



**B.A. PART-III
(SEMESTER-V)**

**PSYCHOLOGY
ABNORMAL PSYCHOLOGY**

UNIT II

**Department of Distance Education
Punjabi University, Patiala**

(All Copyrights are Reserved)

LESSON NO. :

- 2.1 : Stress : Causes, Selyes (GAS);**
- 2.2 : Psycho-Physiological Disorders:
Etiology and Prevention of
Hypertension**
- 2.3 : Psycho-Physiological Disorders:
Etiology and Prevention of Asthma
and Ulcers**
- 2.4 : Correlation : Nature and
Characteristics**
- 2.5 : Types of Correlation : Product
Moment Correlation and Rank Order
Correlation**
- 2.6 : t-Test**

NOTE : Students can download the syllabus from
department's website www.pbiddle.org

Stress: Nature, Categories of Stressors and Causes of Stress

Lesson Structure

2.1.0 Objectives

2.1.1 Introduction

2.1.2 Stress (Eustress & Distress)

2.1.3 Categories of Stressors

2.1.3.1 Frustration

2.1.3.2 Conflict

2.1.3.3 Pressure

2.1.4 Causes of Stress

2.1.4.1 Stressful life events

2.1.4.2 Hassles of daily life

2.1.4.3 Work related stress

2.1.4.4 Environmental sources of stress

2.1.5 Factors predisposing a person to stress

2.1.6 Reaction to stress

2.1.7 Clinical reaction to stress

2.1.7.1 Adjustment disorder

2.1.7.2 Acute stress disorder

2.1.7.3 Dissociative disorder

2.1.8 Treatment

2.1.9 Conclusion

2.1.10 Two sides of stress

2.1.11 Task oriented reaction

2.1.12 Defense oriented reaction

2.1.13 Individual differences in coping

2.1.14 Decompensation under excessive stress

2.1.15 Let us sum up

2.1.16 Keywords

2.1.0 OBJECTIVES

This lesson provides an introduction to the concept of **stress**. We shall discuss the nature of **stress, stressors, eustress and distress**.

By the end of this lesson you should be able to

- Explain the nature of stress and the categories of stressors.

- . Identify the factors predisposing a person to stress.
- . Examine the reactions to stress.

2.1 INTRODUCTION

In the previous lessons we have studied various view points of abnormal behavior and the underlying causes of abnormal behavior and found that the subjective well being and homeostasis is essential for the normal functioning of an individual. In this lesson the emphasis is on “Stress” and “Stressors”. The term stress has been used to refer both to the adjustive demands placed on an organism and to the organisms internal biological and psychological responses to such demands. Adjustive demands are referred as **stressors**, the effects they create within an organism is referred as **stress** and the effort to deal with stress and coping **strategies**.

2.1.2 Stress

Stress is a negative emotional experience accompanied by behavioral, biochemical and physiological changes that are related to perceived acute or chronic challenges. According to Neufeld (1990), stress is a by product of poor or inadequate coping. Hence stress and coping is interdependent. Different people have different physical and psychological reactions to the same event as stressful, whereas others simply take it in stride.

All situations, positive and negative, that require adjustment can be stressful. According to Hans Selye(1956, 1976 a) – stress is eustress when positive and distress when negative stress; during a wedding would be eustress and during failure would be distress.

2.1.3 Categories of Stressors

Stressors are the activators of stress. There are wide ranges of stimuli that can potentially produce stress. Stressors have various characteristics.

- a) They are intense in nature that is they produce a state of overload - we fail to adapt to them.
- b) They evoke incompatible tendencies in us, such as tendencies both to approach and to avoid some object or activity.
- c) They are uncontrollable- beyond our limits to control.

The above characteristics suggest three basic categories of stressors i.e., frustrations, conflicts and pressures.

2.1.3.1 Frustration: When an individual's goals, desires or strivings are thwarted it results into frustration. The obstacles can be both environmental and internal. Some common examples of environmental obstacles are discrimination, death of a loved one, group prejudice etc. Physical handicaps, lack of needed competencies, and inadequate self- control are sources of frustration that can result from our own personal limitations.

The frustrations we face depend heavily on such factors as age and other

personal characteristics, our specific life situation and the society in which we live.

2.1.3.2 Conflict:

In many situations the stress stems out of the necessity of choosing between two needs or goals. The choice of one alternative means frustration with regard to the other. Conflict can be classified into three types.

1. Approach- avoidance conflicts:

This type of conflict involves strong tendencies both to approach and to avoid the same goal. A student may want to pursue his studies in USA but is scared of leaving his family in India.

2. Double- approach conflict:

It involves competition between two or more desirable goals. For e.g. a person has to choose one invitation out of two on the same day. To a large extent, such simple “plus-plus” conflicts result from the inevitable limitations in ones time, space, energy and personal and financial resources- and are handled in stride.

3. Avoidance-Avoidance Conflict:

It is a choice between two undesirable alternatives, like caught between the devil and deep sea. A student for example has to choose preparing a project he intensely dislikes or quitting and being called a failure.

2.1.3.3 Pressure

Stress may stem not only from frustrations and conflicts but also from pressure to achieve particular goals or to behave in particular ways. Such pressures may originate from external or internal sources. A student may feel severe stress because of the pressure from parents to get good grades. In general pressure forces a person to speed up, intensify or change the direction of goal oriented behavior. In certain situations pressure seriously tax our adjustive resources and if they become excessive, they may lead to a breakdown of organized behavior.

2.1.4 Causes of Stress

There are wide range of factors that contribute to stress. Among the most important of these are major stressful life events, such as the death of a loved one or a painful divorce; minor hassles of everyday life; work related stress and certain aspects of the physical environment.

2.1.4.1 Stressful life events:

Death of a spouse, injury to one's child, war, failure in school or at work makes us experience traumatic changes at some time or other. The greater the number of stressful life events experienced by an individual and the longer these events are in duration, the greater the likelihood that the person's subsequent health will be adversely affected.

2.1.4.2 The Hassles of Daily Life:

Daily life is filled with countless minor annoying sources of stress- termed hassles- that seem to make up for their relatively low intensity by their much higher frequency. According to Folkman & Lazarus 1988, their daily hassles are the important cause of stress. The more stress people report as a result of daily hassles, the poorer their psychological well being.

2.1.4.3 Work related stress:

The jobs or careers are a central source of stress. Several factors produce stress at the work settings for e.g.: discrimination, extreme overload or under load, role conflict and performance appraisals.

