International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 1 Jan-Feb 2023, pp: 2057-2072 www.ijprajournal.com ISSN: 2249-7781

To Study the Influence of Sitting Time Duration and Physical Activity Levels on Abdominal Obesity in Adults: An Observational Study

DR. Perisetla Sreenidhi [1], DR.M. Suresh Kumar [2], DR .K. Madhavi [3], DR.N. Kavitha [4]

MPT [Cardiovascular & Pulmonary Conditions] PG Student [1], MPT [Cardiovascular & Pulmonary Conditions] , Faculty[2], ', MPT[Cardiovascular & Pulmonary Conditions] PhD, FIAP, HOD , Principal [3], MPT [Cardiovascular & Pulmonary Conditions] , Faculty [4] , SVIMS, COLLEGE OF PHYSIOTHERAPY, TIRUPATI, ANDHRA PRADESH

Submitted: 15-02-2023 Accepted: 25-02-2023

ABSTRACT: **Background:** Abdominal obesity is also a condition where excessive abdominal fat is present around the stomach. It is also known as truncal / central obesity. The aim of the study is to study the influence of sitting time and physical activity effect on abdominal individuals.

Objectives: This study evaluates the anthropometric measurements (i.e., HT, WT, BMI, WC, HC, WHR), sitting time duration(hrs/week)and physical activity levels(met-min/week) to see the effect on abdominal obesity individuals.

Methodology: An Observational study of 50 young male adults of age group 30 years were included in the study. The study was sent through goggle forms via e-link to 70 individuals. 20 individuals were not included in the study according to the exclusion criteria.

Outcome measures: Anthropometric measurements in the 1st phase of the questionnaire. Sitting time and Physical Activity in the 2nd phase of questionnaire using sitting time and physical activity questionnaires.

Result: 68% of individuals were at very high risk of sitting more and 64 % of individuals were minimally active. The mean values of sitting time and physical activity are 90.68 and 1504.86 respectively.

Conclusion: More sitting time and less physical activity increases the risk of abdominal obesity in young male individuals who have desk job.

Keywords: Abdominal Obesity, BMI, Waist Hip Ratio, Sitting Time, Physical Activity.

I. INTRODUCTION

Abdominal obesity is also known as Central Obesity and Truncal Obesity. It is a condition where excessive abdominal fat is present around the stomach. Abdomen has built up to the extent that it is likely to have a negative impact on health(64).

Abdominal obesity has been strongly linked to cardiovascular disease, Alzheimer's disease (3,8)and other metabolic and vascular diseases. Visceral and central abdominal fat & waist circumference show a strong association with type 2 diabetes(8)

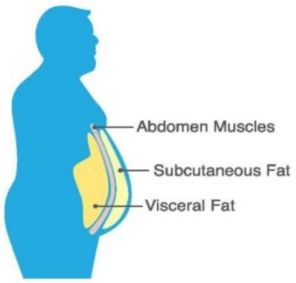


Figure : 1 Abdominal Obesity

Figure : 2 Types of body shape

Visceral fat, also known as organ fat or intra-abdominal fat. It is located inside the peritoneal cavity, packed in between internal organs and torso, as opposed to subcutaneous fat which is found underneath the skin,

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 1 Jan-Feb 2023, pp: 2057-2072 www.ijprajournal.com ISSN: 2249-7781

and intramuscular fat, which is found interspersed in skeletal muscle[64].

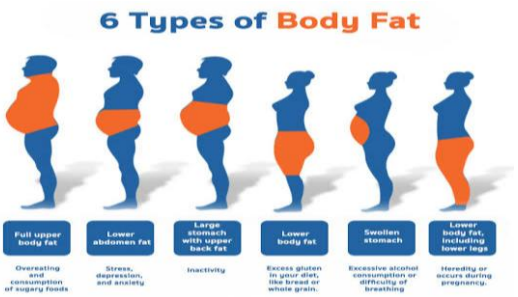


Figure : 3 Types Body Fat

Visceral fat is composed of several adipose depots including mesenteric, epididymal white adipose tissue (EWAT), and perirenal fat. An excess of adipose visceral fat is known as central obesity, the "pot belly" or "beer belly" effect, in which the abdomen protrudes excessively.

This body type is also known as "apple shaped", as opposed to "pear shaped" in which fat is deposited on the hips and buttocks [64]. Obesity represents a rapidly escalating public health issue, taking over many parts of the world that contrary to conventional belief [4].

It is not limited to industrialized countries only but, also majorly affecting the children living in developing countries[4].

PREVALENCE AND INCIDENCE OF ABDOMINAL OBESITY

Abdominal obesity is the most prevalent form of malnutrition. As a chronic disease, prevalent in both developed and developing countries, and affecting children as well as adults, it is now so common that it is replacing the more traditional public health concerns including under nutrition[3,6].

It is extremely difficult to assess the size of the problem and compare the prevalence rates in different countries as no exact figures are available[3,6].

In India, 1.3 % males and 2.5 % females aged more than 20 years were obese in the year 2008[3,6].

The WHO had estimated that in 2016, more than 1.9 billion adults worldwide (39%) were overweight, and over 650 million (13%) were obese. Around 39 million children under the age of 5 were overweight or obese in 2020. Over 340 million children and adolescents aged 5-19 were overweight or obese in 2016[3,6].

In India, more than 135 million individuals are affected by obesity. Prevalence of abdominal obesity varies from 11.8% to 31.3 % and central obesity varies from 16.9% to 36.3% respectively [2].

Prevalence of obesity in India is 40.3 % [10].

According to zonal variations, highest in south as 41.88% and lowest in east [10]. According to gender, women as 41.88 % and men as 38.6%[10]. According to age, under 40 is 34.58% and over 40 is 34.58%[10]. According to physical activity, active is 32.56% and inactive is 43.71%.

According to regions like rural is 36.08% and urban is 44.17%[10].

Overweight prevalence was higher among females than males and in urban areas than in rural areas. Low prevalence was recorded among lower level of education (ill- literate and primary level), and in people whose occupation was connected with agriculture or manual work[10].

From 1998 to 2018, the prevalence of obesity is rapidly spurting due to sedentary lifestyle and consumption of high calorie food[11].

Obesity results into various health problems which are having direct link to cardiovascular diseases. So, that it is time to focus on the problem and take necessary steps to overcome the problem. Compared to U.S. where 66% of adults are categorized in overweight and obese in 2014, it is also expected that Indian data to raise a lot[11].

CAUSES OF ABDOMINAL OBESITY

- Long term excessive calorie intake
- **Stress:-**
  - A steroid hormone known as cortisol helps the body control and deal with stress. When a person is in a dangerous / high pressure situation, their body releases cortisol and this can show impact on their metabolism. People often reach for food for comfort when they feel stressed[24].
  - Cortisol causes those excess calories to remain around the belly and other areas of the body for later use[24].
- **Genetics:-**
  - There is some evidence that a person's genes can play a part in whether they become obese. Scientists think genes can influence behavior, metabolism, and risk of developing obesity related diseases [15].
  - Environmental factors also play a role in the likelihood of people becoming obese[64,15].
- **Poor diet:-**

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 1 Jan-Feb 2023, pp: 2057-2072 www.ijprajournal.com ISSN: 2249-7781

- The American heart association recommends that people replace trans fat with healthy whole grain foods, mono unsaturated fats and poly saturated fats[69].
- Reading food labels can help a person determine whether their food contains trans fat[7].
- Trans fat in particular can cause inflammation and may lead to obesity trans fat are in many foods including fast foods and baked goods like muffins, crackers, etc …..[64].

Poor sleep:-

- A 2013 study, links weight gain to short sleep duration which could lead to an excess of belly fat[4,14].
- Short duration of sleep is linked to an extent which increases the food intake, which may play a part in the development of abdominal fat[4,14].
- Abnormal sleeping pattern can also be potentially lead to unhealthy eating behaviors such as "Emotional eating" [4,14].

Inactivity (lack of exercises):-

- If a person consumes more calories than they burn off, they will put on weight. An inactive lifestyle makes it hard for a person to get rid of excess fat, particularly around abdomen[14].

Smoking:-

- A 2012 study published in the journal showed that although obesity was the same between smokers and nonsmokers but, smokers had more belly and visceral fat than nonsmokers[15].

