your child to store books in their school locker, and only bring home those needed for homework.
- Regularly clean out the backpack, since your child may be storing unneeded items.
- Make sure that items in schoolbag can't move around during transit.
- Regularly ask the child if their backpack is causing fatigue.
- Look for signs of pain. Such as, red marks from straps and poor posture. This indicates if a backpack fits poorly or is overloaded.
- See your doctor if your child complains of back pain.

Recommendations for children's schoolbags:

- Should weigh no more than 10 per cent of the child's BW.
- Should be worn on both shoulders so the weight is evenly distributed.
- Should have a padded back panel and wide padded straps for increased comfort.
- The heaviest items should be packed so they are closest to the spine, to reduce strain.
- The straps should be adjusted so the schoolbag sits high up on the back and a waist strap can be used so the pelvis can hold some of the load.
- Should only contain the necessities (i.e. books needed that day).

Figure.25 : Healthy schoolbag design.

Correct lifting and carrying techniques suggestions:

- Adjust the shoulder straps so that the bottom of the schoolbag is just above the child's waist – don't allow them to wear the schoolbag slung low over their buttocks.
- When fitted correctly, the schoolbag should contour snugly to the child's back, rather than hang off their shoulders.
- The child should lift the backpack with a straight back, using their thigh muscles. The schoolbag should be lifted with both hands and held close to the body. Slip an arm through one shoulder strap, and then the other.
- Make sure the child understands that carrying the backpack over one shoulder will cause back pain and potential injury.

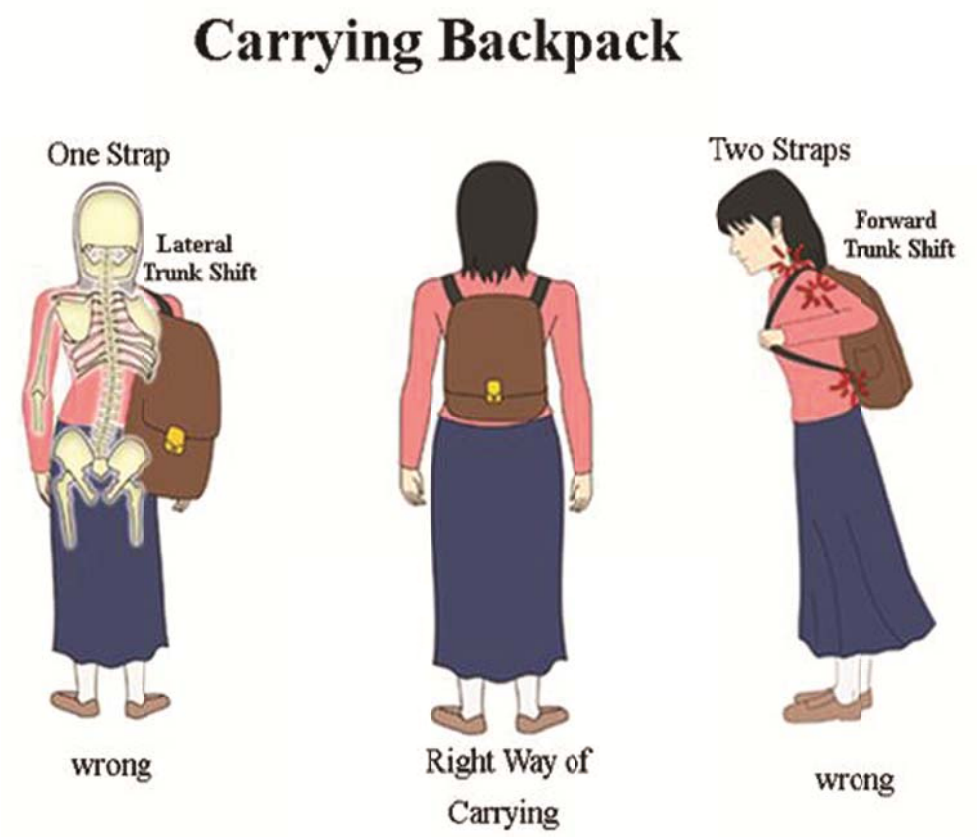


Figure.26 : Correct lifting and carrying schoolbag way

CHAPTER 7

7.1 Conclusion

The shoulder and other bodily pain experienced by the sample of scholars are strongly related to the bag weight and the grade of the students. Girls reported more discomfort due to carrying a schoolbag than boys. Preventive and educational activities should be implemented in this age group.