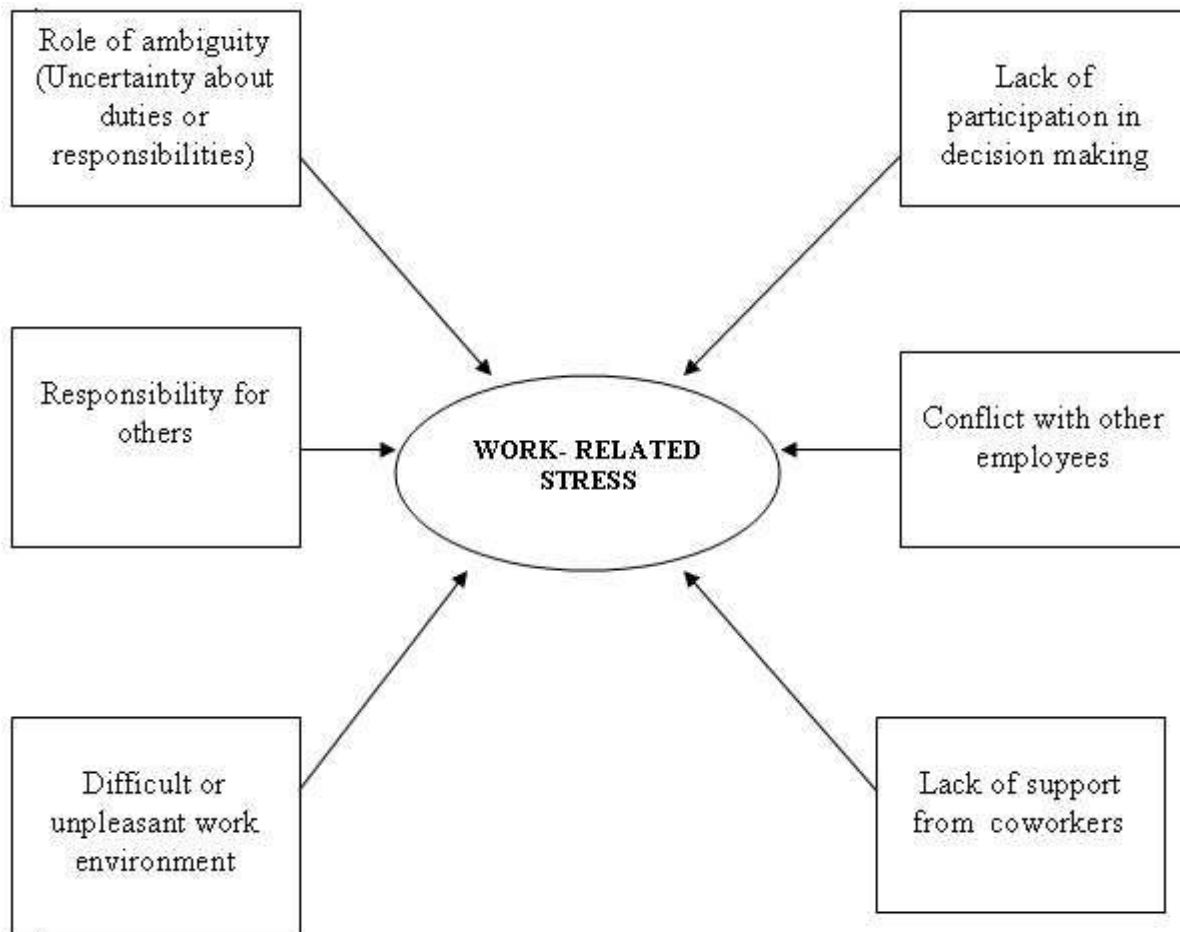


Fig. 2.1.4.3 : Indicates the sources of Work- Related Stress

2.1.4.4 Environmental sources of stress:

Natural events or disasters like tsunami, hurricane, floods, and draughts

can be highly stressful. The survivors of these devastating events often experience the severe psychological aftermath termed **posttraumatic stress disorder**.

2.1.5 Factors Predisposing a Person to Stress:

The severity of stress is gauged by the degree of disruption in the human system that will occur if the individual fails to cope with the adjustive demand. On a psychological level the severity of the stress depends not only on the nature of the stress and individuals resources- both personal and situational- but also on how the stress situation is perceived and evaluated. The factors predisposing a person to stress can be categorized into three headings.

- (a) Characteristics of the adjustive demands.
 - (b) Characteristics of the individual
 - (c) External resources & support.
- (a) **Characteristics of the adjustive demands:** An individual is more stressed if the stressor occurs for a prolonged time (duration) for e.g. chronic illness. Another factor is multiplicity of stressors. If an individual is stressed because of a loss of job and simultaneously he finds his wife is diagnosed to have cancer, his resources to adjust will exhaust because of culminating effect of stressors.
- Often new adjustive demands that have not been anticipated and with no ready made coping patterns are available will place an individual under severe stress.
- (b) **Characteristics of the individual:** The situation that one person finds highly stressful may be only mildly stressful or even non stressful for another. The difference in results is because of the individual differences in the perception of the problem, anticipation of the harm and stress tolerance of the individual. The individuals who are optimistic in life are better at making adjustments to the demands put by the stressor in comparison to pessimistic people.
- (c) **External resources and support:** Family support or friends support greatly enhances the individual's capacity to adjust and cope with the threatening life situations. One of the chief modes of adjustment for a stressed individual is to seek emotional or instrumental support. So the individual who lacks the external support is more vulnerable to stress.

2.1.6 Some Psychological, Bodily and Behavioral Reactions to Stress

1. Psychological Responses

- . Feeling Upset
- . Inability to concentrate
- . Irritability

- . Loss of self-confidence
- . Worry
- . Difficulty in making decisions
- . Racing thoughts
- . Absent mindedness.

2. Bodily Responses:

- . Rapid pulse
- . Pounding heart
- . Increasing perspiration
- . Tensing of arm and leg muscles
- . Shortness of breath
- . Gritting of teeth

3. Behavioral Responses:

- . Deterioration in performance effectiveness
- . Smoking and use of alcohol or other recreational drugs.
- . Accident proneness
- . Nervous mannerisms
- . Increased or decreased eating
- . Increased or decreased sleeping

2.1.7 Clinical Reaction to Stress

Stress plays a role in most of the conditions that make up abnormal psychology. Stress disorders that require clinical attentions are pathological because they go beyond expected, normal emotional and cognitive reactions to severe personal challenges.

According to DSM IV TR stress results into maladaptive behavior if the coping mechanism is not appropriate. This can result into three types of clinical disorders.

2.1.7.1 Adjustment disorders : A person with an adjustment disorder is someone who has not adapted as well as the average person to one or more stressors that have occurred in the previous three months.

2.1.7.2 Acute stress disorder: Stress disorder stems out of facing or experiencing extremely traumatic stressors. Acute stress disorder is marked by the symptoms of dissociation that include a subjective sense of numbness, detachment and absence of emotional responsiveness.

2.1.7.3 Dissociative Disorder: In dissociation there is a breakdown or fragmentation in the coherence of mental life; one group of mental processes seems to become separated from the rest.

2.1.8 Treating Stress- Related Problems:

There are a wide range of therapies for the treatment of stress- related disorders. The treatment is decided with respect to the individual factors and the type of the stressors.

- **Supportive Therapy:** In supportive therapy the therapist provides acceptance and motivates the client to indulge in effective problem solving behavior. The approach of the therapist is non critical towards his client.
- **Medications:** Medications are generally followed by some psychotherapy as drugs relieve the individual's nervous system and the individual temporarily feels relaxed.
- **Cognitive Modifications:** In this therapy the client is made to restructure or redefine the anxiety producing situation in a different way i.e., in a more positive way.
- Relaxation Training and Systematic Desensitization are other stress reducing therapies.

2.1.9 The two sides of stress

Before we study about various coping skills/styles its important to discuss the two sides of stress.

2.1.9.1 Selye's GAS (General Adaptation Syndrome) model provides a framework for understanding how stress affects us physically. Hans Selye has explained the physiological response to stressors in a sequence of three stages.

Stage I: During the alarm stage the body prepares itself for immediate action; arousal of the sympathetic nervous system releases hormones that help to prepare our body to meet threats or dangers.

Stage II: During the resistance stage the body draws on resources at an above- normal rate to cope with a prolonged stressor.

Stage III: During the exhaustion stage the body's capacity to cope with stress is depleted and susceptibility to illness increases dramatically.

2.1.9.2 The Cognitive Side of Stress

Same stressors has a different effect on different individuals i.e., when confronted with the same potentially stress inducing situation; some persons experience stress, whereas others do not. The reason is that individuals differ in their perceptions. In simple terms, the stress occurs only to the extent that the persons involved perceive it.

The cognitive appraisal model illustrates how our interpretation of

potentially stressful events greatly affects our reactions to them.

Primary appraisal addresses the following questions. How threatening is a potentially stressful event?

- . If the event is not perceived as threatening, then we experience no stress.
- . If the event is perceived as threatening, and then we engage in secondary appraisal of the situation.

Secondary appraisal addresses the following questions: Given that an event is viewed as a threat, do we have the resources to cope with it effectively?

- . If the answer is yes, we do not experience stress.
- . If the answer is no, we experience stress.

The coping skills that people adopt largely depend on the cognitive appraisal of the stressor; it influences how much stress they feel and how well they cope with it.

2.1.10 Task Oriented Reactions

In coping with stress, a person is confronted with two problems.

- (a) To meet the requirements of the adjustive demand.
 - (b) To protect the self from psychological damage and disorganization.
- When the person feels competent to handle a stress situation, his behavior tends to be task oriented- that is aimed primarily at dealing with the requirements of the adjustive demands.

Task – oriented reactions may involve making changes in one's self or one's surroundings or both, depending on the situation. The task oriented reactions can be classified as **attack, withdrawal** and **compromise**.

2.1.10.1 Attack: In attack behavior; the individual tries to remove or surmount obstacles to his goals. Attack behavior may be destructive as well as constructive; they range from obvious actions; such as physical assault or learning new skills, to subtle means such as patience or passive resistance.

2.1.10.2 Withdrawal: Attack and withdrawal- fight and flight are fundamental forms of coping with stress found in all animals. Withdrawal serves to remove the organism from dangerous situations it cannot overcome. In addition to withdrawing from danger physically, the individual may withdraw in various psychological ways- for example by admitting defeat, avoiding certain types of adjustive demands, or reducing emotional involvement in a situation and becoming apathetic.

2.1.10.3 Compromise: Compromise entail changing one's method of operation, accepting substitute goals, or working out some sort of accommodation

in which one settles for part or what was initially wanted.

2.1.11 Defense-Oriented reactions:

In defense-oriented response the behavior is directed primarily at protecting the self from hurt and disorganization, rather than at resolving the situations. There are two common types of defense oriented responses. The first consists of responses such as crying, repetitive talking and mourning that seem to function as psychological damage- repair mechanisms. The second type consists of the ego defense mechanisms. These mechanisms relieve tension and anxiety and protect the self from hurt and devaluation. There are many ego- defense mechanisms; we shall discuss only those that seem immediately relevant to an understanding of abnormal behavior.

