

**ANALYSING RELATION BETWEEN HEIGHT AND WEIGHT
OF VARIABLES BY USING
KARL PEARSONS METHOD**

Submitted in partial fulfillment of the requirements for the award of
Bachelor of Science degree in Mathematics (B.Sc.Mathematics)

By

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**DEPARTMENT OF MATHEMATICES
SCHOOL OF SCIENCE AND TECHNOLOGY**

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited with Grade "A" by NAAC

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APRIL – 2021



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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **K.Vickram(38060015)** who carried out the project entitled "**Analyzing Relation between Height and Weight of Variables by Using Karl Pearson's Method**" under our supervision from AUGUST 2020 to APRIL 2021.

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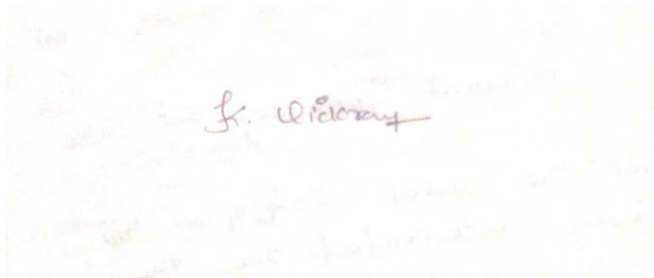
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DECLARATION

K.Vickram(38060015) hereby declare that the Project Report entitled **“Analyzing Relation between Height and Weight of Variables by Using Karl Pearson’s Method”** is done by me under the guidance of **Dr. R.Rajakumar** (Internal) and _____ (External) at Sathyabama Institute Of Science And Technology is submitted in partial fulfillment of the requirements for the award of Bachelor of science degree in mathematics'



DATE:29.3.2021

SIGNATURE OF THE CANDIDATE

PLACE: Chennai

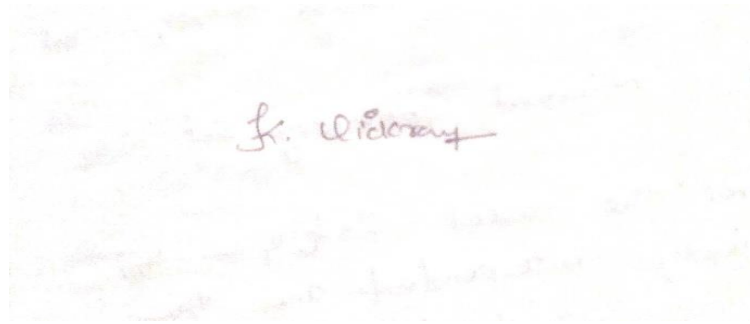
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ANALYSING RELATION BETWEEN HEIGHT AND WEIGHT OF VARIABLES BY USING KARL PEARSONS METHOD

ABSTRACT

Although our country is moving towards the path of development on one hand in things like evolution, civilization, economy, on the other hand, new diseases are developing. The most deadly disease is obesity. The main reason for its formation is bad habits. In my research I selected adults in my village, compared them in terms of body weight and height. I examined them to see if they had the right weight at the right height according to BMI rule and chose the person whose weight is the most and the one whose height is the least. I consulted with them about the consequence of being so. Also choosing the right weight for those with the right height. I compared their height and weight and found the relationship between the two. I found out the idea between the two, by using the Karl Pearson coefficient of correlation rule. This will make everyone aware of the diseases that can lead to obesity and its consequences.

The main purpose of my project is to explain to everyone what physical health is.,

(i)

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CHAPTER-1

INTRODUCTION

1.1. CORRELATION ANALYSIS:

Correlation is a statistical measure that expresses the extent to which two variables are linearly related (meaning they change together at a constant rate). It's a common tool for describing simple relationships without making a statement about cause and effect.

1.1.1. CORRELATION IN STATISTICS:

This section shows how to calculate and interpret correlation coefficient for ordinal and interval level scales. Method of correlation summarizes the relationship between two variables in a single number called the correlation coefficient. The correlation coefficient is usually represented by the symbol r , and it ranges from -1 to +1.

A correlation coefficient quite close to 0, but either positive or negative, implies little or no relationship between the two variables. A correlation coefficient close to plus 1 means a positive relationship between the two

variables , with increasing in one of the variables being associated with increasing in the other variables ..

A correlation coefficient close -1 indicates a Negative relationship between two variables , with an increase in one of the variables being associated with a decrease in the other variable .A correlation coefficient can be produced for ordinal, interval or ratio level variable , but has little meaning for variables which are measured on a scale which is no more than nominal.

For ordinal scales, the correlation coefficient can be calculated by using Spearman's rho. For interval or ratio level scales, the most commonly used correlation coefficient is Pearson's r , ordinarily referred to as simply the correlation coefficient.