Too much alcohol:-

- Consuming excess alcohol causes a variety of health problems including liver diseases and inflammation [15].
- A 2015 report, on alcohol consumption and obesity found that excess drinking of alcohol causes males to gain weight around their bellies; through study results in females are inconsistent [15].

PATHOPHYSIOLOGY OF ABDOMINAL OBESITY

Physiology:-

Control of Appetite:-

Energy balance has 3 components

a) Afferent / peripheral system

- Generates afferent signals from various sites.
- Composed of Leptin, Adiponectin produced by Fat cells, Ghrelin from Stomach, Peptide YY (PYY) from Ileum, Colon, and Insulin from Pancreas [61,63].

1. Arcuate nucleus in hypothalamus

- Processes & integrates neurohumoral peripheral signals.
- Generates efferent signals.
- Composed of 2 subsets of first order neurons

- 1. POMC (pro-opiomelanocortin) & CART (cocaine amphetamine-regulated transcripts) neurons signals[2,61].
- 2. Neuron containing Neuropeptide Y & AgRP (agouti-related peptide) These first order neurons communicate with second order neurons in hypothalamus[2,61].

2. Efferent system

- Carries signals from 2nd order neurons of hypothalamus to control food intake and energy expenditure [63].

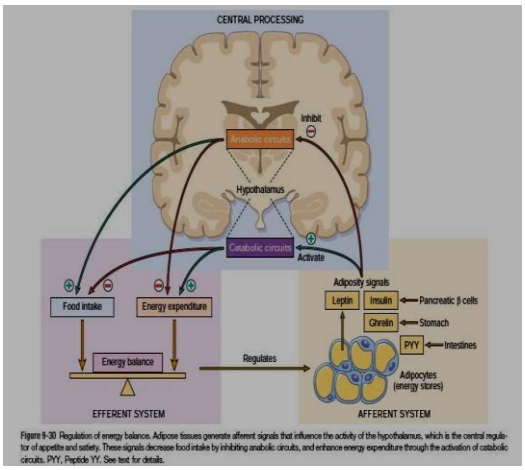


Figure : 4 Energy Balance

- Neurohumoral circuits in Hypothalamus,
- POMC/CART neurons enhance energy expenditure and weight loss through the production of the anorexigenic α-melanocyte-stimulating hormone (MSH), and the activation of the melanocortin receptors 3 and 4 (MC3/4R) in 2nd order neurons[63].

- These 2nd order neurons are in turn responsible for producing factors such as thyroid releasing hormone (TSH) and corticotropin releasing hormone (CRH) that increase the BMR and catabolic metabolism, thus favoring weight loss [63].
- By contrast, the Neuropeptide Y/AgRP neurons promote food intake (orexigenic effect) and weight gain, through the activation of Y1/5 receptors in secondary neurons. These secondary neurons then release factors such as

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 1 Jan-Feb 2023, pp: 2057-2072 www.ijprajournal.com ISSN: 2249-7781

melanin-concentrating hormone (MCH) and orexin, which stimulate appetite[63].

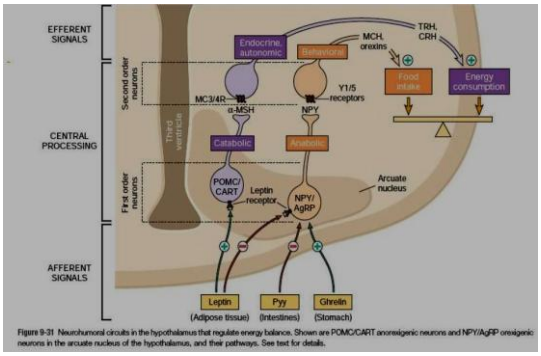


Figure 5 : Neurohumoral Circuits

- Vagal Afferent ie. **Neuronal Signals ,**
- Vagal efferent are stimulated by the nutrient and stretch receptors from stomach after food intake.
- These signals goes to Nucleus tractus solitaries in hind brain and accordingly decreases feeding, causes gastric emptying and increase metabolic rate[63].

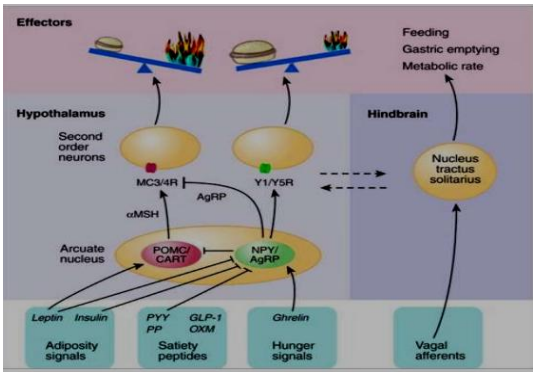


Figure 6 : Vagal Afferens

- **Some Molecules Acting on Long-Term Energy Balance**
  - **Leptin**
    - Leptin is a 167 amino acid hormone secreted by white adipose tissue (i.e., adipokine), which circulates at concentrations proportional to body fat mass. It promotes satiety and energy expenditure by stimulating proopiomelanocortin (POMC) and inhibiting neuropeptideY (NPY) / Agouti-related peptide (AgRP) neurons in the hypothalamus.
    - A deficiency of leptin signaling as a result of mutations of the leptin gene or its cognate receptor causes hyperphagia and severe obesity in both humans and animals ,which clearly demonstratesthat normal body-weight requires intact leptin regulation[1].
  - **Insulin**
    - Insulin is secreted by pancreatic _-cells. Its levels are also positively correlated with body weight and adipose mass, and they provide a negative feedback signal to the central nervous system[10].
    - Dietary carbohydrates, refined sugars in particular, have been suggested to increase insulin secretion. Several studies have suggested that increased insulin secretion contributes to obesity pathogenesis by stimulating the adipocyte uptake of fatty acids and glucose and the caloric storage in form of fat, while concomitantly inhibiting lipolysis[11].

PATHOGENESIS OF COMPLICATIONS

- **Syndrome X or Metabolic syndrome:-**
- Metabolic syndrome (MetS) is defined as the accumulation of risk factors such as abdominal obesity, abnormal glycemia and dyslipidemia, and blood hypertension which increase the risk of type 2 diabetes, cardiovascular diseases, some tumors, and all-cause mortality[9].
- Abdominal obesity (visceral and intra abdominal adipocyte deposition)
- Insulin resistance
- Hyper triglyceridemia
- Low serum HDL
- Increase in risk of CAD
- Seen more in Indians, probably due to low levels of adiponectin[61].

➢ **Hypertension:-**

- Increased Adipose tissue in body
- Increased Leptin
- In Hypothalamus- ↑ MSH, ↓ Agouti Related Peptide, ↓ Neuro Peptide-Y
- Increased SNS activity causes hyper tension [61].

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 1 Jan-Feb 2023, pp: 2057-2072 www.ijprajournal.com ISSN: 2249-7781

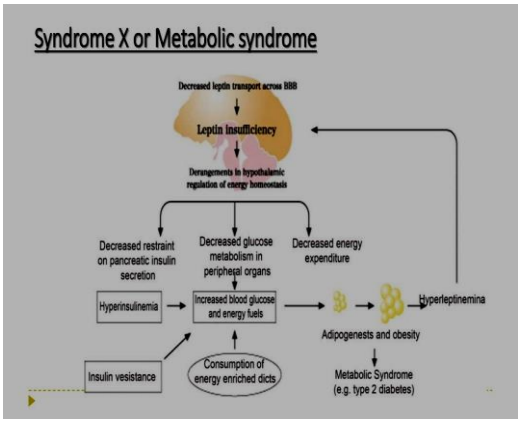


Figure 7 : Syndrome X / Metabollic Syndrome

➢ **Cardiovascular system Obesity:-**

- Obesity is a independent risk factor for CAD, CHF Insulin Resistance
- Waist – Hip ratio Predictor for Cardiovascular system complication best ↑ Insulin
- Abdominal associated obesity with atherogenic lipid
- Excess glucose causes retention of sodium-water leading to Hypertension. profile ↑ FFA ↑ Triglyceride, HDL[61].

SYMPTOMS OF ABDOMINAL OBESITY

- Large body frame
- Difficulty in doing daily activities
- Lethargy
- Breathlessness
- Disproportionate facial features
- Breast region adiposity - (sagging fat cells) in boys
- Big belly (abdomen), sometimes marked with white or purple blemishes
- Male external genitalia may appear disproportionately small
- Flabby fat in the upper arms and thighs
- Knock-knees (Genu valgum) is common[69].