2.1.11.1 Denial: This is the simplest and most primitive of all self- defense mechanisms. In this the individual simply refuses to accept the reality for e.g., during the death of a loved one, an individual may experience the feeling that “This isn’t really happening to me”. This mechanism temporarily relieves from the full impact of the traumatic situation.

2.1.11.2 Repression: This is a defense mechanism by means of which threatening or painful thoughts and desires are excluded from consciousness. It is often referred to as “selective forgetting.” Repression may also help the individual to control dangerous and unacceptable desires.

2.1.11.3 Rationalization: Rationalization involves thinking up logically, socially approved reasons for past, present, or proposed behaviors. For e.g. the child may state the role of teachers prejudice in securing low grades. Rationalization is often used to soften the disappointment of thwarted desires.

2.1.11.4 Projection: Projection is a defense reaction by means of which (a) others are seen as responsible for one’s own shortcomings, mistakes and misdeeds and (b) others are seen as responsible for ones unacceptable impulses, thoughts, and desires.

In projective reactions, the individual attributes his own unacceptable desires and thoughts to others.

2.1.11.5 Reaction Formation : Sometimes an individual protects himself from dangerous desires by not repressing them but by developing conscious attitudes and behavior patterns that are just the opposite. For e.g. an alcoholic may indulge into protest and slogans for banning liquor in the state.

2.1.11.6 Displacement: In this type of the reaction there is a shift of emotions or symbolic meaning from a person or object towards which it was originally directed to another person or object. For e.g. a wife may displace the hostility around because of some trifle with husband by

rebuking her children. It means the anger is taken out on a safer object and hence venting out emotions.

2.1.11.7 Regression: Regression is a defense mechanism in which one returns to the use of reactions patterns long since outgrown. When a new addition to the family has seemingly undermined his status, a little boy may revert to bed- wetting and other infantile behavior that one brought him parental attention.

2.1.11.8 Evaluation: These defense mechanisms are essential for softening failure, alleviating anxiety and hurt and protecting ones feelings of adequacy and worth, we may consider them to the normal adjustive reactions unless they seriously interfere with the effective resolution of stress situations.

2.1.12 Individual Differences in Coping:

There are individual differences in coping behavior; one factor is the **optimism** and **pessimism** dimension. Optimists focus on problem focused coping: making and enacting specific plans for dealing with sources of stress. In contrast pessimist people indulge into escaping the stressful situation may be by giving up their goals.

Research indicates that female adopt more of emotions focused coping and men engage in problem focused coping skills.

Hardiness: is another factor which distinguishes people in their coping styles. Hardiness refers to cluster of characteristics. Hardy persons, those who are relatively stress- resistant, seem to differ from others in three respects. First they show higher levels of commitment- deeper involvement in whatever they do and stronger tendencies to perceive such activities as worth doing. Second, they tend to view change as a challenge and thirdly hardy persons have a stronger sense of control over events in their lives and over the outcomes they experience.

Apart from the inner factors such as a person's frame of reference, motives, abilities or stress tolerance- determine his or her coping strategies certain environmental conditions also play vital role in this mechanism.

2.1.13 Decompensation under excessive stress

Stressors challenge a person's adaptive resources, bringing into play both task and defense-oriented reactions. When stressors are severe, however, a person may not be able to adapt and may experience lowered integrated functioning and eventually, a breakdown. This lowering of adaptive functioning is referred to as decompensation.

2.1.13.1 THE EFFECTS OF SEVERE STRESS

Stress can be damaging, if certain demands are too severe for our coping resources. Severe stress can extract a high cost in terms of lowered efficiency,

wear and tear on the system, and in extreme cases, severe personality and physical deterioration-even death.

(a) Lowering of Adaptive Efficiency

On a physical level, severe stress may result in alternations that can impair the body's ability to fight off invading bacteria and viruses. On a psychological level, the perception of threat leads to an increasingly narrow perceptual field and rigid cognitive process. It thus, becomes difficult for the person to see the situation objectively or to perceive the alternatives actually available. This process often appears to be a part of suicidal behavior.

(b) Depletion of Adaptive Resources:

In using its resources to meet one severe stressor an organism may suffer a lowering of tolerance for other stressors. In general, several or sustained stress on any level leads to a serious reduction in an organism's overall adaptive capacity.

(c) Wear and Tear on the system:

When pressure is severe and long-lasting, adjustment problems such as excessive worry may become chronic, and eventually lead to physical changes such as high blood pressure).

2.1.14 Let us sum up

Stress can arise either from specific situation or from daily hassles of life. Stress can have undesirable effects on behavior, thought and bodily functioning. Different people react to stressors in different ways and the effect of stressors on different people is varied depending upon objective or subjective factors. Among the disorders that seem most related to stress are adjustment disorders, acute stress disorders and dissociative disorders. A variety of approaches are used either alone or in combination to treat stress-related disorders. Coping can be classified into two categories i.e. task oriented and defence mechanism. When the individual tends to adjust to the stressor it involves task oriented coping and when individual feels that the stressor is beyond his resources to cope with, he tries to save his ego from being hurt and indulges into ego defense mechanisms. There are individual differences in coping with the same type of a stressor.

Check Your Progress

- Q: Write a note on task-oriented coping skills.
- Q: What is Defense Mechanism? Explain the various types of Defence Mechanisms.
- Q: Explain the role of cognitive appraisal in coping.

2.1.15 Keywords**Frustration**

When an individual's goals, desires or strivings are thwarted it results into frustration. The obstacles can be both environmental and internal. Some common examples of obstacles are discrimination, death of a loved one, group prejudice, inadequate self control and physical handicaps etc.

Avoidance-Avoidance Conflict

It is a choice between two undesirable alternatives, like caught between the devil and the deep sea. A student for example has to choose preparing a project he intensely dislikes or quitting and being called a failure.

Adjustment disorders

A person with an adjustment disorder is someone who has not adapted as well as the average person to one or more stressors that have occurred in the previous three months.

Supportive Therapy

In supportive therapy the therapist provides acceptance and motivates the client to indulge in effective problem solving behaviour. The approach of the therapist is non critical towards his client.

Hardiness

It refers to cluster of characteristics. Hardy persons are relatively stress resistant, seem to differ from others in three respects i.e. higher levels of commitment, deeper involvement and stronger tendencies to perceive tasks as worth doing.

References

1. Casson and Butcher : Abnormal Psychology Modern Life.
2. Sasason and Sasason: Abnormal Psychology : The Problem Maladaptive behaviours

LESSON NO. 2.2

**PSYCHO-PHYSIOLOGICAL DISORDERS: ETIOLOGY
AND
PREVENTION OF HYPERTENSION**

- 2.2.0 Objective
- 2.2.1 Introduction
- 2.2.2 A brief history of the disorders:
- 2.2.3 Three important points about Psycho-Physiological disorders
- 2.2.4 Hypertension
 - 2.2.4.1 Types of hypertension
 - 2.2.4.1.1 Essential Hypertension
 - 2.2.4.1.2 Secondary Hypertension
 - 2.2.4.2 Measurement of Hypertension
 - 2.2.4.3 The etiology/development of essential hypertension:
 - 2.2.4.3.1 Physiological Aspect:
 - 2.2.4.3.2 Psychological Causes:
 - 2.2.4.3.2.1 Psychoanalytic Interpretation:
 - 2.2.4.3.2.2 Stressful conditions
 - 2.2.4.3.2.3 Personality and Hypertension
 - 2.2.4.4 Prevention & Treatment
 - 2.2.4.4.1 Drug Treatment
 - 2.2.4.4.2 Psychological Interventions:
 - 2.2.4.4.2.1 Stress management
 - 2.2.4.4.2.2 Relaxation Techniques
 - 2.2.4.4.2.3 Self-management Training
- 2.2.5 Summary
- 2.2.6 Keywords
- 1.7 References

2.2.0 Objective

In this lesson, we will discuss how psychological factors can cause physical disorders. This is an important topic because psychological factors influence

various serious physical disorders. Among these are heart attacks, high blood pressure, strokes, headaches, hypertension, asthma, muscle and joint pain, etc. the primary focus of this chapter would be on the etiology and prevention of Hypertension. Ulcers and asthma would be discussed in detail in the next lesson.

2.2.1 Introduction

Psycho-Physiological disorders are categorized under mental disturbance that arise from psychological problems which are manifested through physical symptoms. However, these physical symptoms cannot be traced back to any serious physical disease or any origin. Nor are they under the conscious control of the patient.