1.1.2. CORRELATION COEFFICIENT:

A correlation coefficient is generally applied in statistics to calculate a relationship between two variables. The correlation shows a specific value of a degree of a linear relationship between X and Y variables. There are various types of correlation coefficient. However, Pearson's correlation (also called Pearson's R) is the correlation coefficient frequently used in linear regression

1.1.3. SCATTER DIAGRAM:

It is a visual & statistical testing quality tool that is used to find out the relationships between two variables

1.1.4. TYPES OF CORRELATION:

- ❖ *Positive Correlation*
- ❖ *Negative Correlation*
- ❖ *No Correlation (or) zero correlation*

1.1.4.1. POSITIVE CORRELATION:

If the weight of an individual increases in proportion to increase in his height, the relation between this increase of height and weight is called as **Positive correlation**. Ranges from 0 to + 1. If it is 0 then there is no relation at all. When it is + 1, then there is perfect Positive correlation.

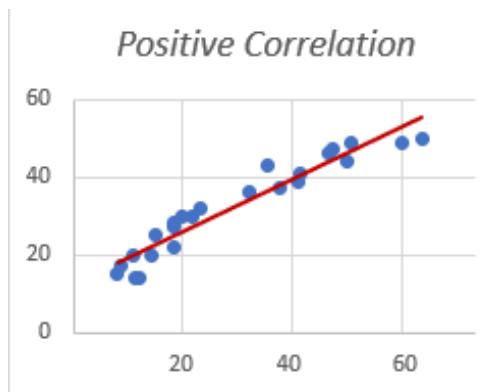


Fig 1.1 positive correlation

1.1.4.2. Negative Correlation:

It is just the opposite of Positive correlation. If the weight of an individual does not increase in proportion to increase in his height or if the weight of an individual decreases with an increase in height, then it is said to be **Negative**

correlation, also Ranges from 0 to -1. -1 is perfect Negative correlation.

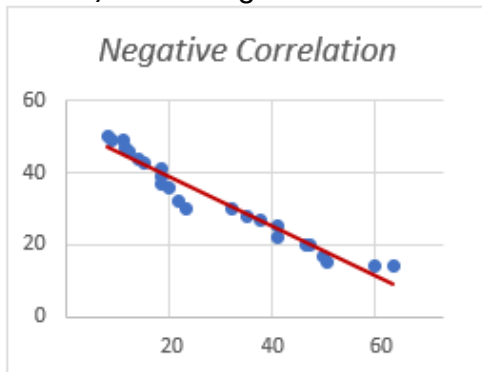


Fig 1.2*negative correlation*

1.1.4.3. Zero Correlation (or) No Correlation:

Zero correlation is a correlation showing no relationship, or a correlation having a correlation coefficient of **zero**.

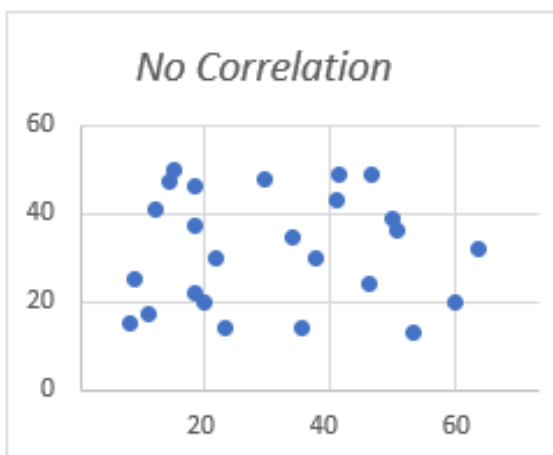


Fig1.3*zero correlation*

1.1.5. CORRELATION AND REGRESSION:

Table: 1.1.Difference *between correlation and regression*

Parameter of Comparison	Correlation	Regression
Meaning	It determines the co-relationship, which is the association between two variables. Largely depends on statistics-based procedures.	Justifies the arithmetic relation between the two, an autonomous value and a dependent one.
Objective	Meaning	In Regression, the values of a fixed variable help us pinpoint and approximate the values of the random variable.

Parameter of Comparison	Correlation	Regression
Usage	The linear association between two variables is shown.	Mostly based on an estimation based on one variable to predict the value of the other variable.
Independent Variable & Dependent variable	Both dependent as well as independent variables are similar to each other.	Independent and dependent variables are not the same.
Indication	It is the measure of the degree to which the two variables change simultaneously.	Regression signifies how the switch in the value of a variable (x) is determined by the variable (y).

1.1.6. Main Difference between Correlation and Regression:

- Only a single piece of data or statistics is considered in Correlation. However, Regression provides a complete mathematical equation.
- Correlation pinpoints the degree to which two variables are associated with each other. On the other hand, Regression reflects the impression of a unit change in the independent variable due to the changes in the dependent variable.
- Correlation can give a crisp value describing the relationship between the two variables. Regression is beneficial as it thoroughly examines and further predicts values for a variable using mathematical equations.

- In Correlation, the variables 'x' and 'y' are arbitrary. They can weight, blood pressure, or cholesterol level. As opposed to Regression that assumes 'x' as a fixed variable with no error, such as temperature setting

1.1.7. IMPORTANCE OF COTRRELATION:

- ❖ Correlation is very important in the field of Psychology and Education as a measure of relationship between test scores and other measures of performance. With the help of correlation, it is possible to have a correct idea of the working capacity of a person. With the help of it, it is also possible to have knowledge of the various qualities of an individual.
- ❖ After finding the correlation between the two qualities or different qualities of an individual, it is also possible to provide his vocational guidance. In order to provide educational guidance to a student in selection of his subjects of study, correlation is also helpful and necessary.