COMPLICATIONS OF OBESITY:-

➢ **Coronary Heart Disease :–**

- Build up of plaque in the arteries supplying oxygen-rich blood to the heart. Decreased blood flow causes pain and heart attacks[67,68].

➢ **Heart failure :–**

- Heart is unable to pump adequate blood for circulation. A Johns Hopkins University study puts severe obesity as an independent or a stand-alone risk factor for acquiring heart failure[67,68].

➢ **Body Fat Abnormality :–**

- Excess of triglycerides and bad cholesterol and lesser amounts of good cholesterol [67,68].

➢ **Metabolic Syndrome** :–

- Having 3 of the following risk factors increases the chances of having a heart disease, diabetes or stroke.
- An abnormal waistline
- Lower than normal good cholesterol
- Higher than normal triglycerides
- Higher than normal blood pressure
- Higher than normal fasting blood sugar[67,68].

➢ **High Blood Pressure :–**

- Pressure inside the arteries serving oxygenated blood is high breathing habits that results[67,68].

➢ **Diabetes Mellitus** :–

- Obese people are 40 times more likely to get Type 2 Diabetes[67].

➢ **Stroke** :–

- Poor blood flow to the brain caused by a blood clot[67].

➢ **Osteoarthritis :–**

- A joint problem of the knees and hips aggravated by obesity[67].

➢ **Sleep Apnea or breathing** pauses while sleeping due to excess fat around the neck[67].

➢ **Cancer** of the colon, breast, endometrial and gall bladder[67].

➢ Menstrual issues and infertility in women[67].

➢ **Obesity hypoventilation syndrome :–**

- Some obese people tend to have poor breathing habits that result in increased carbon dioxide blood levels (hypoventilation) and decreased oxygen blood levels (hypoxemia) [67,68,69].

TREATMENT OF ABDOMINAL OBESITY:-

- **Conservative Management:-**

▪ **Reduce Intake of Calories** – Proposed limits are 1000 - 1200 calories for a woman and 1200 - 1600 calories for a man per day. Eating small frequent meals, and reducing portion sizes are other ways to reduce calories[67].

▪ **Moderate but regular aerobic exercises** such as walking, swimming, gardening and dancing provided it does not exceed their cardiovascular capacity as well as muscle strengthening, bone strengthening and stretching. [67].

▪ **Eating healthy** - A meal that is high in fiber and low in saturated and trans fat,

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 1 Jan-Feb 2023, pp: 2057-2072 www.ijprajournal.com ISSN: 2249-7781

cholesterol, sodium and added sugar especially high fructose corn syrup[67].

- **Medical Management :-**
- **Weight-loss medicines** are used if it is not possible to lose 1 pound per week after 6 months of lifestyle changes.
- **Orlistat (Xenical and Alli)** are FDA approved drugs that reduce the absorption of fats, and vitamins A, D, E, and K to promote weight loss. With Xenical, the weight loss that usually occurs within the first 6 months of taking the drug is around 5 -10 pounds[68].
- Two FDA approved medicines for chronic weight management of adults having a BMI of 30 or greater are :

a) (Belviq) Lorcaserin hydrochloride and Qsymia (combination of **phentermine** and topiramate). They have to be combined with reduced calorie intake and physical activity[14].

b) Sibutramine, fenfluramine, dexfenfluramine, rimonabant and leptin drugs are also used in the treatment of obesity [14].

- **Surgical Management:-**
- **Weight-loss surgeries** may be an option, usually as a last resort, and are only recommended in case of morbid or gross obesity for adults with a BMI of 35/above (Or) for those who have a life-threatening condition [68].

- **Vertical Banded Gastroplasty (VBG)** or **Stomach Stapling** is a restrictive technique that uses a band to create a small pouch on the top of the stomach that limits the amount of food and liquids the stomach can hold [68].
- **Gastric Banding** is also a type of restrictive surgery which involves the use of laparoscopy to place a silicon band in the stomach. This band is adjustable and is capable of squeezing the stomach to hold about one ounce of food [68].
- **Sleeve Gastrectomy** technique is one of the most popular restrictive surgery method which removes more than half of the part of stomach resulting in a vertical sleeve-like portion behind [68].

II. NEED OF THE STUDY

Abdominal obesity is a complex disease involving an excessive amount of body fat around the abdomen region.
The abdominal obesity can be caused by lack of physical activity, sedentary lifestyle, and endocrine diseases & hereditary diseases.
This increases the risk of heart diseases, type 2 diabetes, high blood pressure, and certain cancers.

Apart from all these, only a few literature review studies were majorly done. Some of the studies are

- Abdominal obesity with physical activity
- Obesity and lifestyle modifications
- Abdominal obesity on memory consolidation

But there is a paucity of data on the sitting time levels and physical activity levels on abdominal obesity individuals in our Indian population.
Hence, my need of the study centers in the aspect of sitting time and physical activity levels in abdominal obesity.

III. AIM OF THE STUDY

The aim of the study is to study the influence of sitting time and physical activity effect on abdominal obesity in adults: An Observational study.

IV. HYPOTHESIS OF THE STUDY

HYPOTHESIS:

- Duration of sitting time and physical activity has an influence on abdominal obesity adults.

NULL HYPOTHESIS:

- Duration of sitting time and physical activity doesn't have an influence on abdominal obesity adults.

V. OBJECTIVES OF THE STUDY

- To find out the BMI (kg/m2) to evaluate the obesity levels in adults.
- To find out the WHR (cm)to evaluate the abdominal obesity in adults.
- To evaluate the sitting time (hrs/week) influence on abdominal obesity individuals through the sitting time questionnaire.

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 1 Jan-Feb 2023, pp: 2057-2072 www.ijprajournal.com ISSN: 2249-7781

- To evaluate the physical activity influence on abdominal obesity individuals through IPAQ questionnaire.

VI. METHODOLOGY

a) Study design - An Observational study
- **Study duration** – 6 months
- **Sample size estimation** - 60
- **Sampling** – Convenience sample
- **Sample size** – 50

Sample size estimation formula:

$(Z\text{- score})^2$ x stdDev x (1 – std)/ (Margin of Error $)^2$

Z score (Z) = 1.28; **Standard Deviation (P)** = O.9; **Margin of Error** (e) = 0.05

$= (1.28)^2 \times 0.9 \times (1\text{-}0.9)^2 / (0.05)^2$
$= (1.6384) \times 0.9 \times 0.1 / 0.0025$
$= 0.147456 / 0.0025$
$= 58.9824$
$= 59$
$= \pm 60$

b) Materials:-
- Pen
- Paper
- Laptop

c) Inclusion criteria:-
- Age above 30 years were included.
- Only male individuals were included.
- BMI more than 25 (over weight, obese) were included.
- Waist hip ratio more than 0.96 to 1.0 / higher (moderate, high) are included in this study.

d) Exclusion criteria:
- Individuals who are not willing to participate are excluded from this study.
- Female individuals are excluded.
- Age below 30 years.
- BMI less than 18.8 – 24.9
- Waist hip ratio less than 0.95
- Any musculoskeletal disorders.
- Any neurological disorders.
- Any lung disorders.
- Any cardiac disorders.
- Any vascular disorders.
- Any psychological disorders.

e) Study method:-

Individuals who were willing and met the inclusion criteria were included in the study and an informed consent was obtained. Anthropometric measurements and the subjective data were collected in the 1st part of questionnaire and in the 2nd part, the questionnaire for sitting time and physical activity were included. 50 Subjects filled the form with their informed consent sent through Google form via e – link

f) Outcome measures:
- To find out the anthropometric measurement BMI using **BMI = kg/m2**.
- To find out the anthropometric measurement WHR using **WHR =wc/hc in cm.**
- To evaluate the **sitting time** through the sitting time questionnaire in **Hrs/Week .**
- To evaluate the **physical activity** through IPAQ questionnaire in **Met- Min /Week.**

Body Mass Index (BMI):-
- BMI stands for body mass index. It is a measurement of a person's weight relative to his / her height. It is an indicator not a direct measurement of a person's total body fat.
- It is expressed in : BMI = weight (kg)/ height (m2)

Waist Hip Ratio (WHR):-
- Waist hip ratio is the ratio of the circumference of waist to that of the hips.
- According to the world health organization's data gathering protocol , the waist circumference should be measured at the midpoint between the lower margin of the last palpable rib and the top of the iliac crest , using a stretch resistant tape that provides a constant 100g tension.