Psycho-Physiological disorder is a physical disease which is thought to be caused or made worse by psychological factors. Some physical diseases are thought to be particularly prone by some psychological conditions like stress and anxieties.

Psycho-Physiological disorders are also called 'Psychosomatic disorders', which means that the mind is adversely affecting the body. According to American Psychiatric Association, Psycho-Physiological disorders are characterized by physical symptoms that are caused by emotional factors and involve a single organ system, usually under the control of the autonomic nervous system.

2.2.2 A brief history of the disorders:

Physicians have been aware that people's mental and emotional states influence their physical well being since the time of Hippocrates (460-311 B.C.). Hein Rotn first used the word 'psychosomatic', applying it to problems of insomnia. In the twentieth century, the discoveries of psychologists have shed new light on how the mind and body interact to produce health and illness. Sigmund Freud introduced the idea that unconscious thought can be converted into physical symptoms. The formal study of psychosomatic illness began in Europe.

Cannon showed how different emotions produce pattern of physiological alternation, emphasizing the importance of the autonomic nervous system. It is also known that certain inherited traits respond differently to certain stimuli like stress and anxiety causing physical system break down. In the 1950's stress became the focus in psychosomatic, the main promoter of the idea being Hans Selye. Later on the environment and social models were combined with the one of the major life changes and social stress. It is a well known fact that psychological and social factors exert an influence over bowel and gastric dysfunctions, mainly peptic ulcers and irritable bowel syndrome, thus the bio-psychosocial model has been considered while understanding these diseases.

Sometime the term psychosomatic disorders is used when psychological factors cause physical symptoms, but where there is no real physical disease, these kinds of disorder should be called as somatoform disorders. Thus, we should distinguish between the Psycho-Physiological disorders and somatoform disorder. In somatoform disorders, psychological factors cause symptoms of physical disorders but there is no actual physical disorder (i.e. No tissue damage). On the other hand, in Psycho-Physiological disorders, psychological factors lead to real physical disorders. For example, prolonged psychological stress can cause the production of excess acid in the stomach, and the acid in turn cause ulcer (holes in the walls of the stomach).

2.2.3 Three important points about Psycho-Physiological disorders

Three important points must be remembered about Psycho-Physiological disorders:

1. A Psycho-Physiological disorder is a real disease that harms the body. The fact that such disorders are believed to be due to emotional factors does not make the disease imaginary.
2. Psycho-Physiological disorders must be distinguished from somatoform or hysterical disorders. The difference has been mention in previous section.
3. We should stress that the disorders termed “Psycho-Physiological” are not always due to emotional distress. E.g. Asthma is called a Psycho-Physiological disorder, but psychological factors are thought to be the primary cause in only 34% of all cases (Rees, 3964). Thus, these diseases may also have physical origin, but can be an outcome of psychological processes.

We have been using terms “Psychosomatic or Psycho-Physiological disorders” for the physical diseases that are influenced by psychological factors, but the American Psychiatric Association’s Diagnostic and Statistical manual of mental disorders (DSM-IV) labels psychosomatic illness as under “Psychological Factors Affecting Physical Conditions.”

The realization that psychological factors contribute to many physical disorders has led to the development of the new area of health psychology, in which psychologists work to identify, prevent and treat the psychological factors that lead to physical illness.

The parts of the body most commonly affected by psychosomatic disorders are; gastrointestinal and respiratory systems, Gastric and duodenal ulcers, ulcerative colitis and irritable bowl syndrome. Respiratory problems caused or worsened by psychological factors include asthma and hyperventilation syndrome.

Cardiovascular complaints include coronary artery disease, hypertension and migraine headaches. Psychosomatic disorders also affect the skin (eczema,

allergies and etc.) and genitourinary system (menstrual disorders and sexual dysfunction). All these complaints are attributed in part to the emotional state of the patient; the most obvious difference among them is the part of the body affected. In present chapter, we will focus on hypertension and how psychological factors influence this disorder.

2.2.4 Hypertension

It is one of the most serious psycho-physiological disorders Hypertension or high blood pressure occurs when the supply of blood through the vessels is putting excessive pressure on the vessel walls. When high blood pressure is a recurring pattern, it can cause hardening of the arteries' walls and deterioration of the cell tissue. Hypertension is a serious medical problem for several reasons. It is a risk factor for other disorders such as coronary artery disease (Heart attacks), kidney failure and stroke. It may also produce some cognitive impairment.

Hypertension is a cardiovascular disease and it means high blood pressure. During states of calm, the beat of the heart is regular, the pulse is even, blood pressure is relatively low and internal organs are well supplied with blood. During stress, blood flows in greater quantity to the muscles of the trunk and limbs with increased heart beat we can feel. As it beats faster and with greater force, the pulse quickens and blood pressure mounts. Usually when the stress passes, the body resumes normal functioning and the blood pressure returns to normal. Under continuing emotional strain, however, high blood pressure may become chronic which we called hypertension.

2.2.4.3 Types of hypertension

2.2.4.3.1 Essential Hypertension

It is also called primary Hypertension. Essential hypertension is high blood pressure for which a physical cause has not been found and thus, it is assumed that the elevated pressure is due to psychological factors.

2.2.4.3.2 Secondary Hypertension

Secondary hypertension is high blood pressure that stems from known physiological causes such as excessive salt in the diet, kidney malfunction or atherosclerosis. It is called secondary because the elevated blood pressure is a side effect of some other physical disorder.

In this chapter, we will be concerned mostly with essential hypertension as we are focusing on psycho-physiological disorders.

2.2.4.2 Measurement of Hypertension

Hypertension is determined by the levels of systolic and diastolic blood pressure as measured by a sphygmomanometer. The systolic blood pressure is the high level of pressure that occurs immediately after each heart beat, when blood is suddenly forced through the system. It is sensitive both to the volume of blood

leaving the heart and to the arteries' ability to stretch to accommodate blood (their elasticity). Diastolic blood pressure is the low level of pressure that occurs just before each heart beat. It is the pressure in the arteries when the heart is relaxed. It is related to resistance of the blood vessels to blood flow.

Normal Systolic pressure is about 120 mm Hg (millimeters of mercury) and normal diastolic pressure is generally considered to be 80 mm. individuals are usually diagnosed as suffering from hypertension if they have sustained blood pressure reading of 140 mm of systolic and above 90 of diastolic blood pressure.

2.2.4.3 The etiology/development of essential hypertension:

2.2.4.3.1 Physiological Aspect:

Initially, stress results in a temporary increase in blood pressure, then the increased blood pressure cause the arteries to stretch and it is detected by a set of sensors called baro-receptors that send signals to the central nervous system to reduce blood pressure. If the pressure is high for a prolonged period of time, the baro-receptors adjust to the higher level of pressure and signal to the central nervous system only when the pressure goes even higher. In other words, after an extended increase in pressure, the baro-receptors reset themselves, and high pressure becomes the norm.

2.2.4.3.2 Psychological Causes:

2.2.4.3.2.1 Psychoanalytic Interpretation:

The classical psychoanalytic interpretations of hypertension are that affected people suffer from "suppressed rage". There is high incidence of hypertension among those who suppress hostility and anger but this hypothesis can not be said to be firmly established in respect to all.

2.2.4.3.2.2. Stressful conditions

Various stressful conditions have been examined to determine their role in the etiology of essential hypertension. Stressful events, natural disasters, anger and anxiety have been found to produce short term elevations in blood pressure. Chronic psychological stress e.g. loss of employment has been accepted as an important factor in essential hypertension. Crowded high stress and noisy environment all produce higher rates of hypertension. The underlying explanation of stress and hypertension relationship is the excessive arousal of sympathetic nervous system activity during stressful times. The stressful events that require active adaptability may have greater role in the development of hypertension than do stressful events that require only passive acceptance with recurring or prolonged exposure to stress; the

physiological changes produced by heightened reactivity may cause permanent damage, laying the ground work for chronic hypertension.

2.2.4.3.2.3 Personality and Hypertension

Hypertension, originally, was thought to be marked by personally traits, mainly by the tendency to suppress anger. Certain personality traits may be important in conjunction with other risk factors. The most researched trait is suppressed hostility. Another variable that is implicated in the development of hypertension as well as other cardiovascular disease is Type A Behaviour. Type A Behaviour Syndrome was originally formulated by Fredman & Rosenman (3914) as a behavioural and emotional style marked by an aggressive, increasing struggle to achieve more and more in less time, often in competition with other individuals. In particular Type A Syndrome is characterized by three components:

- (i) Easily aroused hostility.
- (ii) A sense of time urgency, and
- (iii) Competitive achievement striving.

Thus, three main personality factors i.e. Type A Behaviour pattern, hostility and suppressed anger play an important role in the development of essential hypertension because these factors contribute to more frequent and more prolonged elevation in blood pressure.