1.1.8.METHODS OF CORRELATION:

1.1.8.1. *Graphical Methods:*

- Scatter diagram or Scattergram.
- Simple graph or Graphical Method

1.1.8.2. *Mathematical Methods:*

- Concurrent Deviations Method.
- **Karl Pearson's Coefficient of Correlation Method or Karl Pearson's method.**
- Spearman's Coefficient Correlation Method or Rank Difference Method.

1.2. Karl Pearson's Coefficient Of Correlation:

1.2.1. KARL PEARSON:(1857-1936)

Pearson was born in Islington, London into a Quaker family.



His father was William Pearson QC of the Inner Temple, and his mother Fanny (née Smith), and he had two siblings, Arthur and Amy. Pearson attended University College School, followed by King's College, Cambridge in 1876 to study mathematics, graduating in 1879 as Third Wrangler in the Mathematical Trios. He then travelled to Germany to study physics at the University of Heidelberg under G H Quincke and metaphysics under Kuno Fischer. Karl Pearson FRS FRSE was an English mathematician and biostatistician. He has been credited with establishing the discipline of mathematical statistics. He founded the world's first university statistics department at University College, London in 1911, and contributed significantly to the field of biometrics and meteorology. Pearson was also a proponent of social Darwinism and eugenics. Pearson was a protégé and biographer of Sir Francis Galton. He edited and completed both William Kingdom Clifford's

1.2.2. KARL PEARSON METHOD:

Is widely used mathematical method wherein the numerical expression is used to calculate the degree and direction of the relationship between linear related variables .

Pearson's method, popularly known as a **Pearson's Coefficient of Correlation**, is the most extensively used quantitative methods in practice. The coefficient of correlation is denoted by "**r**".

If the relationship between two variables X and Y is to be ascertained, then the following formula is used

$$r = \frac{\sum(X-\bar{X})(Y-\bar{Y})}{\sqrt{\sum(X-\bar{X})^2} \sqrt{\sum(Y-\bar{Y})^2}}$$

Where, $\bar{X}$ = mean of X variable

$\bar{Y}$ = mean of Y variable

1.2.3. PROPERTIES OF COEFFICIENT OF CORRELATION:

- The value of the coefficient of correlation (r) always **lies between ± 1** .
Such as:
r=+1, perfect positive correlation
r=-1, perfect negative correlation
r=0, no correlation
- The coefficient of correlation is independent of the **origin and scale**. By origin, it means subtracting any non-zero constant from the given value of X and Y the value of “r” remains unchanged. By scale it means, there is no effect on the value of “r” if the value of X and Y is divided or multiplied by any constant.
- The coefficient of correlation is a **geometric mean of two regression coefficient**. Symbolically it is represented as:

$$r = \sqrt{b_{xy} + b_{yx}}$$

- The coefficient of correlation is “**zero**” when the variables X and Y are independent. But, however, the converse is not true.

- Alternative Formula (covariance formula)

$$\text{Cov}(X,Y) = \frac{\sum (X - \bar{X})(Y - \bar{Y})}{N} = \frac{\sum xy}{N}$$

1.2.4. ASSUMPTION OF KARL PEARSON'S COEFFICIENT OF CORRELATION:

The assumptions and requirements for calculating Pearson's correlation coefficient are as follows:

1. The data set which is to be correlated should approximate to the normal distribution. If the data is normally distributed, then the data points tend to lie closer to the mean

2. When the data follows a linear relationship, it is said to be linearity. If the data points are in the form of a straight line on the scatter plot, then the data satisfies the condition of linearity.

3. The variables which can take any value in an interval are continuous variables. The data set must contain continuous variables to compute the Pearson correlation coefficient. If one of the data sets is ordinal, then Spearman's rank correlation is an appropriate measure.

4. The data points must be in pairs which are termed as paired observations. There exists a dependent variable for every observation of the independent variable.

5. The relationship between the variables is "**Linear**", which means when the two variables are plotted; a straight line is formed by the points plotted.

6. There are a large number of independent causes that affect the variables under study so as to form a **Normal Distribution**. Such as, variables like price, demand, supply, etc. are affected by such factors that the normal distribution is formed.

7. The variables are independent of each other.

Note: The coefficient of correlation measures not only the magnitude of correlation but also tells the direction. Such as, $r = -0.67$, which shows correlation is negative because the sign is “-“ and the magnitude is **0.67**.