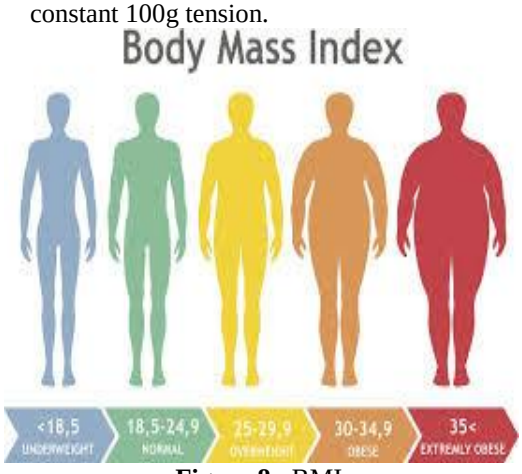


Figure 8 : BMI

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 1 Jan-Feb 2023, pp: 2057-2072 www.ijprajournal.com ISSN: 2249-7781

- Hip circumference should be measured around the widest portion of the buttocks, with the tape parallel to the ground.
- For both measurements, the individuals should stand with feet close together , arms at the side and body weight evenly distributed, and should wear little clothing .
- The subject should be relaxed, and the measurements should be taken at the end of a normal expiration. Each measurement should be repeated twice; if the measurements are within 1 cm of one another, the average should be calculated.
- If the difference between the two measurements exceeds 1 cm, the two measurements should be repeated.
- Greater than 35 inches for women and greater than 40 inches for men are considered.

Figure 9 : Waist And Hip Circumference

IPAQ (International Physical Activity Questionnaire-Short Form):-

- IPAQ is an instrument designed primarily for population surveillance of adults. It has been developed and tested for use in adults (age range of 15-69 years) and until further development and testing is undertaken the use of IPAQ with older and younger age groups is not recommended.

Characteristics of the IPAQ short-form instrument:-

1. IPAQ assesses physical activity undertaken across a comprehensive set of domains including leisure time, domestic and gardening (yard) activities, work-related and transport-related activity;
2. The IPAQ short form asks about three specific types of activity undertaken in the three domains introduced above and sitting. The specific types of activity that are assessed are walking, moderate-intensity activities and vigorous intensity activities; frequency (measured in days per week) and duration (time per day) are collected separately for each specific type of activity.
3. The items were structured to provide separate scores on walking; moderate-intensity; and vigorous-intensity activity as well as a combined total score to describe overall level of activity.
4. Computation of the total score requires summation of the duration (in minutes) and frequency (days) of walking, moderate-intensity and vigorous-intensity activity;31
5. Another measure of volume of activity can be computed by weighting each type of activity by its energy requirements defined in METS.

- A MET-minute is computed by multiplying the MET score by the minutes performed. MET-minute scores are equivalent to kilocalories for a 60 kilogram person. Kilocalories may be computed from MET-minutes using the following equation: MET-min x (weight in kilograms/60 kilograms).
- The selected MET values were derived from work undertaken during the IPAQ Reliability Study undertaken in 2000-2001.
- Using the Ainsworth et al. Compendium (Med Sci Sports Med 2000) an average MET score was derived for each type of activity.
- For example; all types of walking were included and an average MET value for walking was created.
- The same procedure was undertaken for moderate-intensity activities and vigorous-intensity activities.

These following values continue to be used for the analysis of IPAQ data:

- Walking = 3.3 METs
- Moderate PA = 4.0 METs
- Vigorous PA = 8.0 METs

The criteria for these three levels are shown below.

1. Inactive (CATEGORY 1)

- This is the lowest level of physical activity. Those individuals who not meet criteria for Categories 2 or 3 are considered .**insufficiently active'** [CATEGORY 1].

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 1 Jan-Feb 2023, pp: 2057-2072 www.ijprajournal.com ISSN: 2249-7781

2. Minimally Active (CATEGORY 2)

- The minimum pattern of activity to be classified as sufficiently active is any one of the following 3 criteria:

a) 3 or more days of vigorous activity of at least 20 minutes per day

OR

b) 5 or more days of moderate-intensity activity or walking of at least 30 minutes per day

OR

c) 5 or more days of any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum of at least 600 MET-min/week.

- Individuals meeting at least one of the above criteria would be defined as achieving the minimum recommended to be considered ` **minimally active '** [CATEGORY 2].
- This category is more than the minimum level of activity recommended for adults in current public health recommendations, but is not enough for total PA when all domains are considered.
- IPAQ measures total physical activity whereas the recommendations are based on activity (usually leisure-time or recreational) over and above usual daily activities.

3. HEPA active (CATEGORY 3)

- A separate category labeled **HEPA level**, which is a more active category [CATEGORY 3] can be computed for people who exceed the minimum public health physical activity recommendations, and are accumulating enough activity for a healthy lifestyle.
- This is a useful indicator because it is known that higher levels of participation can provide greater health benefits, although there is no consensus on the exact amount of activity for maximal benefit. Also, in considering lifestyle physical activity, this is a total volume of being active which reflects a healthy lifestyle. It is at least 1.5 to 2 hours of being active. Throughout the day, this is more than the LTPA-based recommendations of 30 minutes. In the absence of any established criteria, the IPAQ scientific group proposes this new cut point, which equates to approximately at least 1.5 -2 hours of total activity per day, of at least moderate – intensity activity.
- It is desirable to have a .HEPA. activity category, because in some populations, a large proportion of the population may be classified as .minimally active. because the IPAQ instrument assess all domains of activity. Category 3 sets a higher threshold of activity and provides a useful mechanism to distinguish variation in sub-population groups.

The two criteria for classification as HEPA active are:

a) Vigorous-intensity activity on at least 3 days achieving a minimum of at least 1500 MET-minutes/week

OR

b) 7 or more days of any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum of at least 3000 MET-minutes/week

Data collected with IPAQ can be reported as a continuous measure and reported as median MET minutes.

Median values can be computed for walking (W), moderate-intensity activities (M), and vigorous-intensity activities (V) using the following formulas:

MET values and Formula for computation of Met-minutes

- Walking MET-minutes/week = 3.3 * walking minutes * walking .days.
- Moderate MET-minutes/week = 4.0 * moderate-intensity activity minutes * moderate days
- Vigorous MET-minutes/week = 8.0 * vigorous-intensity activity minutes * vigorous-intensity days

- A combined total physical activity MET-min/week can be computed as the sum of Walking + Moderate + Vigorous MET-min/week scores.
- The MET values used in the above formula were derived from the IPAQ validity and reliability study undertaken in 2000-2001.
- As there are no established thresholds for presenting MET-minutes, the IPAQ Research Committee proposes that these data are reported as comparisons of median values and inter quartile ranges for different populations.

Continuous Score

Expressed as MET-min per week: MET level x minutes of activity x events per week

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 1 Jan-Feb 2023, pp: 2057-2072 www.ijprajournal.com ISSN: 2249-7781

MET levels MET-min/week for 30 min episodes, 5 times/week

- Walking = 3.3 METs > 3.3x30x5 = 495 MET-min/week
- Moderate Intensity = 4.0 METs > 4.0x30x5 = 600 MET-min/week
- Vigorous Intensity = 8.0 METs > 8.0x30x5 = 1,200 MET-min/week

TOTAL = 2,295 MET-min/week
Total MET-min/week = (Walk METs*min*days) + (Mod METs*min*days) + Vig METs*min*days)

g) Statistical Analysis :-

- Statistical analysis has been carried out to analyze the significant impact of waist hip ratio, sitting time and physical activity using SPSS (version 29.0) for windows. Microsoft excel was used to generate graphs and tables.
- All the 50 subjects filled the questionnaire sent through e – link via google form.
- Descriptive statistics was performed to find out the mean, standard deviation for demographic variables and outcome variables.
- The outcomes variables of the study are Body Mass Index (BMI), Waist hip ratio(WHR), Sitting time questionnaire(STQ) for sitting time , and International Physical Activity Questionnaire (IPAQ) for physical activity.
- One-Sample Kolmogorov-Smirnov Test was used to find out association between the variables such as sitting time questionnaire for sitting time and International physical activity questionnaire – short form for physical activity in males with abdominal obesity.
- Pearson Correlations between the waist hip ratio and sitting time ; between the waist hip ratio and physical activity & between the sitting time and physical activity are measured .
- Microsoft excel was used to generate graphs and tables. A p. value of < 0.005 is considered to be a statistical significance.