2.2.4.4 Prevention & Treatment

Prevention of hypertension is usually focused on two factors: diet and stress management. First, attempt are made to change the person's diet and secondly, attempts are made to teach the person how to control or reduce stress in life because stress is a major contributor to cardiovascular diseases specifically hypertension.

Hypertension has been controlled in a variety of ways. Commonly, patients are put on low sodium diets to restrict their sodium intake. Reduction of alcohol is also recommended for hypertension patients. Weight reduction in overweight patients is strongly urged and exercise is recommended for all hypertensive patients. Caffeine restriction is often included as part of the dietary treatment of hypertension.

2.2.4.4.1 Drug Treatment

Most commonly, hypertension is treated with drugs like diuretics and beta-adrenergic blockers, but some anti hypertensive drugs have undesirable side effects, such as drowsiness, light headedness and erectile difficulties for men. Thus, many investigations have been

undertaken on non-pharmacological treatment for essential hypertension. Efforts have been directed at weight reduction, restriction of salt intake, aerobic exercise, etc.

2.2.4.4.2 Psychological Interventions:

Psychological interventions have been applied to teach hypertensive individuals to lower sympathetic nervous system arousal. A variety of behavioural and cognitive behavioural methods have been evaluated for their potential success in lowering blood pressure. Some of the psychological interventions are as follows:

2.2.4.4.2.1 Stress management

The stress management condition is described as “teaching four methods of relaxation i.e. slow-breathing, progressive muscle relaxation, mental imagery and stretching, plus techniques to manage stress perception, reactions and situations. It is stressed here that role of stress management is more effective in preventing hypertension. Once hypertension is developed, other techniques must be used. There are several approaches under the rubric of stress management and more than one are typically followed in any given instance. The main objectives of these programs are to reduce aroused level, restructure cognitions and to train them for behavioural skills.

2.2.4.4.2.2 Relaxation Techniques

Method that draw on relaxation include bio-feed back, progressive muscle relaxation, hypnosis and meditation all of which are thought to reduce the blood pressure via the induction of a state of low arousal. Deep breathing and imagery are often added to accomplish this task. The relaxation therapy may be especially effective with patients who have elevated sympathetic tone and low left ventricular mass.

2.2.4.4.2.3 Self-management Training

Such training provides techniques to the people to identify their particular stress and to develop plans for dealing with them. The programs include training in self-reinforcement, self-calming task, goal setting and time management. These cognitive Behavioural techniques are thought to reduce blood pressure by helping people avert the anxiety they would otherwise develop in response to environmental stress. Beside this technique people to express anger might be useful as suppress of anger has been linked to hypertension. People can be trained either to reduce their anger through cognitive restructuring and relaxing procedure or they can be told the appropriate ways to express their anger.

Overall, it has been found that psychological interventions appear to be more successful than no-treatment with mild hypertension. Psychological therapy may actually substitute for pharmacological approach. However, with the severely hypertensive, both during treatment and psychological intervention should be used.

2.2.5 Summary

Psycho-Physiological disorders are characterized by physical symptoms that are caused by emotional factors. The formal study of psychosomatic illness began in Europe in the 1920's. In the 1950's stress became the focus in psychosomatic, the main promoter of the idea being Hans Selye. The realization that psychological factors contribute to many physical disorders has led to the development of the new area of health psychology, in which psychologists work to identify, prevent and treat the psychological factors that lead to physical illness. Hypertension is a cardiovascular disease and it means high blood pressure. It is one of the most serious psycho-physiological disorders. Hypertension or high blood pressure occurs when the supply of blood through the vessels is putting excessive pressure on the vessel walls. Prevention of hypertension is usually focused on two factors: diet and stress management. First, attempt are made to change the person's diet and secondly, attempts are made to teach the person how to control or reduce stress in life because stress is a major contributor to cardiovascular diseases specifically hypertension.

Exercise

- Q.1. Write the brief introduction of psycho-physiological disorders, describe various Psychological causes which may lead to development of hypertension.
- Q.2 Critically examine different techniques that are used for treating hypertension.

2.2.6 Keywords

1. Psychological Interventions:

Psychological interventions have been applied to teach hypertensive individuals to lower sympathetic nervous system arousal. A variety of behavioural and cognitive behavioural methods have been evaluated for their potential success in lowering blood pressure.

2. Essential Hypertension

It is also called primary Hypertension. Essential hypertension is high blood pressure for which a physical cause has not been found and thus, it is assumed that the elevated pressure is due to psychological factors.

3. Secondary Hypertension

Secondary hypertension is high blood pressure that stems from known physiological causes such as excessive salt in the diet, kidney malfunction or atherosclerosis. It is called secondary because the elevated blood pressure is a side effect of some other physical disorder.

4. Psycho-Physiological disorders

These are categorized under mental disturbance that arise from psychological problems which are manifested through physical symptoms. However, these physical symptoms cannot be traced back to any serious physical disease or any origin. Nor are they under the conscious control of the patient.

2.2.7 References

1. Taylor, S.E. (1993). Health Psychology. Los Angeles, CA: McGraw-Hill.
2. Carson, R.C. & Butcher, J.N. (1992). Abnormal Psychology and Modern Life (Ninth Edition). New York: HarperCollins.
3. Holmes, D. (1993). Abnormal psychology. New York: Harper Collins.

LESSON NO. 2.3

**PSYCHO-PHYSIOLOGICAL DISORDERS: ETIOLOGY
AND
PREVENTION OF ASTHMA AND ULCERS**

Lesson Structure

2.3.0 Objective

2.3.1 Introduction

2.3.2 Asthma

2.3.2.1 Types of Asthma

2.3.2.1.1 Extrinsic Asthma

2.3.2.1.2 Intrinsic Asthma

2.3.2.2 Etiology of Asthma:

2.3.2.2.1 Psychological causes

2.3.2.2.1.1 Family Factor

2.3.2.2.1.2 Personality and Asthma

2.3.2.2.1.3 Stress and Anxiety:

2.3.2.3 Prevention/Treatment

2.3.2.3.1 Relaxation Training

2.3.2.3.2 Systematic desensitization

2.3.2.3.3 Self-management

2.3.3 Ulcers

2.3.3.1 Types of Peptic Ulcers

2.3.3.1.1 Duodenal Ulcers:

2.3.3.1.2 Gastric Ulcers:

2.3.3.2 Causes of Ulcer

2.3.3.2.1 Physiological Causes

2.3.3.2.2 Psychological Causes

2.3.3.2.2.1 Prolonged Exposure to Anxiety

2.3.3.2.2.2 Personality

2.3.3.2.2.3 Negative Attitude

2.3.3.3 Treatment and Preventions

2.3.4 Summary

2.3.5 Keywords

2.3.6 References

2.3.0 Objective

Psycho-Physiological disorder is a physical disease which is thought to be caused or made worse by psychological factors. In this lesson, two common psycho-physiological disorders i.e. asthma and ulcers would be discussed. As basics of psycho-physiological disorders have been discussed in previous lesson, we will start directly from Asthma in which symptoms, types, and causes especially psychological ones would be the main concern. After mentioning treatment of asthma, we will shift our focus to ulcers. Discussing types, etiology and treatment of ulcers would be our primary concern

2.3.1 Introduction

In Psycho-Physiological disorders, psychological factors lead to real physical disorders. For example, prolonged psychological stress can cause the production of excess acid in the stomach, and the acid in turn cause ulcer (holes in the walls of the stomach). The parts of the body most commonly affected by psychosomatic disorders are; gastrointestinal and respiratory systems, Gastric and duodenal ulcers, ulcerative colitis and irritable bowel syndrome. Respiratory problems caused or worsened by psychological factors include asthma and hyperventilation syndrome. In present chapter, we will focus on asthma and ulcers and how psychological factors influence these disorders.

2.3.2 Asthma

A respiratory trouble causing impairment in breathing air by individual is characterized by this disorder. Wheezing while exhaling, coughing, tightness in the chest etc. are the features of the asthma. In Asthma, the air passages are narrowed, causing breathing to be extremely difficult (particularly exhalation). In addition, there is an inflammation of lung tissues mediated by the immune system. Numerous attempts have been made to define Asthma over the past two decades. National Heart, Lung and Blood Institute (1992) of the USA defined Asthma as “A lung disease manifested symptomatologically with airway obstruction that is reversible either spontaneously or with treatment; airway inflammation; and airway hyper-responsiveness.

People who have asthma have difficulty in breathing, feel constriction in the chest, gasping and apprehension. The asthma sufferer takes a longer time than normal to exhale and whistling sounds can be detected through the chest.

2.3.2.1 Types of Asthma

There are two types of Asthma:

2.3.2.4.1 Extrinsic Asthma

It is also called allergic asthma. The causes of such disorders are dust, pollens, etc.