1.3. BODY MASS INDEX(BMI):



BMI Means Body Mass Index and is used to calculate a healthy range from underweight to overweight people. BMI is often used by Doctors, Nutritionists, and fitness professionals to determine the best diet and exercises an individual

- ❖ It is calculated from your height and weight. BMI is an estimate of body fat and a good gauge of your risk for diseases that can occur with more body fat. The higher your BMI, the higher your risk for certain diseases such as heart disease, high blood pressure, type 2 diabetes, gallstones, breathing problems, and certain cancers.
- ❖ It may overestimate body fat in athletes and others who have a muscular build. It may underestimate body fat in older persons and others who have lost muscle. The body mass index (BMI) is a statistic developed by Adolphe Quetelet in the 1900's for evaluating body mass. It is not related to gender and age. It uses the same formula for men as for women and children. The body

mass index is calculated based on the following formula:

Bodyweight in kilograms divided by height in meters squared

BMI = x KG / (y M * y M) x=bodyweight in KG
y=height in

CHAPTER-2

2. LITERATURE SURVEY

1. Relationship between Height-Weight Difference Index and Body-Fat Percentage Estimated by Bioelectrical Impedance Analysis in Thai Adults:

Cited by: 1 Publish Year: 2017

Author: Kanokkarn Junta ping,
Kaweesak Chittawa

Abstract

The height-weight difference index (HWDI) is a new indicator for evaluating obesity status. While body-fat percentage (BF%) is considered to be the most accurate obesity evaluation tool, it is a more expensive method and more difficult to measure than the others. *Objective.* Our objectives were to find the relationship between HWDI and BF% and to find a BF% prediction model from HWDI in relation to age and gender. *Method.* Bioelectrical impedance analysis was used to measure BF% in 2,771 healthy adult Thais. HWDI was calculated as the difference between height and weight. Pearson's correlation coefficient was used to assess the relationship between HWDI and BF%. Multiple linear and nonlinear regression analysis were used to construct the BF% prediction model. *Results.* HWDI and BF% were found to be inverse which related to a tendency toward a linear relationship. Results of a multivariate linear regression analysis, which included HWDI and age as variables in the model, predicted BF% to be $34.508 - 0.159 (\text{HWDI}) + 0.161 (\text{age})$ for men and $53.35 - 0.265 (\text{HWDI}) + 0.132 (\text{age})$ for women. *Conclusions.* The prediction model provides an easy-to-use obesity evaluation tool that should help awareness of underweight and obesity condition.

2. Relationship between Height-Weight Difference Index and Body-Fat Percentage Estimated by Bioelectrical Impedance Analysis in Thai Adults:

- Cited by: **59**
- Publish Year: **2016**

- Author: **Matthew Sperrin, Alan David Marshall, Vanessa Higgins, Andrew Renehan, Iain E. Buchan**
- Published: **17/10/2016**

Abstract:

Obesity is a common problem in many countries and has increasingly become a global epidemic resulting in lower quality of life all over the world. In 2014, the World Health Organization (WHO) reported that about 13%, or one in 10, of the world population aged over 18 (11% men and 15% women) suffered from obesity [1]. This problem is responsible for an increase in the mortality rate from chronic disease (44% from diabetes, 23% from heart disease, and 7% from cancer) [2, 3]. In the Asian community, Thailand ranks second highest behind Malaysia for the number of obese people. The main concern is the apparent increase in the number of children with obesity. A survey in the year 2010 reported 1 in 10 children aged between 1 and 14 in Thailand suffered from obesity [4]

3. Body mass index relates weight to height differently in women and older adults: serial cross-sectional surveys in England (1992–2011)

Matthew Sperrin, Alan D. Marshall,

Vanessa Higgins,

Andrew G. Renehan,

Iain E. Buchan

Abstract:

By height quartile, mean BMI decreased with increasing height, more so in women than in men ($P < 0.001$). The decrease in mean BMI in the tallest compared with the shortest height quartile was 0.77 in men (95% CI 0.69, 0.86) and 1.98 in women (95% CI 1.89, 2.08). Regression analysis of log (weight) on log (height) revealed that the inverse association between BMI and height was more pronounced in older adults and stronger in women than in men, with little change over calendar time. Unlike early childhood, where taller children tend to have higher BMI, adults, especially women and older people, show an inverse BMI–height association. BMI is a heterogeneous measure of weight-for-height; height may be an important and complex determinant of BMI trajectory over the life course

4.THE RELATIONSHIP BETWEEN HEIGHT, WEIGHT AND FEET-LENGTH OF THE HUMAN BODY:

Sir Adamjee
Institute, Karachi,
Pakistan

Abstract:

This research contains the data regarding the heights, weights and feet-lengths of the people of different age groups. This research provides the knowledge about the dependence of dependent factors i.e., weight and feet-length over the independent factor i.e., height of a person. The sample used in this research belonged to different areas of Karachi. The respondents are then divided into 2 groups, i.e., above and below 20 years of age, from both males and females. This research also provides the average height, weight and feet-length of the people at different ages. From this research, we can also calculate the Height, Weight and Feet-length of ancient people (provided that 2 of such factors / variables are given). The basic statistical analysis of survey respondents provides that among weight and feet-length, feet-length has stronger relationship with height as compared to weight, and the coefficient of feet-length is statistically significant.