VII. RESULT

TABLE 1: Demographic Data- Descriptive Statistics

Demographic Data	Mean	Standard Deviation
BMI (Kg/M2)	27.9540	± 3.27389
Waist Hip Ratio(Cm)	1.0034	± 0.06871

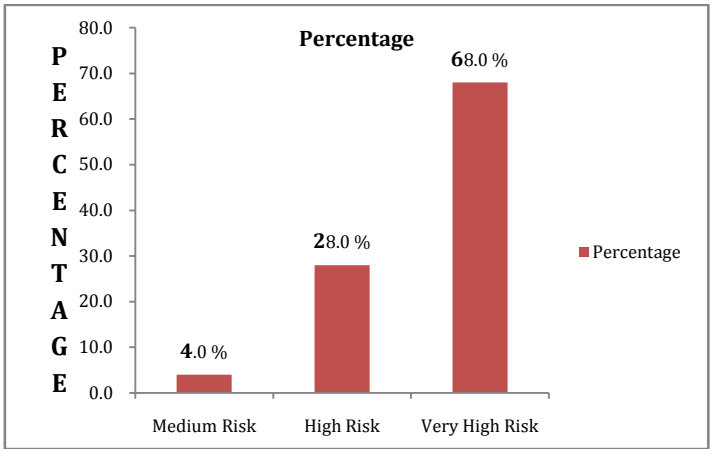
According to the **table 1**, the **mean value** of BMI is 27.9540 kg/m2, and Waist Hip Ratio is 1.0034 respectively. The standard deviation of BMI is ± 3.27389 and Waist Hip Ratio is ± 0.06871 respectively.

TABLE 2 : Risk Of Sitting Time Per Week among the abdominal obesity individuals

Sitting Time Per Week (Hrs)	Percentage
Medium Risk	4.0%
High Risk	28.0%
Very High Risk	68.0%

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 1 Jan-Feb 2023, pp: 2057-2072 www.ijprajournal.com ISSN: 2249-7781

Graph 1: Percentage of Risk of Sitting Time per Week



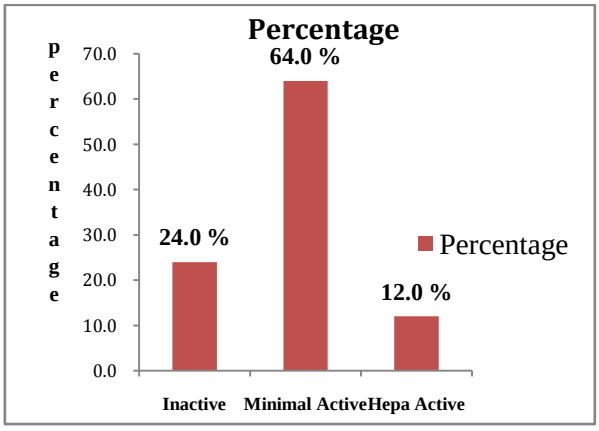
Based on the total study population of 50, the **table 2** describes the risk of sitting time. It shows that individuals with medium risk are 4.0%, high risk is 28.0%, and very high risk is 68.0% respectively. The most of the responses are having very high risk when they are sitting.

The mean value of the percentage of risk of sitting time per week (hrs) is 33.34 and standard deviation is ± 32.331 respectively. The mean value of the sitting time per week (hrs) is 90.68 and standard deviation is ± 26.527 respectively.

TABLE 3 : Percentage of Physical Activity levels

Physical activity per week (met-min /week)	**Percentage**
Inactive	24.0%
Minimal active	64.0%
HEPA active	12.0%

Graph 2: Percentage of Physical Activity levels



International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 1 Jan-Feb 2023, pp: 2057-2072 www.ijprajournal.com ISSN: 2249-7781

Based on the total study population of 50, the **table 3** describes the physical activity per week. It shows that individuals with inactive are 24.0%, minimal active is 64.0%, and HEPA active is 12.0% respectively.

The mean value of the percentage of physical activity is 36.45 and standard deviation is ± 27.227 respectively. The mean value of physical activity is 1504.86 and standard deviation is ± 1157.309 respectively.

TABLE - 4: One Sample Kolmogorov – Smirnov Test

One-Sample Kolmogorov-Smirnov Test				
Parameters	**Mean**	**Std. Deviation**	**Z**	**P**
Age In Years	41.50	± 10.566	1.208	0.108
BMI (Kg/M2)	27.9540	± 3.27389	1.571	0.014
Waist / Hip Ratio	1.0034	± 0.06871	2.261	0.000
Sitting Time Per Week (Hrs)	90.68	± 26.527	0.886	0.412
Physical Activity Per Week (Met-Min/Week)	1504.86	± 1157.309	0.876	0.427

"One Sample Kolmogorov – Smirnov Test " is a non parametric test of null hypothesis and describes the equality of continuous one dimensional probability distribution that can be used to compare a sample with 2 variables.

According to the above table (5),

- The results of the test for **demographic data** considering **age, BMI, WHR** were in the expected direction. The significant difference of age is Z = 1.208, p<0.005; BMI is Z = 1.571,p<0.005 and WHR is Z = 2.201,p<0.005.
- The **sitting time per week in hours** is calculated with mean value of 90.68 and a Z score of Z = 0.886, p<0.005.
- The **physical activity per week (met – min /week)** is calculated with a mean value of 1504.86 and a Z score of Z = 0.876, p<0.005.

Table 6: Correlation between Sitting Time and Waist Hip Ratio Influencing the Abdominal Obesity:

Sitting time per week (hrs/week)	**Waist Hip Ratio**	
	Moderate	**High**
Medium risk	1	1
High risk	7	7
Very high risk	19	15

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 1 Jan-Feb 2023, pp: 2057-2072 www.ijprajournal.com ISSN: 2249-7781

According to table 6, sitting time in relation to waist hip ratio is calculated.
The sitting time per week in moderate WHR and medium risk are 1, high WHR and high risk individuals are 7,& in very high risk in relation to WHR with moderate and high are 19 and 15 respectively.

Table 7: Correlation between Physical Activity and Waist Hip Ratio Influencing the Abdominal Obesity:

Physical activity per week (met – min/ week)	**Waist Hip Ratio**	
	Moderate	**High**
Inactive	7	5
Minimally active	17	15
HEPA active	3	23

According to table 7, physical activity in relation to waist hip ratio is calculated.
The Physical activity per week (met – min/ week) in moderate WHR and inactive are 7, high WHR and inactive are 7 , minimally active & moderate WHR and high risk individuals are 17 and 15, & in heap active in relation with moderate and high WHR are 19 and 15 respectively.

TABLE 8 : Correlation between Sitting Time and Physical Activity Influencing the Abdominal Obesity:

Parameters	**Pearson's Correlation**
Sitting Time Per Week (Hrs)	1
Physical Activity Per Week (Met-Min/Week)	0.166

Pearsons Correlation	**Sitting Time Per Week (Hrs)**	**Physical Activity Per Week (Met-Min/Week)**
Sitting Time Per Week (Hrs)	1	0.166
Physical Activity Per Week (Met-Min/Week)	0.166	1

The '**Pearson correlation'** measures the strength of the linear relationship between 2 variables. It has a value of between -1 to +1, with a value of -1 meaning a total negative linear correlation, 0 being no correlation and +1 meaning a total positive correlation.

According to table 8,

- The **Pearson correlation** for sitting time is +1 and physical activity is 0.166 . This shows a positive correlation between the sitting time and physical activity influence in abdominal obesity

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 1 Jan-Feb 2023, pp: 2057-2072 www.ijprajournal.com ISSN: 2249-7781

VIII. DISCUSSION

Abdominal obesity has become a big concern for the youth and young generation as well as adults of today's generation[7]. The abdominal obesity can be a genetical problem / disorder that caused due to unhealthy lifestyle habits of a person / endocrine disorder [14,16].

Physical activity and the environment in which an individual's life are also the factors that may lead to abdominal obesity [20]. Medications like steroids can also lead to physical inactivity which decreases the metabolism and may lead to abdominal obesity [23].

Obesity is heterogeneous as some obese patients are insulin sensitive where as others are insulin resistant [16]. The measuring index of abdominal obesity such as waist circumference is clinically relevant as it allows the identification of abdominal obese patients who are more likely to insulin resistant [7].