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Appendix.1

Questionnaire
[6, 53, 64]

The study on Effect of School Bag Weight and Carrying Way on Neck, Shoulder, and Back on Primary School Students in Nablus City

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We An-Najah National University Students, Nursing College, fourth year, are doing a questionnaire field aims to study the impact of school bags for students in grade III and IV, V and VI aged between 8 - 11 years, where they will be taking weight student, length and weight of school bag and fill the attached questionnaire.

We hope that you will cooperate with us, knowing that the information is used for research purposes only

Partnership with us indicate approval.

Guardian's signature: _____ Student Signature: _____.

(A) PERSONAL DETAILS

***Data writing by student:*

Age: _____

Gender: _____

Grade: _____

School: _____

How long you carry the bag:_____

***Data writing by investigators:*

Student Height: _____

Student Weight: _____

School Bag Weight: _____

(B) MEDICAL HISTORY

(1) Do you suffer from any illnesses? _____

If yes, what type of illness and for how long did you have this illness?

_____

(2) Have you suffered from any illnesses in the past?_____
If yes, what type of illness and for how long did you have this illness?
_____

(C) SCHOOL ACTIVITY

(1) Do you participate in any sporting activity at school?_____
If yes, specify the type(s) of activity._____
_____

(2) Did you sustain any injuries during this activity?_____
If yes, state the type of injury, the activity involved and when the injury occurred.
_____

(D) ACTIVITIES OUT OF SCHOOL

(1) Do you participate in any activities out of school?
(e.g. Club soccer, club netball, karate, etc). _____
If yes, specify the type(s) of activity.
_____

(2) Did you sustain any injuries during this activity?_____
If yes, state the type of injury, the activity involved and when the injury occurred.
_____

(E) SCHOOL BAG

(1) Which of this school bag is your bag? Tick the appropriate choice.

☐ One strap

☐ Two straps

☐ Rolling trolley

(2) Which of this way you carry your school bag? Tick the appropriate choice.

☐ On one shoulder ☐ On two shoulders ☐ Rolling trolley by hand

(3) Do you experience pain in your neck, shoulder or back? _____

If yes, where does the pain occur? Tick the appropriate choice.

_____ Neck

_____ Shoulder

_____ Back

(4) If you do experience pain, what do you think causes it?

_____

_____

(5) If the pain is related to the carrying of your bag, does the pain:

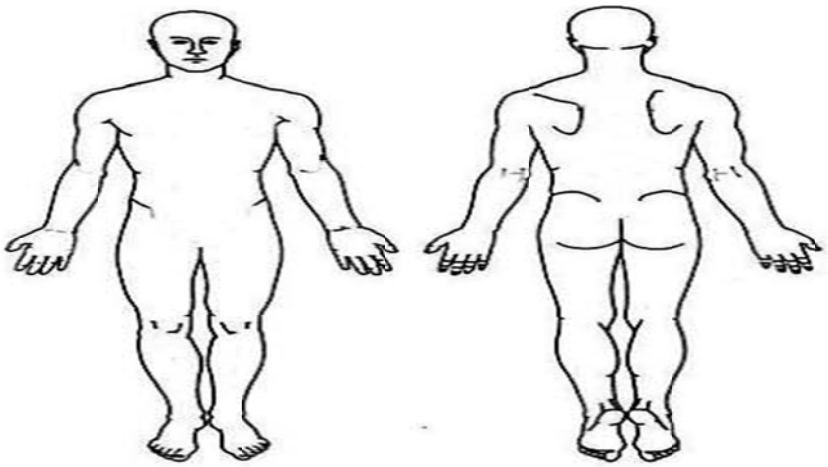
a- Occur while you carry your bag.

b- Occur after removing bag off shoulder.

c- Always remain present.