5. Relationship between perceived body weight and body mass index based on self- reported height and weight among university students: a cross-sectional study in seven European countries

- [Rafael T Mikolajczyk,](#)
- [Annette E Maxwell,](#)
- [Walid El Ansari,](#)
- [Christiane Stock,](#)
- [Janina Petkeviciene &](#)
- [Francisco Guillen-Grima](#)

- **Abstract:**

Despite low rates of obesity, many university students perceive themselves as overweight, especially women. This is of concern, because inappropriate weight perceptions can lead to unhealthy behaviours including eating disorders. Although the majority of students reported a normal BMI (72-84% of males, 65-83% of females), only 32% to 68% of students considered their weight "just right". Around 20% of females with BMI of 20 kg/m² considered themselves "a little too fat" or "too fat", and the percentages increased to 60% for a BMI of 22.5 kg/m². Male students rarely felt "a little too fat" or "too fat" below BMI of 22.5 kg/m², but most felt too thin with a BMI of 20 kg/m²

Conclusions

Weight ideals are rather uniform across the European countries, with female students being more likely to perceive themselves as "too fat" at a normal BMI, while male students being more likely to perceive themselves as "too thin". Programs to prevent unhealthy behaviors to achieve ill-advised weight ideals may benefit students.

6.RELATIONSHIPBETWEEN HEIGHT.WEIGHT AND 1RM TOSHOT PUT PERFORMANCE IN YOUNG MALE ADULTS OFHILLY AREA:

- Dr. Amandeep Singh ¹ | Vikesh Kumar ²
- ¹ Assistant Professor Department of Physical Education, Guru Nanak Dev University, Amritsar, Punjab, India.
- Lecturer, Department of Youth Services and Sports, Jammu and Kashmir, India

Abstract:

The purpose of the study was to find out the relationship between height, weight, and 1 RM to the shot put performance among school boys. To achieve the purpose often study forty male subjects were selected from Govt. higher secondary school, Rabat, Jammu and Kashmir, the age group ranged between 17 to 21 years. All the subjects were physically active. The above selected variables were tested through height (studio-meter), weight (weighing machine), and 1RM (bench press) respectively. Each subject was given three trials and the best performance was considered in the final score. The collected data was statistically analyzed with Pearson Product Moment correlation. The result of the study showed that there was a moderate positive correlation between weight and shot put performance, whereas a strong positive correlation was found between weight and shot put performance and 1RM and shot put performance. To test the hypothesis, the level of significance was set at 0.05

7. Population differences in the relationship between height, weight, and adiposity: An application of Burton's model:

Daniel Hruschka,

Elaine C. Rush,

Alexandra Slade

•CLAS-SS: Global Health, Center for

CLAS-SS: Human Evolution and Social Change, School of (SHESC)

Abstract:

The study of human variation in adiposity and lean mass is important for understanding core processes in human evolution, and is increasingly a public health concern as the "obesity epidemic" expands globally. The dominant measure of population differences in adiposity is Body Mass Index (BMI), which suffers from systematic biases across populations due to variation in the relationship between true body fat, height and weight. Here we develop simplified corrections for such anthropometric-based measures of adiposity that can take into account this population variation. These corrections derive from a recent model proposed by Burton that assumes humans accrue mass in two ways - growth in height that adds bone and muscle, and growth in body fat and the ancillary fat-free mass (FFM) needed to support this additional body fat. We analyze two ethnically diverse datasets with dual X-ray absorptiometry-measured (DXA) fat mass, assessing the fit of Burton's model and deriving novel corrections based on estimated musculoskeletal slenderness. The resulting model provides excellent fit to fat mass within populations (average $R^2 = 0.92$ for women and $R^2 = 0.83$ for men). World populations differ dramatically in musculoskeletal slenderness (up to a difference of 4.4 kg/m^2), as do men and women (differences of $3.3\text{-}4.5 \text{ kg/m}^2$), leading to clear population corrections. These findings point to a conceptually straightforward tool for estimating true differences in adiposity across populations, and suggest an alternative to BMI that provides a more accurate and theoretically based estimate of body fat than that traditionally derived from height and weight measures

CHAPTER-3

3. AIM AND SCOPE OF THE PRESENTATION:

My survey selected adults age group in my hometown and found their weight and height .They are classified according to HEIGHT and WEIGHT according to BMI .They were selected to overweight and underweight studies and counseling was conducted to raise awareness. Also according to Karl Pearson, people of the right weight and height are selected and the relationship between them is found and quantity discovered.

CHAPTER-4

4. MATERIAL AND METHODS:

4.1. RESEARCH OBJECTIVE:

Recent studies have reported that globally, more than 1.9 billion adults are overweight and 650 million are obese. Approximately 2.8 million deaths are reported as a result of being overweight or obese. Due to the consumption of energy dense food (i.e. unhealthy food habits), sedentary life style, lack of health care services and financial support, the developing countries are facing high risk of obesity and their adverse consequences (i.e.

diabetes, ischemic heart disease, etc). In India, more than 135 million individuals were affected by obesity.

The prevalence of obesity in India varies due to age, gender, geographical environment, socio-economic status, etc. According to ICMR-INDIAB 31.3% and 16.9%-36.3% respectively. In India, abdominal obesity is one of the major risk factors for cardiovascular disease (CVDs). Various studies have shown that the prevalence of obesity among women were significantly higher as compared to men.