It has been repeatedly associated with insulin resistance, and several seminal review papers have been published on this topic [41, 42, 44].

Recently, the Insulin Resistance Atherosclerosis Study showed that waist circumference was a strong predictor of reduced peripheral insulin action in non diabetic lean individuals [43]. Wang et al. [45] also confirmed that waist circumference was a better predictor of type 2 diabetes than WHR or BMI.

Energy balance is the result of equilibrium between energy intake and energy expenditure. When energy intake exceeds expenditure, the excess energy is deposited as body tissue [46]. During adulthood, the maintenance of stable body weight depends on the energy derived from food and drink (energy intake) being equal to total energy expenditure over time. To lose body weight, energy expenditure must exceed intake, and to gain weight, energy intake must exceed expenditure [47] .

Very small deviations from energy balance, on the order of 1–2% of daily energy intake, can result in large long-term changes in body weight (~20 kg)[48] .

Energy intake, in particular, besides sometimes is a considerable measurement error in its assessment, can be subject to selective biases, such as the tendency of overweight and obese people to underestimate their intake [48].

Our main aim of the study was to "Study the influence of sitting time duration and physical activity levels in abdominal obesity adults: an observational study ".

The results of the conducted analyses show a positive association between ST and PA influencing the effect of abdominal obesity. However, there were a positive correlation between the relationships between ST and PA considering the WHR.

According to Paul A et.al ; it has been confirmed that sitting time was associated with a greater risk of abdominal obesity in women [31] and was positively correlated with waist circumference in men [32, 33].

Dr. Joe Henson[34] argues that the more the people spent the time on sitting during the day the more visceral fat and the total abdominal fat they had around their visceral organs which may lead to abdominal obesity. Results of the study reveals that sitting time and WHR individuals were very high risk (68%) for abdominal obesity supporting the literature.

According to the recent studies, researchers reported that not achieving the desired level of physical activity recommendations is responsible for 5.3 million deaths annually worldwide.

Chun xiao xu et.al; stated that heavy occupational activity (cycling to/ from work) and leisure time physical activity significantly lowers the risk of abdominal obesity in male employees[35].

According to Eka prasetya budi mulia et.al; has confirmed that physical activity was associated with a lower risk of abdominal obesity [36] and Camoes et.al [37] ;also stated that increased physical activity is associated with a decrease in the incidence of abdominal obesity.
Results of the study reveals that physical activity and WHR individuals were minimally active (64%) for abdominal obesity supporting the literature.

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 1 Jan-Feb 2023, pp: 2057-2072 www.ijprajournal.com ISSN: 2249-7781

The main finding of this observational study was that becoming inactive and being persistently inactive from the period of adulthood to adults was independently associated with overall abdominal obesity at the age of starting from 30 years in relation with the sitting time.

The outcome of the study doesn't completely provide the information of the study, for that we need closer supervision on the individuals.

Limitations of the study, was the relatively short duration of time. The study was conducted on less number of people i.e., small sample size and the eating pattern of the individual is lacking.

Furthermore, there is a possibility that the questionnaire might be filled randomly without understanding the exact question pattern and duration of time involving.

IX. CONCLUSION

According to the present results of the study, concluded that the sitting time and physical activity can influence the effect of abdominal obesity in young males.

This study also concluded that more sitting time and less physical activity / inactivity can lead to abdominal obesity in young male individuals.

The study supports the alternate hypothesis that sitting time, physical activity and waist hip ratio influences the abdominal obesity in young male individuals.

X. REFERENCES

1) Michael K. Badman And Jeffrey S. Flier Conducted A Study On The Gut And Energy Balance: Visceral Allies In The Obesity Wars And Published In 2005
2) Rajeev Ahirwar, Prakash Ranjan Mondal " Conducted A Study On The Prevalence Of Hypertension In Indian Populations In Last And Published In 2020.
3) Murali Venkatrao, Raghuram Nagarathna, Vijaya Majumdar, Suchitra S. Patil, Sunanda Rathi1 And Hongasandra Nagendra Conducted A Study On "Prevalence Of Obesity In India And Its Neurological Implications: A Multifactoranalysis Of A Nationwide Cross-Sectional Study" And Published In 2020.
4) Redinger Rn.The Pathophysiology Of Obesity And Its Clinical Manifestations. Gastroenterology And Hepatology. And Published In 2007
5) David W. Dunstan A, Paul Z. Zimmet A, Timothy A. Welborn B,Adrian J. Cameron A, Jonathan Shaw A, Maximilian De Courten A Et.Al ; Ausdiab Steering Committee Conducted A Study On " The Australian Diabetes, Obesity And Lifestyle Study(Ausdiab)—Methods And Response Rates" And Published In 2002. **(Sitting Time Quesionnaire)**
6) Adrian J Cameron, Timothy A Welborn, Paul Z Zimmet Et Al Conducted A Study On "Overweight And Obesity In Australia: The 1999–2000 Australian Diabetes, Obesity And Lifestyle Study (Ausdiab)", In The 5 May 2003 Issue Of The Journal). **(Sitting Time Quesionnaire)**
7) Rajeev Ahirwar, Prakash Ranjan Mondal Conducted A Study On Prevalence Of Obesity In India: A Systematic Review And Published In 2018
8) George Razay , Anthea Vreugdenhil , Gordon Wilcock Conducted A Study On Abdominal Obesity And Alzheimer Disease And Published In 2006.
9) Edyta Suliga , Elżbieta Cieśla , Dorota Rębak ,Dorota Kozieł , Stanisław Głuszek Conducted A Study On Relationship Between Sitting Time, Physical Activity, And Metabolic Syndrome Among Adults Depending On Body Mass Index (Bmi) And Published In 2018.
10) Emanuel Fryk , Josefin Olausson , Karin Mossberg , Lena Strindberg , Martin Schmelz , Helén Brogren Et.Al ; Conducted A Study On Hyperinsulinemia And Insulin Resistance In The Obese May Develop As Part Of A Homeostatic Response To Elevated Free Fatty Acids: A Mechanistic Case-Control And A Population-Based Cohort Study And Published In 2021.
11) 51
12) Michael W. Schwartz, Randy J. Seeley, Lori M. Zeltser, Adam Drewnowski, Eric Ravussin, Leanne M. Redman, Et.Al ; Conducted A Study On Obesity Pathogenesis: An Endocrine Society Scientific Statement And Published In 2017.

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 1 Jan-Feb 2023, pp: 2057-2072 www.ijprajournal.com ISSN: 2249-7781