2.3.2.4.2 Intrinsic Asthma

Intrinsic Asthma: It is also called infective asthma. Infections rather than allergic noxious agents play a significant role in the etiology of this sort of asthma.

Most often, asthmatic attacks begin suddenly. The asthmatic individual has a sense of tightness in the chest and coughs. Subjective reaction can include panic, fear, irritability and fatigue. A severe attack is a very frightening experience indeed. The asthma sufferer has immense difficulty getting air into and out of the lungs and feels as he or she is suffocating. The sufferer may become exhausted by the exertion and fall asleep as soon as breathing is more normal.

2.3.2.2 Etiology of Asthma:

Asthma is a disease with multiple causes. Medically, Asthma is viewed as an immunological disorder which interacts with psychosomatic medicine. Therefore, there are conflicting views on the precise role of the various emotional states responsible for eliciting an asthmatic response. On one extreme, asthma is considered entirely a psychosomatic disorder; others view it as a psychological disturbance stemming from the outcome of a pulmonary functional flare up.

While investigating the causes of asthma, Rees (1964) divided the various possible causes into three categories:

- a) Allergic,
- b) Infective,
- c) Psychological.

Allergic agents like pollen, molds, fur and dust can predispose respiratory tract to bring Asthma. On the other hand, respiratory infections most often acute bronchitis can also make the respiratory system vulnerable to asthma. Among Psychological variables, anxiety, tension, frustration, anger, depression, are all may induce emotionally disturbance which inhibit the adequate functioning of the respiratory system and thus cause asthma.

It must be noted that the different causes of asthma varied in importance depending on the age of the individual. For younger than five years of age, the infective factor predominates. From ages six to sixteen the infective factor still predominates but psychological variables increased in importance. In the range from ages sixteen to sixty five, psychological factors decreased in importance until about the thirty fifty years thereafter becoming more consequential again (Rees, 1964).

Some cases of asthma have psychological factors as a primary cause. Even when asthma is originally induced by an infection or allergy, psychological stress can

precipitate attacks. A study by Kleeman (1961), showed that 69% of the asthmatic attacks began with an emotional disturbance.

2.3.2.2.1 Psychological causes

2.3.2.2.1.1 Family Factor

The role of familial psychosocial factors in inducing asthmatic disorders has been observed among vulnerable children. Doctors have also noted certain asthmatic children whose symptoms improved markedly or remitted when isolated from a stressful familial environment. Parent-child relationship has found to be a significant predictor of Asthma. Although certain emotional factors in the home may be important in eliciting early asthmatic attacks in some children, in other the illness may originally develop for non-familial reasons.

2.3.2.2.1.2 Personality and Asthma

It has been suggested that particular personality traits are linked to asthma. Person with neurotic symptoms such as dependency, sensitivity, anxiety, perfectionism are more prone to be asthmatic.

2.3.2.2.1.3 Stress and Anxiety:

The emotional overtone as during stress and anxiety can make individual vulnerable to asthmatic attacks because this heightened arousal brings bio-physical changes in respiratory function.

Besides all other causes, a diathesis-stress explanation should be kept in mind, which states that, if individual's respiratory system is predisposed to asthma, any psychological stresses can interact with the diathesis or weakness to produce the disease.

2.3.2.3 Prevention/Treatment

In order to deal effectively with negative consequences of asthma, two specialists should be involved in the management of this condition, the physician and the behavioural therapist or psychologist. As we are discussing psychological aspect of asthma, we will primarily focus on psychological therapies to deal with asthma.

The patients with physical symptoms and psychological disturbance due to psychosomatic diseases often have special therapeutic needs. Presently psychosomatic treatment uses psycho education, relaxation techniques, stress management and supportive therapy mainly cognitive-behavioural to deal with psycho-physiological disorders. Three distinct behavioural approaches are usually considered in management:

- (i) Abnormal Pulmonary Function must be modified (Role of Physician).
- (ii) Emotional disturbances must be changed (Role of Psychotherapist).

- (iii) Maladaptive asthma related to inconsistent family behaviour and conditions must be altered (Family Interventions). A Psychotherapist can assist asthma patient with the help of five approaches:

2.3.2.3.1 Relaxation Training

There are various procedures to relax the patient so that their emotional arousal can be made to the optimal level. Herbert Benson is the promoter of relaxation techniques and considered these as strategic and preventive therapy approaches in psychosomatics.

Relaxation Techniques:-

- (i) Edmund Jacobson's Progressive muscle relaxation therapy,
- (ii) Deep breathing exercises improves the respiratory function and eliminate stress and tension.
- (iii) Guided Imagery: It is a two component process: the first component implies deep relaxation and then imagination of restful mind and the body,
- (iv) Biofeedback training: It is a combination of relaxation, visualization and cognitive method.
- (v) Music therapy: It has indirect affect on psychosomatic disease, as it alleviates stress and anxiety which further leads to reduction in psychosomatic symptoms.

2.3.2.3.2 Systematic desensitization

Systematic desensitization involves Making the individual less sensitive to anxiety arousing situation by gradual approaching stressful situation in relaxed state of mind.

2.3.2.3.3 Self-management

Self-management: It is to educate clients to achieve self initiated skills and competence. It includes; 1) medical and behavioural knowledge 2) skill to control stressful events, 3) to cope positively with external stressors.

Since Psycho-Physiological disorders are the physical disturbances, sound psychotherapeutic practice requires close consultation with a physician.

2.3.3 Ulcers

The word ulcer refers to any abnormal break in the skin or a mucus membrane. The ulcers from which most people suffer are peptic ulcers which occur in the digestive system. In addition to causing considerable pain, ulcer can be dangerous because they lead to internal bleeding and can result in death. The term peptic is derived from pepsin, an important component of the acid stomach juices that aid in the early phases of digestion. This ulceration of the stomach or

upper intestine (the duodenum) were found primarily in young women, but a shift occurred in the second half of the nineteenth century and in the twentieth century men became far more prone to peptic ulcers than women.

2.3.3.1 Types of Peptic Ulcers

Peptic ulcers are divided into two types, depending on where in the digestive system they occur.

2.3.3.1.1 Duodenal Ulcers:

These types of ulcers occur in the duodenum which is the first part of the small intestine where the food enters the intestine from the stomach. About 25% of such ulcers are caused by over production of gastric acid rather than by under protection of mucus.

2.3.3.1.2 Gastric Ulcers:

Gastric Ulcers occur in the stomach and in contrast to duodenal ulcers; they are usually the result of too little protective mucus rather than too much gastric acid. In many cases, individuals develop gastric ulcers because they have ingested high levels of substance like aspirin or alcohol that reduce mucus, thus causing an acid-mucus imbalance.

2.3.3.2 Causes of Ulcer

2.3.3.2.1 Physiological Causes

Ulcers result from an imbalance between the level of gastric acid (primarily hydrochloride acid and pepsin) that is produced to break down food stuff and the level of mucus that is produced to neutralize the acid and thereby protect the walls of the intestinal tract. If the acid level gets too high because too much acid is being produced or because not enough mucus is being produced, the acid will create holes (ulcers) in the walls of the intestinal tract. The ulcers result in pain and vomiting (sometimes of blood).

2.3.3.2.2 Psychological Causes

A major reason for the overproduction of gastric acid is stress. Some types of stress are more likely to lead to ulcers than others. E.g. unpredictable stress is more likely to lead to ulcers than predictable stress. Another factor related with stress and ulcers is controllability as uncontrollable stress leads to more ulcers.

2.3.3.2.2.1 Prolonged Exposure to Anxiety

Intense anger or anxiety produced intense physiological reactions which can lead to development of ulcers as anxiety producing condition produce excessive secretion of hydrochloric acid.

2.3.3.2.2.2 Personality

Alexander (1950) developed a profile of the Ulcer-prone personality as someone whose disorder was caused primarily by excessive need for dependency and love. Repressed emotions resulting from frustrations, dependencies and love seeking needs are said to increase the secretion of acid in the stomach, eventually, eroding the stomach lining and producing ulcers.

2.3.2.2.3 Negative Attitude

Negative thinking and attitude induces immune-suppression and health endangering life style which may predispose toward peptic ulcer.

In general, the research consistently indicates that a predisposition to produce high level of gastric acid in combination with stress leads to the development of ulcers. Then, rather than talking about the stress-ulcer relationship, we should talk about the predisposition-stress-ulcer relationship.

2.3.3.3 Treatment and Preventions

Medical treatment for ulcers involves removing the ulcer or cutting the vagus nerve to lessen acid production or using anti-acid drugs but because it does not remove the underlying problems i.e. acid production and stress, the ulcers are very likely to return. Thus, the treatment of choice should involve various types of stress-management training programs in which individual are taught to avoid or control stress. Following specific techniques can be used in management of ulcers.