Obesity is one of the main medical and financial burdens for the government. This problem of obesity can be preventable by spreading public awareness about obesity and its health consequences. Governmental agencies should promote the benefits of healthy life style, food habits and physical activity. The aim of this article is to report the prevalence of obesity in different regions of India and highlight the problem areas

4.2. METHODOLOGY:

4.2.1. OBESITY IN INDIA:

Obesity in India has reached epidemic proportions in the 21st century, with morbid obesity affecting 5% of the country's population.^[1] India is following a trend of other developing countries that are steadily becoming more obese. Unhealthy, processed food has become much more accessible following India's continued integration in global food markets. This, combined with rising middle class incomes, is increasing the average caloric intake per individual among middle class and high income households.^[2] Obesity is a major risk factor for

cardiovascular disease, and NGOs such as the Indian Heart Association have been raising awareness about this issue.^[3]

While studying 22 different SNPs near to MC₄-R gene, scientists have identified a SNP (single nucleotide polymorphism) named rs12970134 to be mostly associated with waist circumference. In this study more than two thousand individuals of Indian origin participated and the aforementioned SNP is highly prevalent in this group.^[4]

Internationally, a BMI over 25 kg/m² is considered overweight. Due to genetic tendency of Indians towards abdominal obesity and its associated risk of related lifestyle diseases such as diabetes and heart disease, guidelines for diagnosis of obesity and abdominal obesity for India have been published in JAPI (2009) that a BMI over 23 kg/m² is considered overweight.^[5] Further definitions: Normal BMI: 18.0-22.9 kg/m², Overweight: 23.0-24.9 kg/m², Obesity: >25 kg/m².^[5]

4.2.2. NFHS Data:

This is a list of the states of India ranked in order of percentage of people who are **overweight or obese**, based on data from the 2007 National Family Health Survey.^[6]

Table 4.1NFHSS DATA

States	Males (%)	Males rank	Females (%)	Females rank
--------	-----------	------------	-------------	--------------

States	Males (%)	Males rank	Females (%)	Females rank
India	12.1	14	16	15
Delhi	45.5	-	49.8	-
Punjab	30.3	1	37.5	1
Kerala	24.3	2	34	2
Goa	20.8	3	27	3
Tamil Nadu	19.8	4	24.4	4

4.2.3. WAIST CIRCUMFERENCE:

Measuring waist circumference helps screen for possible health risks that come with overweight and obesity. If most of your fat is around your waist rather than at your hips, you're at a higher risk for heart disease and type 2 diabetes. This risk goes up with a waist size that is greater than 35 inches for women or greater than 40 inches for men. To correctly measure your waist, stand and place a tape measure around your middle, just above your hipbones. Measure your waist just after you breathe out.

The table **Risks of Obesity-Associated Diseases by BMI and Waist Circumference** provides you with an idea of whether your BMI combined with your waist circumference increases your risk for developing obesity-associated diseases or conditions.

4.2.4.RISK FACTORS FOR HEALTH TOPICS ASSOCIATED WITH OBESITY:

Along with being overweight or obese, the following conditions will put you at greater risk for heart disease and other conditions:

Risk Factors

- High blood pressure (hypertension)
- High LDL cholesterol ("bad" cholesterol)
- Low HDL cholesterol ("good" cholesterol)
- High triglycerides
- High blood glucose (sugar)
- Family history of premature heart disease
- Physical inactivity
- Cigarette smoking

4.3.KNOWLEDGE OF DIRECTION OF CORRELATION:

Pearson's co-efficient of correlation gives the knowledge about the direction of relationship whether it is positive or negative.

4.3.1. SIZE OF CORRELATION:

This method also indicates the size of relationship between the variables i.e. correlation ranges between +1 and -1

4.3.2. PROPERTIES OF THE PEARSON'S CORRELATION COEFFICIENT:

⇒ r is unit-less. Thus, we may use it to compare association between totally different bivariate distributions as well. For eg – you may compare how much of you not going for a movie is related to your friends not joining you, and to you not being much interested for the movie yourself, both at the same time, with the Pearson's correlation coefficients obtained from both the cases. In economics therefore, where the cost price or the market shares depend on lots of different factors, this parameter is of utmost importance in ascertaining the connection between various quantities.

⇒ The value of r always lies between +1 and -1. Depending on its exact value, we see the following degrees of association between the variables-

fig: 4.2. STRENGTH OF ASSOCIATION

r value variation:

STRENGTH OF ASSOCIATION	NEGATIVE r	POSITIVE r
Weak	-0.1 to -0.3	0.1 to 0.3

average	-0.3 to -0.5	0.3 to 0.5
Strong	-0.5 to -1.0	0.5 to 1.0

A value greater than 0 indicates a positive association i.e. as the value of one variable

increases, so does the value of the other variable. A value less than 0 indicates a negative association i.e. as the value of one variable increases, the value of the other variable decreases.

⇒ The Pearson product-moment correlation does not take into consideration whether a variable has been classified as a dependent or independent variable. It treats all variables equally.