13) Erind Gjermeni , Anna S. Kirstein , Florentien Kolbig , Michael Kirchhof , Linnaeus Bundalian, Julius L. Katzmann , Et.Al ; Conducted A Study On Obesity– An Update On The Basic Pathophysiology And Review Of Recent Therapeutic Advances And Published In 2021.
14) Dr. David Dunston Conducted A Study On Risk For Sitting Disease And Summarized A Calculator Which Was Published In 2012. Http://Sittingtime.Juststand.Org
15) Dr. Trupti Shirole,_ Dr. Simi Paknikar Written A Blog On Weight Loss Drugs (Diet Pills) And Was Reviewed By The Med India Medical Review Team And Published In 2019 .
16) Alba Gómez-Cabelloa,B, Raquel Pedrero-Chamizoc, Pedro R. Olivaresd, Rayco Hernández-Pererae, José A. Rodríguez-Marroyof, Esmeralda Matag, Et.Al ; Conducted A Study On Sitting Time Increases The Overweight And Obesity Risk Independently Of Walking Time In Elderly People From Spain And Published In 2012.
17) Colin Wilborn, Jacqueline Beckham, Bill Campbell, Travis Harvey, Melyn Galbreath, Paul La Bounty Et.Al Conducted A Study On Obesity: Prevalence, Theories, Medical Consequences, Management, And Research Directions And Published In 2005.
18) S. O'neill And L. O'driscoll Conduted A Study On Metabolic Syndrome: A Closer Look At The Growing Epidemic And Its Associated Pathologies And Published In 2014.
19) Brittany T. Macewen, Travis J. Saunders, Dany J.Macdonald, And Jamie F. Burr Conducted A Study On Sit-Stand Desks To Reduce Workplace Sitting Time
20) In Office Workers With Abdominal Obesity: A Randomized Controlled Trial And Published In 2017.
21) Wael Maktouf, Sylvain Durand, Bruno Beaune, And Sébastien Boyas Conducted A Study On Influence Of Obesity And Impact Of A Physical Activity Program On Postural Control And Functional And Physical Capacities In Institutionalized Older Adults: A Pilot Study And Published In 2020.
22) T Tammelin1, J Laitinen1 And S Na¨Yha¨ Conducted A Study On Change In The Level Of Physical Activity From Adolescence Into Adulthood And Obesity At The Age Of 31 Years Published In 2004.
23) John M. Jakicic, Renee J. Rogers, Kelliann K. Davis, And Katherine A. Collins Conducted Astudy On Role Of Physical Activity And Exercise In Treating Patients With Overweight And Obesity And Published In 2018.
24) William T. B. Eddolls, Melitta A. Mcnarry, Leanne Lester, Charles O. N. Winn, Gareth Stratton, Kelly A. Mackintosh Conducted A Study On The Association Between Physical Activity, Fitness And Body Mass Index
25) On Mental Well-Being And Quality Of Life In Adolescents And Published In 2018.
26) André Tchernof And Jean-Pierre Després Conducted A Study On Pathophysiology Of Human Visceral Obesity: An Update In 2013.
27) Björntorp P. "Portal" Adipose Tissue As A Generator Of Risk Factors For Cardiovascular Disease And Diabetes. *Arteriosclerosis* 10: 493–496, 1990.
28) Després Jp. Abdominal Obesity As Important Component Of Insulin-Resistance Syndrome. *Nutrition* 9: 452–459, 1993.
29) Karter Aj, D'agostino Rb Jr, Mayer-Davis Ej, Wagenknecht Le, Hanley Aj, Hamman Rf, Bergman R, Saad Mf, Haffner Sm. Abdominal Obesity Predicts Declining Insulin Sensitivity In Non-Obese Normoglycaemics: The Insulin Resistance Atherosclerosis Study (Iras). *Diabetes Obes Metab* 7: 230–238, 2005.
30) Kissebah Ah, Krakower Gr. Regional Adiposity And Morbidity. *Physiol Rev* 74: 761–811, 1994
31) Wang Y, Rimm Eb, Stampfer Mj, Willett Wc, Hu Fb. Comparison Of Abdominal Adiposity And Overall Obesity In Predicting Risk Of Type 2 Diabetes Among Men. *Am J Clin Nutr* 81: 555–563, 2005.
32) Anderson As, Key Tj, Norat T, Scoccianti C, Cecchini M, Berrino F Et Al. European Code Against Cancer 4th Edition: Obesity,

Body Fatness And Cancer. Cancer Epidemiol. 2015.
33) Scientific Advisory Committee On Nutrition (2011) Dietary Reference Values For Energy. The Stationery Office, London
34) Hall Kd, Sacks G, Chandramohan D, Chow Cc, Wang Yc, Gortmaker Sl Et Al (2011) Quantification Of The Effect Of Energy Imbalance On Bodyweight. Lancet 378(9793):826–837.
35) Dorota Rebak, Dorota Koziel ,Stanislaw Conducted A Study On Relationship Between Sitting Time, Physical Activity, And Metabolic Syndrome Among Adults Depending On Body Mass Index (Bmi) In 2018.
36) Yoon Myung Kim And Sojung Lee Conducted A Literature Review On Physical Activity And Abdominal Obesity In Youth In 2009.
37) Bronwyn K Clark And Other Authors Conducted A Study On Validity Of A Multi-Context Sitting Questionnaire Across Demographically Diverse Population Groups: Ausdiab3 In 2015 .
38) Brittany T.Macewen,Travis J.Saunders,Dany J.Macdonald And Jamie F.Burr Conducted A Study On Sit-Stand Desks To Reduce Workplace Sitting Time In Office Workers With Abdominal Obesity: A Randomized Controlled Trial In 2017 .
39) Jing Xiao, Chong Shen, Hui Cai Conducted A Study On Physical Activity And Sedentary Behavior Associated With Components Of Metabolic Syndrome Among People In Rural China In 2016
40) Heng Kiang Soon And Other Authors Conducted A Study On Effects Of Combined Physical Activity And Dietary Intervention On Obesity And Metabolic Parameters In Adults With Abdominal Obesity In 2013
41) Norafidah Ar And Other Authors Conducted A Study On Factors Influencing Abdominal Obesity By Waist Circumference Among Normal Bmi Population In 2013.
42) Katherine Samaras, Mbbs, Fracp; And Other Authors Conducted A Study On Genetic And Environmental Influences On Total-Body And Central Abdominal Fat: The Effect Of Physical Activity In Female Twins In 1999.
43) Maria Teresa Anselmo Olinto And Other Authors Conducted A Study On Epidemiology Of Abdominal Obesity In 2017.
44) Erind Gjermeni , Anna S. Kirstein , Florentien Kolbig , Michael Kirchhof , Linnaeus Bundalian, Julius L. Katzmann And Et.Al Conducted A Study On Obesity–An Update On The Basic Pathophysiology And Review Of Recent Therapeutic Advances In 2021.
45) Rajeev Ahirwar, Prakash Ranjan Mondal " Conducted A Study On The Prevalence Of Hypertension In Indian Populations In Last Decade In 2020 .
46) Emanuel Fryk , Josefin Olausson , Karin Mossberg , Lena Strindberg , Martin Schmelz , Helén Brogren , And Et.Al Conducted A Study On Hyperinsulinemia And Insulin Resistance In The Obese May Develop As Part Of A Homeostatic Response To Elevated Free Fatty Acids: A Mechanistic Case-Control And A Population-Based Cohort Study In 2021.
47) Murali Venkatrao , Raghuram Nagarathna , Vijaya Majumdar , Suchitra S. Patil, Sunanda Rathi1 And Hongasandra Nagendra Conducted A Study On Prevalence Of Obesity In India And Its Neurological Implications: A Multifactoranalysis Of A Nationwide Cross-Sectional Study In 2020.
48) Tong Li Joon, Naganathan Pillai, Christina Gertrude Yap, Nowrozy Kamar Jahan Conducted A Study On Obesity And Female Infertility—A Review On Mechanisms (Endocrinology) In 2022 .
49) Michael W. Schwartz, Randy J. Seeley, Lori M. Zeltser, Adam Drewnowski, Eric Ravussin, Leanne M. Redman, And Rudolph L. Leibel Conducted A Study On Obesity Pathogenesis: An Endocrine Society Scientific Statement In 2017 .
50) Isabelle Romieu, Laure Dossus, Simón Barquera, Hervé M. Blottière,Paul W. Franks, Marc Gunter Et.Al ; Conducted A Study On Energy Balance And Obesity: What Are The Main Drivers?In 2017 .
51) John M. Jakicic, Renee J. Rogers, Kelliann K. Davis, And Katherine A.

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 1 Jan-Feb 2023, pp: 2057-2072 www.ijprajournal.com ISSN: 2249-7781