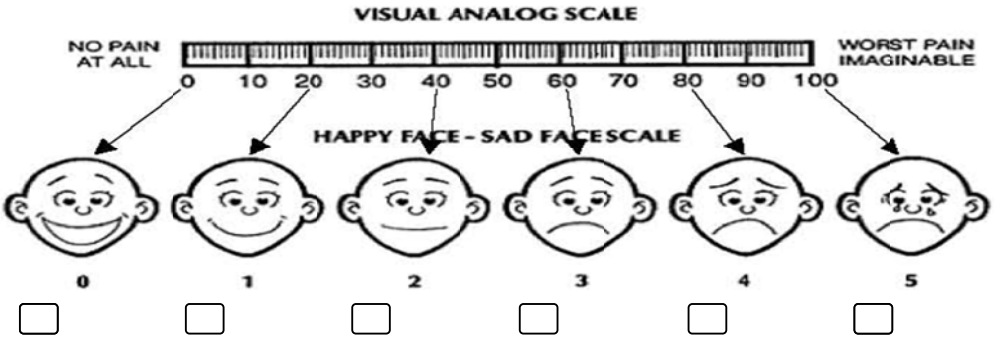
*State whether (a), (b) or (c): _____

(6) On the diagram below, shading the area of pain you feel related to school bag:



(7) On a scale from 0 to 5 (0 being no pain and 5 being the most pain) how would you rate your pain? Tick the appropriate choice.

0 - No pain
1 - Mild pain
2 - Moderate pain
3 - Average pain
4 - Acute pain
5 - Sever pain



(8) What do you do to make the pain go away?

_____

(9) What is your toward weight of your school bag?

_____ Light weight.
_____ Normal weight.
_____ Heavy weight.

Thank you for participating in this study

Appendix.2

استفتاء

دراسة بعنوان تأثير وزن الحقيبة المدرسية وطريقة حملها على الظهر والرقبة والأكتاف، لدى طلاب المدارس الابتدائية في مدينة نابلس.

نحن طلبة جامعة النجاح الوطنية كلية التمريض سنة رابعة، نقوم بعمل استبيان ميداني يهدف إلى دارسة تأثير الحقائب المدرسية على طلبة الصف الثالث والرابع والخامس والسادس الذين تتراوح أعمارهم ما بين 8 - 11 سنة، حيث سيتم أخذ وزن الطالب وطوله ووزن الحقيبة المدرسية وتعبئة الاستبيان المرفق.

نرجو من حضرتكم التعاون معنا مع العلم أن المعلومات تستخدم لأغراض البحث العلمي فقط

مشاركتك معنا تدل على الموافقة.

توقيع ولي الأمر:_____ توقيع الطالب:_____.

(A) تفاصيل شخصية

***** بيانات تعبأ بواسطة الطالب:***

العمر: _____

الجنس: _____

الصف: _____

المدرسة: _____

مدة حمل حقيبتك(بالساعات): _____

***** بيانات تعبأ بواسطة الباحثين:***

طول الطالب: _____

وزن الطالب: _____

وزن حقيبة المدرسة: _____

(B) التاريخ الطبي

(1) هل تعاني من أي أمراض؟ _____

إذا كانت الإجابة بنعم، ما هو نوع المرض ومنذ متى لديك هذا المرض؟

_____

(2) هل عانيت من أي أمراض في الماضي؟ _____

إذا كانت الإجابة بنعم، ما هو نوع المرض ومتى كان لديك هذا المرض؟

_____

(C) الأنشطة المدرسية

(1) هل تشارك في أي نشاط رياضي في المدرسة؟ _____

إذا كانت الإجابة بنعم، حدد نوع/أنواع الأنشطة._____

(2) هل تعرضت لأي إصابة خلال هذا النشاط؟ _____

إذا كانت الإجابة بنعم، حدد نوع الإصابة ومتى حدثت.

_____

(D) الأنشطة خارج المدرسة

(1) هل تشارك في أي أنشطة خارج المدرسة؟

(على سبيل المثال نادي كرة القدم أو كرة السلة أو الكاراتيه، وغيرها). _____

إذا كانت الإجابة بنعم، حدد نوع الأنشطة.

---

(2) هل تعرضت لإصابات خلال هذا النشاط؟ _____

إذا كانت الإجابة بنعم، حدد نوع الإصابة، وماذا كان النشاط، ومتى حدثت الإصابة.

_____

(E) الحقيبة المدرسية

(1) أي من هذه الحقائب المدرسية هي حقيبتك؟ ضع علامة على الاختيار المناسب.