⇒ A change of origin of the system, or any scaling of the variables doesn't affect the value of r . The sign might change depending on the sign of scaling done.

Basically, if the bivariate system (x, y) is converted to another bivariate system (u, v) by a change of origin or scaling or both, in the following way –

$$u = \frac{x - a}{b}, v = \frac{y - c}{d} \quad u = bx - a, v = dy - c$$

Then the correlation coefficient takes on the following value –

$$r_{(u,v)} = \frac{bd}{|b||d|} \quad \backslash \quad r_{(x,y)} \quad r(u,v) = \frac{bd}{|b||d|} r(x,y)$$

4.3.3. ASSUMPTIONS:

While calculating the Pearson's Correlation Coefficient, we make the following assumptions –

- There is a linear relationship (or any linear component of the relationship) between the two variables
- We keep Outliers either to a minimum or remove them entirely

An outlier is a data point that does not fit the general trend of your data but would appear to be an extreme value and not what you would expect compared to the rest of your data points. you can detect outliers by plotting the two variables against each other on a graph and visually inspecting the graph for extreme points.

You can then either remove or manipulate that particular point as long as you can justify why you did so. Outliers can have a very large effect on the line of best fit and the Pearson correlation coefficient, which can lead to very different conclusions regarding your data. Both of the above points for a given pair of variables can be analyzed easily by studying their scatter plots.

4.4. PEARSON CORRELATION COEFFICIENT FORMULA:

The linear correlation coefficient defines the degree of relation between two variables and is denoted by “ r ”. It is also called as Cross correlation coefficient as it predicts the relation between two quantities. Now let us proceed to a statistical way of calculating the correlation coefficient.

If x & y are the two variables of discussion, then the correlation coefficient can be calculated using the formula

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{[n \sum x^2 - (\sum x)^2][n \sum y^2 - (\sum y)^2]}$$

Here,

n = Number of values or elements

$\sum x$ = Sum of 1st values list

$\sum y$ = Sum of 2nd values list

$\sum xy$ = Sum of the product of 1st and 2nd values

CHAPTER-5

5. RESULT AND DISCUSSION:

5.1. CASE STUDY - BMI and r:

From our village, I received the data of **HEIGHT** and **WEIGHT** of 70 People. Using Karl Pearson method. I calculated the Karl Pearson correlation coefficient resulting in BMI, Used to categorize people as obese, underweight and so on.,

Table: 5.1.HEIGHT AND WEIGHT OF PEOPLE

	WEIGHT (kg)	HEIGHT (CM)	BMI
1	76	180	23.5
2	69	150	30.7
3	50	155	20.8
4	98	145	46.6
5	79	180	20.0
6	100	172	33.8
7	69	160	27.0
8	85	175	27.8
9	95	150	42.2
10	110	155	45.8
11	79	140	40.3

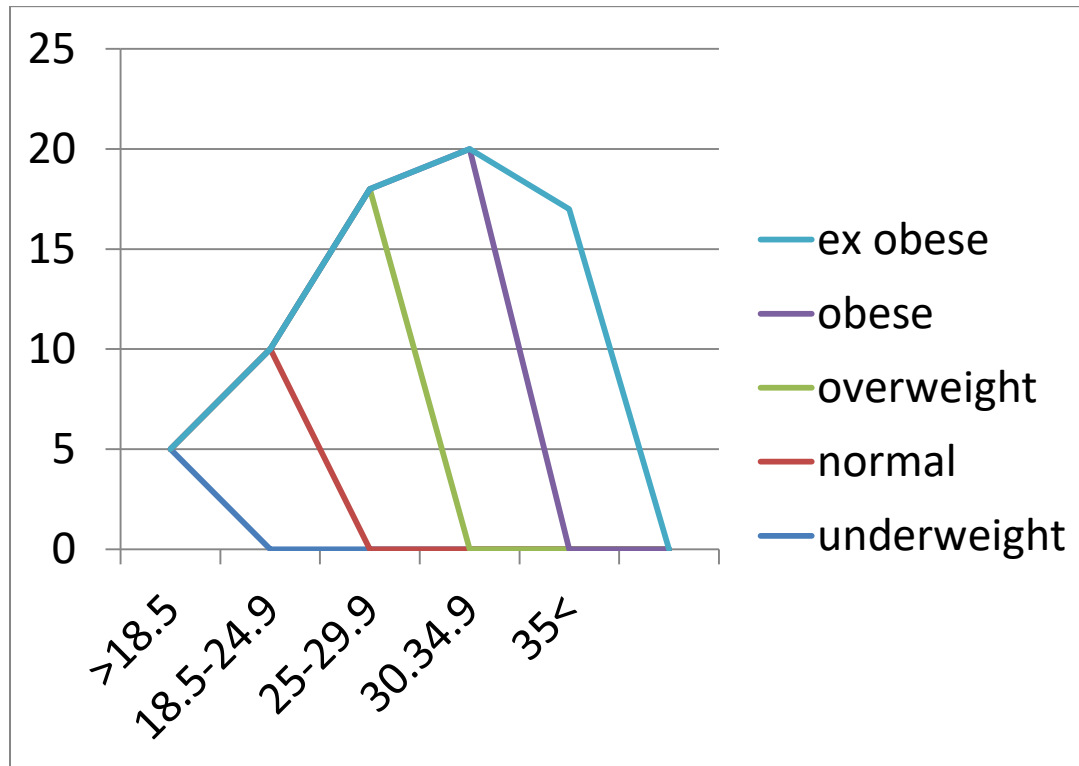
12	90	140	45.9
13	70	146	32.8
14	69	150	19.5
15	99	130	58.6
16	89	170	30.8
17	99	174	32.7
18	45	165	16.5
19	67	167	24.0
20	78	159	30.9
21	65	158	26.0
22	44	168	15.6
23	87	166	31.6
24	89	170	30.8
25	88	159	34.8
26	58	177	18.5