Collins Conducted A Study On Role Of Physical Activity And Exercise In Treating Patients With Overweight And Obesity In 2017 .
52) William T. B. Eddolls, Melitta A. Mcnarry , Leanne Lester2 · Charles O. N. Winn, Gareth Stratton, Kelly A. Mackintosh Conducted A Study On The Association Between Physical Activity, Fitness And Body Mass Index On Mental Well-Being And Quality Of Life In Adolescents In 2018.
53) S. O'neill And L. O'driscoll Conducted A Study On Etiology And Pathophysiology/Obesity Comorbiditiesmetabolic Syndrome: A Closer Look At The Growing Epidemic And Its Associated Pathologies In 2014 .
54) Colin Wilborn, Jacqueline Beckham, Bill Campbell, Travis Harvey, Melyn Galbreath, Paul La Bounty, Erika Nassar, Jennifer Wismann , And Richard Kreider. Conducted A Study On Obesity: Prevalence, Theories, Medical Consequences, Management, And Research Directions In 2005
55) Jean-Pierre Despre´S Conducted A Study On Abdominal Obesity: The Most Prevalent Cause Of The Metabolic Syndrome And Related Cardiometabolic Risk In 2006
56) R.Rakesh, Prathibha K.Muthu,Prem Kumar Sundararajan,Naresh K.Gutta Conducted A Study On Influence Of Abdominal Obesity(Waist-Hip-Ratio) On Memory Consolidation In Adolescent Medical Undergraduates – A Cross Sectional Study In 2021.
57) Mary Forhan, Phd, Ot Reg(Ont), Simone V. Gill, Phd, Otr/L Conducted A Study On Obesity, Functional Mobility And Quality Of Life In 2013.
58) Alba Gómez-Cabello, Raquel Pedrero-Chamizo, Pedro R. Olivares, Rayco Hernández-Perera, José A. Rodríguez-Marroyo And Et.Al On Behalf Of The Exernet Study Group Conducted A Study On Sitting Time Increases The Overweight And Obesity Risk Independently Of Walking Time In Elderly People From Spain In 2012
59) Breno Quintella Farah, Aluı´Sio Andrade-Lima, Antoˆnio Henrique Germano-Soares, Diego Giulliano Destro Christofaro , Mauro Virgı´Lio Gomes De Barros, Wagner Luiz Do Prado, Raphael M. Ritti-Dias Conducted A Study On Physical Activity And Heart Rate Variability In Adolescents With Abdominal Obesity In 2017 .
60) Zargar Ah, Masoodi Sr, Laway Ba, Khan Ak, Wani Ai, Bashir Mi, *Et Al*. Prevalence Of Obesity In Adults: An Epidemiological Study From Kashmir Valley Of Indian Subcontinent. *J Assoc Physicians India* 2000; *48* : 1170-4.
61) Deepa M, Farooq S, Deepa R, Manjula D, Mohan V. Prevalence And Significance Of Generalized And Central Body Obesity In An Urban Asian Indian Population In Chennai, India (Cures: *Eur J Clin Nutr* 2009; *63* : 259-67.
62) Harrison .Harrison's Principles Of Internal Medicine.19ed, And Published In 2015.
63) World Health Organization(Who) Factsheet On Obesity And Overweight: World Health Organization Fact Sheet, And Published In 2020.
64) Https://Www.Who.Int/News-Room/Fact-Sheets/Detail/Obesity-Andoverweight (Accessed April 12, 2021).
65) K. Park. Park's Text Book Of Prevention And Social Medicine.23ed, And Published In 2010.
66) Https://En.Wikipedia.Org/Wiki/Abdominal_Obesity
67) Https://Www.Hse.Ie/Eng/About/Who/Cspd/Ncps/Copd/Pulmonary Rehabilitation/International-Physical-Activity-Questionnaire-Ipaq.Pdf **Ipaq (Original Questionnaire)**
68) Medindia.Net – Obesity; What Are The Symptoms Of Obesity Published In 2020.
69) Suchitra Chari Written A Blog On Obesity And Was Reviewed By The Med India Medical Review Team And Published In 2020.
70) Vertical Banded Gastroplasty Surgery – And Published In 2020.
71) Https://Medlineplus.Gov/Obesity.Html About Obesity – Published 2020
72) Dietary Treatment Of Obesity –And Published In 2018.

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 1 Jan-Feb 2023, pp: 2057-2072 www.ijprajournal.com ISSN: 2249-7781

XI. ABBREVATIONS

ABBREVIATIONS	PARTICULARS
EWAT	Epididymal White Adipose Tissue
PYY	Peptide YY
POMC	Pro – Opio Melanocortin
CART	Cocaine Amphetamine Regulated Transcripts
Ag RP	Agouti Related Peptide
MSH	Melanocyte Stimulating Hormone
TSH	Thyroid Releasing Hormone
CRH	Corticotrophin Releasing Hormone
MCH	Melanin Concentrating Hormone
HDL	High Density Lipoprotein
CAD	Coronary Artery Disease
CHF	Congestive Heart Failure
FFA	Free Fatty Acids
VBG	Vertical Banded Gastroplasty
Ht	Height
Wt	Weight
BMI	Body Mass Index
WC	Waist Circumference
HC	Hip Circumference
WHR	Waist Hip Ratio
STQ	Sitting Time Questionnaire
IPAQ	International Physical Activity Questionnaire
MET	Metabolic Equivalents
W	Walking
M	Moderate
V	Vigourous
AO	Abdominal Obesity

XII. APPENDIX

SUBJECT PROFORMA

Google Form Sent Questionnaire:-

Section 1 – Title of the study

To Study The Influence Of Sitting Time Duration And Physical Activity Levels On Abdominal Obesity In Adults : An Observational Study

Section 2 - Demographic Data

Name -
Age -
Gender -
Occupation -
Marital status -
Weight (in kg) -
Height (in cm) -

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 1 Jan-Feb 2023, pp: 2057-2072 www.ijprajournal.com ISSN: 2249-7781

Waist circumference (in cm)	-
Hip circumference (in cm)	-
Email id	-
Address	-
Phone number	-

Section 3 – Sitting Time

1. Sitting for work in a week day (Monday to Friday) (in hours)
    a) 4 hours per day
    b) 4 to 8 hours per day
    c) 8 to 11 hours per day
    d) More than 11 hours per day
    e) Don't know
2. Sitting for work in a **weekend day** (Saturday and Sunday) (in hours)
    a) 4 hours per day
    b) 4 to 8 hours per day
    c) 8 to 11 hours per day
    d) More than 11 hours per day
    e) Don't know
3. Sitting for transport in a week day (Monday to Friday) (in hours)
    a) 2 hours per day
    b) 1 hour per day
    c) 45 minutes per day
    d) 20 to 30 minutes per day
    e) 10 to 15 minutes per day

4. Sitting for transport in a **weekend day** (Saturday and Sunday) (in hours)
    a) 2 hours per day
    b) 1 hour per day
    c) 45 minutes per day
    d) 20 to 30 minutes per day
    e) 10 to 15 minutes per day
5. TV viewing in a week day (Monday to Friday) (in hours)
    a) 5 hours per day
    b) 3 hours per day
    c) 2 hours per day
    d) 45 minutes per day
    e) 30 minutes per day
6. TV viewing in a **weekend day** (Saturday and Sunday) (in hours)
    a) 5 hours per day
    b) 3 hours per day
    c) 2 hours per day
    d) 45 minutes per day
    e) 30 minutes per day
7. Computer, internet, electronic games in a week day (Monday to Friday) (in hours)
    a) 5 hours per day
    b) 3 hours per day
    c) 2 hours per day
    d) 1 hour per day
    e) 30 minutes per day
8. Computer, internet, electronic games in a **weekend day** (Saturday and Sunday) (in hours)

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 1 Jan-Feb 2023, pp: 2057-2072 www.ijprajournal.com ISSN: 2249-7781

a) 7 hours per day
b) 5 hours per day
c) 3 hours per day
d) 1 hour per day
e) 30 minutes per day

9. Sitting for other purposes a week day (Monday to Friday) (in hours)
    a) 2 hours per day
    b) 1 hour per day
    c) 45 minutes per day
    d) 30 minutes per day
    e) 15 minutes per day
10. Sitting for other purposes in a **weekend day** (Saturday and Sunday) (in hours)
    a) 2 hours per day
    b) 1 hour per day
    c) 45 minutes per day
    d) 30 minutes per day
    e) 15 minutes per day

Section 4 – Physical Activity

1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?
    a) 7 days per week
    b) 5 days per week
    c) 3 days per week
    d) 1 day in a week
    e) No vigorous physical activities
2. How much time did you usually spend doing **vigorous** physical activities on one of those days?
    a) 40 minutes per day
    b) 30 minutes per day
    c) 20 minutes per day
    d) 10 minutes per day
    e) Don't know/Not sure
3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis ? Do not include walking.
    a) 7 days per week
    b) 5 days per week
    c) 3 days per week
    d) 1 day in a week
    e) No moderate physical activities
4. How much time did you usually spend doing **moderate** physical activities on one of those days ?
    a) 40 minutes per day
    b) 30 minutes per day
    c) 20 minutes per day
    d) 10 minutes per day
    e) Don't know/Not sure
5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time ?
    a) 7 days per week
    b) 5 days per week
    c) 3 days per week
    d) 1 day in a week
    e) No walking
6. How much time did you usually spend **walking** on one of those days ?
    a) 40 minutes per day
    b) 30 minutes per day

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 1 Jan-Feb 2023, pp: 2057-2072 www.ijprajournal.com ISSN: 2249-7781

c) 20 minutes per day
d) 10 minutes per day
e) Don't know/Not sure

7. During the **last 7 days**, how much time did you spend **sitting** on a **week day**?
   a) 5 hours per day
   b) 3 hours per day
   c) 1 hour per day
   d) 45 minutes per day
   e) Don't know/Not sure