- (1) Learning better coping skills.
- (2) Reappraisal of stressful situations and preserved ability of the self.
- (3) Relaxation techniques (Breathing, progressive mustive relaxation, Bio-feed back).
- (4) Psycho-educational techniques.

2.3.4 Summary

In Asthma, the air passages are narrowed, causing breathing to be extremely difficult (particularly exhalation). In addition, there is an inflammation of lung tissues mediated by the immune system. Asthma is a disease with multiple causes. Medically, Asthma is viewed as an immunological disorder which interacts with psychosomatic medicine. Therefore, there are conflicting views on the precise role of the various emotional states responsible for eliciting an asthmatic response. On one extreme, asthma is considered entirely a psychosomatic disorder; others view it as a psychological disturbance stemming from the outcome of a pulmonary functional flare up. Since Psycho-Physiological disorders are the physical disturbances, sound psychotherapeutic practice

requires close consultation with a physician. The ulcers from which most people suffer are peptic ulcers which occur in the digestive system. In addition to causing considerable pain, ulcer can be dangerous because they lead to internal bleeding and can result in death. The treatment of ulcers should involve various types of stress-management training programs in which individual are taught to avoid or control stress.

Exercise

- Q1: Describe various causes of Asthma with main emphasis on psychological ones.
- Q2: Explain the role of physiological factors in Ulcers.
- Q3: How can we prevent ulcers and asthma with the help of Psychological principals.

2.3.5 Keywords**1. Intrinsic Asthma:**

It is also called infective asthma. Infections rather than allergic noxious agents play a significant role in the etiology of this sort of asthma.

2. Systematic desensitization

Systematic desensitization involves Making the individual less sensitive to anxiety arousing situation by gradual approaching stressful situation in relaxed state of mind.

3. Self-management

Self-management: It is to educate clients to achieve self initiated skills and competence. It includes; 1) medical and behavioural knowledge 2) skill to control stressful events, 3) to cope positively with external stressors.

4. Music therapy

It has indirect affect on psychosomatic disease, as it alleviates stress and anxiety which further leads to reduction in psychosomatic symptoms.

2.3.6 References

1. Brannon, L.& Feist, J.(2000). Health Psychology: An Introduction to Behaviour and Health(4th edition) Brooks/Cole,USA.
2. Taylor, S.E. (1991). Health Psychology. Los Angeles, CA: McGraw-Hill.
3. Holmes, D. (1991). Abnormal psychology. New York: Harper Collins.
4. Davison, G.C., & Neale, J.M. (1996). Abnormal psychology (6th ed.) New York: Wiley.

LESSON NO. 2.4

CORRELATION: NATURE AND CHARACTERISTICS

Lesson Structure

- 2.4.0 Objective
- 2.4.1 Introduction
- 2.4.2 Types of Correlations
 - 2.4.2.1 Positive correlation
 - 2.4.2.2 Negative correlation
 - 2.4.2.3 Zero correlation
- 2.4.3 Characteristics of correlation
- 2.4.4 Correlation coefficient(r)
- 2.4.5 Example
- 2.4.6 Interpretation of the correlation coefficient
- 2.4.7 Assumptions and Limitations
 - 2.4.7.1 Assumptions
 - 2.4.7.2 Limitations
- 2.4.8 Let us sum up
- 2.4.9 Keywords
- 2.4.10 References

2.4.0 Objective

Science, at a basic level attempts to answer questions through careful observation and collection of data. These answers can then (at a more complex or higher level) be used to further understand our knowledge of us and our world, as well as help us predict subsequent events and behavior. For this purpose various techniques

are applied to understand the research findings. In this chapter, one of the important statistics used in psychological researches i.e. correlation, would be discussed in detail. This chapter would provide basic nature, types, calculations, assumptions and limitations of the correlation analysis which may help students in applying this statistics in their research work.

2.4.1 Introduction

Statistics refers to methods and rules for organizing and interpreting quantitative observations. Statistics is a collection of a bunch of mathematical techniques that help to analyze and present data. Statistics is also used in associated tasks such as designing experiments and surveys and planning the collection and analysis of data from these. Among other statistical tools, correlation is an important statistics used in psychology.

'Correlation' is a statistical tool which studies the relationship between two variables and Correlation Analysis involves various methods and techniques used for studying and measuring the extent of the relationship between the two variables. It determines the extent to which values of the two variables are "proportional" to each other. When two variables vary together, statisticians say that there is a lot of covariation or correlation. Statistical correlation is a statistical technique which tells us if two variables are related. If the change in one variable is accompanied by a change in the other, then the variables are said to be correlated.

2.4.2 Types of Correlations

There are three important types of correlation. They are (1) Positive, (2) Negative and (3) Zero correlation.

2.4.2.1 Positive correlation

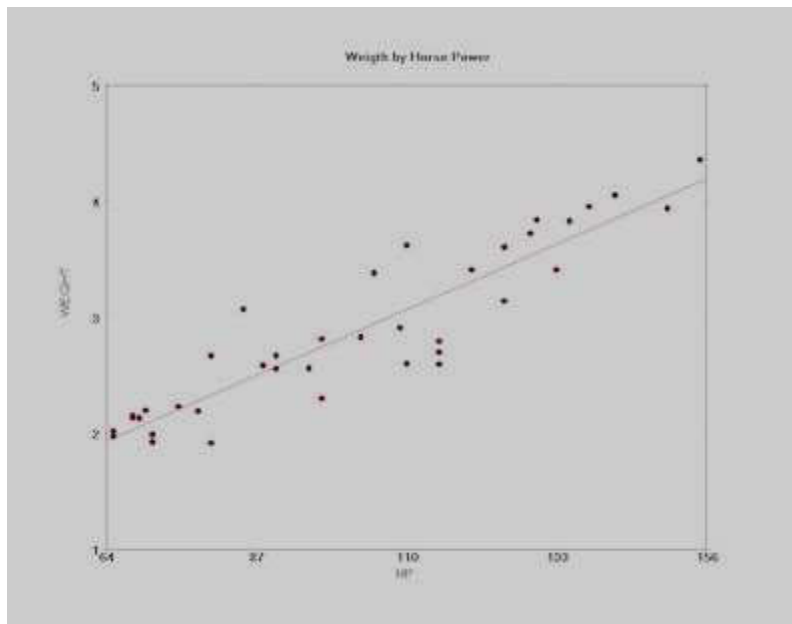
If the values of the two variables deviate in the same direction i.e. if an increase (or decrease) in the values of one variable results, on an average, in a corresponding increase (or decrease) in the values of the other variable the correlation is said to be positive.

Some examples of series of positive correlation are:

- (i) Heights and weights;

- (ii) Household income and expenditure;
- (iii) Amount of rainfall and yield of crops.

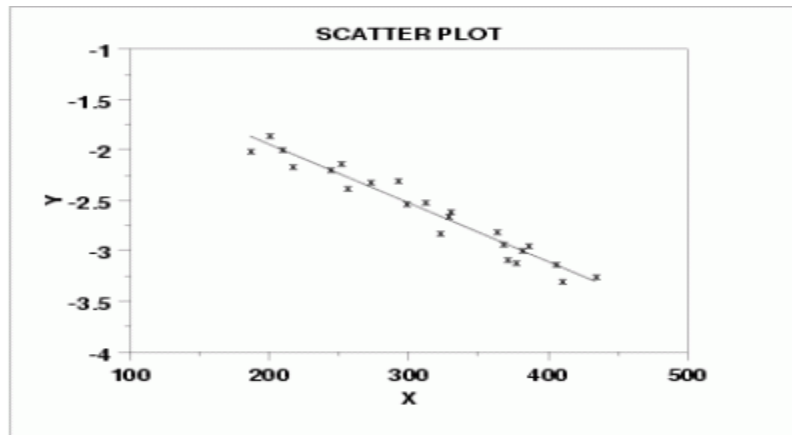
Suppose that an X value was above average, and that the associated Y value was also above average. Then the product would be the product of two positive numbers which would be positive. If the X value and the Y value were both below average, then the product would be of two negative numbers, which would also be positive. Therefore, a positive correlation is evidence of a general tendency that large values of X are associated with large values of Y and small values of X are associated with small values of Y.