27	90	180	27.8
28	65	166	23.6
29	98	149	44.1
30	88	180	27.2
31	51	174	16.8
32	75	161	28.9
33	77	166	27.9
34	58	178	18.5
35	91	156	37.4
36	96	169	33.6
37	79	175	25.8
38	58	150	25.8
39	72	160	28.1
40	90	177	28.7
41	81	154	34.2

42	68	137	36.2
43	88	180	27.2
44	95	156	39.0
45	77	176	24.9
46	63	155	26.2
47	69	166	25.0
48	70	181	21.4
49	100	178	31.6
50	79	166	28.7
51	102	155	42.5
52	60	178	18.9
53	97	175	31.7
54	83	165	30.5
55	45	169	15.8
56	86	155	35.8

57	89	159	35.2
58	91	170	31.5
59	69	140	35.2
60	80	149	36.0
61	93	165	34.2
62	102	170	35.3
63	69	180	21.3
64	79	165	29.0
65	98	154	41.3
66	40	168	14.2
67	42	160	16.4
68	85	165	31.2
69	65	145	30.9
70	74	166	26.9

5.1.1. Chart:



5.2.UNDERWEIGHT (>18.5):

TABLE: 5.2.underweight category

	Height	Weight
1	165	45
2	168	44
3	168	40
4	160	42
5	169	45

5.2.1.NORMAL WEIGHT (18-24.9):

Table:5.3. *Normal Category*

1	50	155
2	79	180
3	69	150
4	58	177
5	65	166
6	58	178
7	77	176
8	70	181
9	60	178
10	69	180

5.2.2. OVERWEIGHT(25-29.9)

Table: 5.4.Overweight category

1	76	180
2	69	160
3	85	175
4	65	158
5	90	180
6	88	180
7	75	161
8	77	166
9	79	175
10	58	150
11	72	160
12	90	173
13	88	180
14	63	155
15	69	166
16	79	166
17	79	165
18	74	166

5.2.3.OBESE(30-34.9)

Table: 5.5.Obese Category

	WEIGHT	HEIGHT
1	69	150
2	100	172
3	89	170
4	99	174
5	67	167
6	78	159
/7	87	166
8	89	170
9	88	159
10	57	166
11	96	170
12	81	159
13	100	174
14	97	169
15	83	154
16	91	178
17	93	175

18	85	165
19	65	170
20	70	146

5.2.4.EX OBESE(35<)

Table: 5.6.Ex Obese Category

1	98	145
2	95	150
3	110	155
4	79	140
5	90	140
6	99	130
7	98	149
8	91	156
9	68	137
10	95	156
11	102	137
12	86	156

13	89	155
14	69	155
15	80	159
16	102	140
17	98	5..

5.3.KARL PEARSON COEFFICIENT OF CORRELATION (r)

Making use of the Similarity among the various classes such as Underweight,Obese etc., the Karl Pearson coefficient is calculated only for NORMAL people.

Table:5.7.Karl person's coefficient of correlation

X	Y	x	x ²	y	y ²	xy
50	5.0	-15.5	240.25	-0.61	0.37	9.455
79	5.9	13.5	182.25	0.29	0.08	3.915
69	4.9	3.5	12.25	-0.71	0.50	-2.485
58	5.8	-7.5	56.25	0.19	0.03	-1.425
65	5.4	-0.5	0.25	-0.21	0.04	0.105
58	5.8	-7.5	56.25	0.19	0.03	-1.425
77	5.7	11.5	132.25	0.09	0	1.035
70	5.9	4.5	20.25	0.29	0.08	1.035
60	5.8	-5.5	30.25	0.19	0.03	-1.045
69	5.9	3.7	12.25	0.29	0.08	1.073
$\sum X = 655$	$\sum Y = 56.1$		$\sum x^2 = 742.5$		$\sum y^2 = 1.24$	$\sum xy = 10.238$

$r=0.33(+)$

Correlation coefficient of height(X) and weight(Y) is +0.33 ,

There is positive correlation between X and Y

CHAPTER-6

6. CONCLUSION:

- ❖ In our project we have used Karl Pearson Correlation Coefficient (that is used to **quantitatively** relate variables), to relate to BMI.
- ❖ We have used only **Normal weight** category people and we have found the correlation coefficient is **POSITIVELY** varying, here.

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