☐ حزام واحد للكتف

☐ حزامين للكتف

☐ عربة تجر

(2) أي من هذه الطرق تحمل بها حقيبتك المدرسية؟ ضع علامة على الاختيار المناسب.

☐ على كتف واحد

☐ على كتفين

☐ تجرها بيدك

(3) هل تعاني من ألم في الكتف أو الرقبة أو الظهر؟ _____

إذا كانت الإجابة بنعم، أين يحدث الألم ؟ ضع علامة على الاختيار المناسب.

الرقبة _____

الكتف _____

الظهر _____

(4) إذا كنت تعاني من الألم ، برأيك ما هي الأسباب لحدوث ذلك؟

_____

(5) إذا كان الألم يرتبط بحمل حقيبتك، هل الألم:

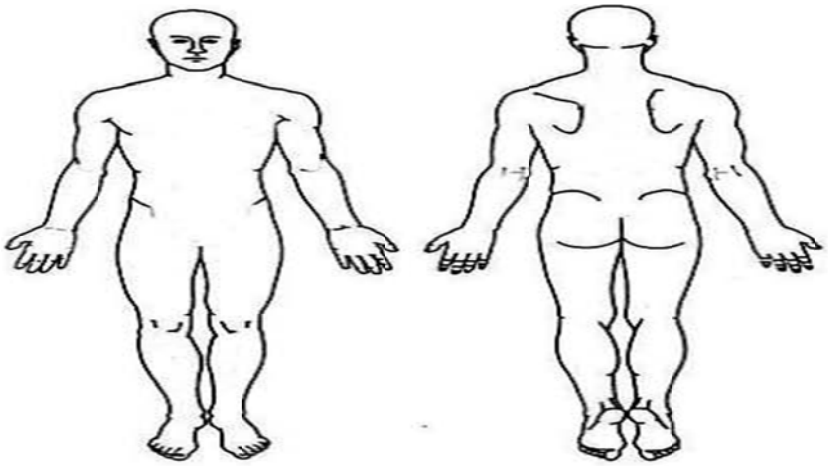
(أ) يحدث أثناء حملك الحقيبة.

(ب) يحدث بعد إزالة الحقيبة عن الكتف.

(ج) يبقى موجودا دائما.

* اختر منهم (أ) أو (ب) أو (ج): _____

(6) في الرسم البياني أدناه، قم بتظليل منطقة الألم الذي تشعر به بسبب الحقيبة المدرسية:



(7) على المقياس من 0 إلى 5، (حيث 0 لا ألم و 5 هي الأكثر ألماً)، كيف تقيم ألمك؟ ضع علامة على الاختيار المناسب.

0- لا ألم

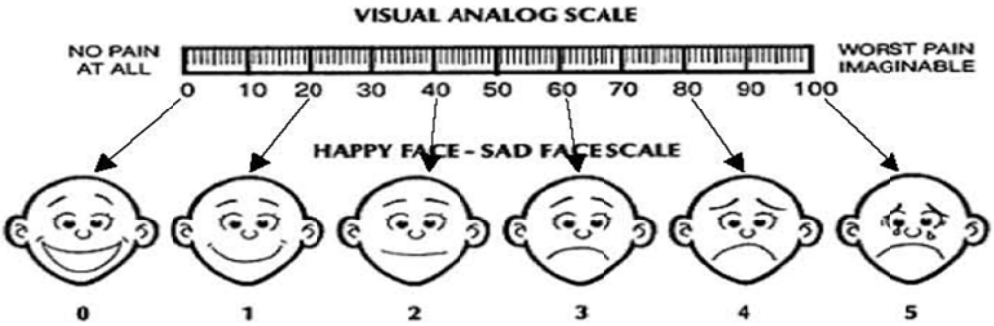
1- ألم خفيف جدا

2- ألم خفيف

3- ألم متوسط

4- ألم حاد

5- ألم حاد جدا



☐ ☐ ☐ ☐ ☐ ☐

(8) ماذا تفعل لجعل الألم يزول؟

_____

(9) ما هو رأيك بوزن الحقيبة المدرسية الخاصة بك؟

خفيفة الوزن _____.

وزنها طبيعي _____.

ثقيلة الوزن _____.

شكرا لكَ على المشاركة في هذه الدراسة