2.4.2.2 Negative correlation

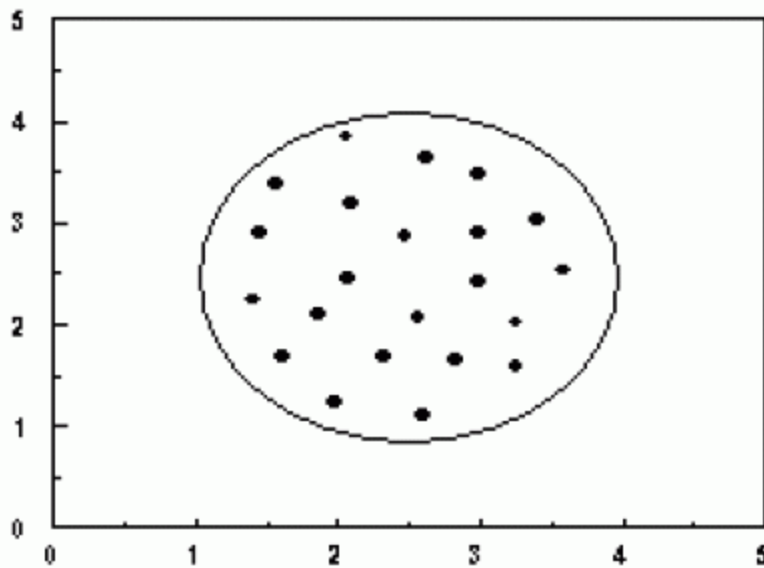
Correlation between two variables is said to be negative or inverse if the variables deviate in opposite direction. That is, if the increase in the variables deviate in opposite direction. That is, if increase (or decrease) in the values of one variable results on an average, in corresponding decrease (or increase) in the values of other variable. Example of negative correlation is; Price and demand of goods. Suppose that an X value was above average, and that the associated Y value was instead

below average. Then the product would be the product of a positive and a negative number which would make the product negative. If the X value was below average and the Y value was above average, then the product above would also be negative. Therefore, a negative correlation is evidence of a general tendency that large values of X are associated with small values of Y and small values of X are associated with large values of Y.



2.4.2.3 Zero correlation

When the two variables are independent and the change in one variable has no effect in other variable, then the correlation between these two variables is known as Zero Correlation.



Correlation analysis provides us with these three types of correlations between variables i.e. whether correlation is positive, negative or no correlation. With this information, researchers can predict variance in variables and can try to control it for better future outcome.

2.4.3 Characteristics of correlation

Correlations have several important characteristics.

- The value of r always falls between -1 and 1 . Positive values indicate a positive association between the variables, while negative values indicate a negative association between the variables.
- Correlation does not mean causation. Even if there is a strong correlation between two variables, we can not say for sure that one variable is causing change in another variable.
- If $r = 1$ or $r = -1$ then all of the cases fall on a straight line. This means that the one variable is actually a perfect linear function of the other. In general, when the correlation is closer to either 1 or -1 then the relationship between the variables is closer to a straight line.

- The value of r will not change if you change the unit of measurement of either x or y .
- Correlations only measure the degree of linear association between two variables. If two variables have a zero correlation, they might still have a strong nonlinear relationship.

2.4.4 Correlation coefficient(r)

One of the most widely used statistics is the coefficient of correlation ' r ' which measures the degree of association between the two values of related variables given in the data set. The correlation coefficient, r , quantifies the direction and magnitude of correlation. A correlation coefficient is a number between -1 and +1 that measures the degree of association between two variables (call them X and Y). A positive value for the correlation implies a positive association (large values of X tend to be associated with large values of Y and small values of X tend to be associated with small values of Y). A negative value for the correlation implies a negative or inverse association (large values of X tend to be associated with small values of Y and vice versa). In general, $r > 0$ indicates positive relationship, $r < 0$ indicates negative relationship while $r = 0$ indicates no relationship (or that the variables are independent and not related). Here $r = +1.0$ describes a perfect positive correlation and $r = -1.0$ describes a perfect negative correlation.

Value of r	Interpretation
$r=0$	The two variables do not vary together at all.
$0 < r < 1$	The two variables tend to increase or decrease together.
$r = 1.0$	Perfect correlation.
$-1 < r < 0$	One variable increases as the other decreases.
$r = -1.0$	Perfect negative or inverse correlation.

A correlation coefficient of $r=.50$ indicates a stronger degree of linear relationship than one of $r=.40$. Likewise a correlation coefficient of $r=-.50$ shows a greater degree of relationship than one of $r=.40$. Thus a correlation coefficient of zero ($r=0.0$) indicates the absence of a linear relationship and correlation coefficients of $r=+1.0$ and $r=-1.0$ indicate a perfect linear relationship. The value of correlation coefficient does not depend on the specific measurement units used; for example, the correlation between height and weight will be identical regardless of whether inches and pounds, or centimeters and kilograms are used as measurement units. The coefficient of correlation can be calculated with the help of different methods. The most commonly used methods are Pearson's product moment correlation coefficient and Spearman's rank order correlation. These methods would be discussed in next chapter. The coefficient of correlation 'r' is given by the formula

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

2.4.5 Example

The following example illustrates this idea.

A study was conducted to find whether there is any relationship between the weight and blood pressure of an individual. The following set of data was arrived at from a clinical study. Let us determine the coefficient of correlation for this set of data. The first column represents the serial number and the second and third columns represent the weight and blood pressure of each patient.

S. No.	Weight	Blood Pressure
1.	78	140
2.	86	160
3.	72	134
4.	82	144
5.	80	180
6.	86	176
7.	84	174
8.	89	178
9.	68	128
10.	71	132

Solution:

x	y	x ²	y ²	xy
78	140	6084	19600	10920
86	160	7396	25600	13760
72	134	5184	17956	9648
82	144	6724	20736	11808
80	180	6400	32400	14400
86	176	7396	30976	15136
84	174	7056	30276	14616
89	178	7921	31684	15842
68	128	4624	16384	8704
71	132	5041	17424	9372
796	1546	63,776	243036	1242069

Then

$$r = \frac{10(124206) - (796)(1546)}{\sqrt{[(10)(63776) - (796)^2][(10)(243036) - (1546)^2]}}$$

$$\begin{aligned} &= \frac{11444}{\sqrt{(1144)(40244)}} \\ &= 0.5966 \end{aligned}$$

Here, we can see that the correlation coefficient between weight and blood pressure has been found to be 0.5966. There is positive association between weight and blood pressure.

2.4.6 Interpretation of the correlation coefficient

To interpret correlations, four pieces of information are necessary.

- The numerical value of the correlation coefficient.

Correlation coefficients can vary numerically between 0.0 and 1.0. The closer the correlation is to 1.0, the stronger the relationship between the two variables. A correlation of 0.0 indicates the absence of a relationship.

- The sign of the correlation coefficient.

A positive correlation coefficient means that as variable 1 increases, variable 2 increases, and conversely, as variable 1 decreases, variable 2 decreases. In other words, the variables move in the same direction when there is a positive correlation. A negative correlation means that as variable 1 increases, variable 2 decreases and vice versa. In other words, the variables move in opposite directions when there is a negative correlation.

- The statistical significance of the correlation.

A statistically significant correlation is indicated by a probability value of less than .05. This means that the probability of obtaining such a correlation coefficient by chance is less than five times out of 100, so the result indicates the presence of a relationship.

- The effect size of the correlation.

For correlations, the effect size is called the coefficient of determination and is defined as r^2 . The coefficient of determination can vary from 0 to 1.00 and

indicates that the proportion of variation in the scores can be predicted from the relationship between the two variables.

A correlation can only indicate the presence or absence of a relationship, not the nature of the relationship and Correlation is not causation. There is always the possibility that a third variable influenced the results.

Closer the coefficients are to +1.0 and -1.0, greater is the strength of the relationship between the variables. As a rule of thumb, the following guidelines on strength of relationship are often useful (though many experts would somewhat disagree on the choice of boundaries).

Value of r	Strength of relationship
-1.0 to -0.5 or 1.0 to 0.5	Strong
-0.5 to -0.3 or 0.3 to 0.5	Moderate
-0.3 to -0.1 or 0.1 to 0.3	Weak
-0.1 to 0.1	None or very weak

Correlation is only appropriate for examining the relationship between meaningful quantifiable data (e.g. air pressure, temperature) rather than categorical data such as gender, favorite color etc.

2.4.7 Assumptions and Limitations

The correct use of the coefficient of correlation depends heavily on the assumptions made with respect to the nature of data to be correlated and on understanding the principles of forming this index of association. Correlation is a central measure within the general linear model of statistics. It can be employed for measurement of relationships in countless applied settings. However, in situations where its assumptions are violated, correlation becomes inadequate to explain a given relationship. These assumptions mandate that the distributions of both variables should be normal and that the scatter-plots should be linear and homoscedastic.

2.4.7.1 Assumptions

- **Linear relationship:**

The relation between two variables is said to be **linear** if the change of one unit in one variable result in the corresponding change in the other variable over the entire range of values. For example consider the following data.

X	2	4	6	8	10
Y	7	13	19	25	31

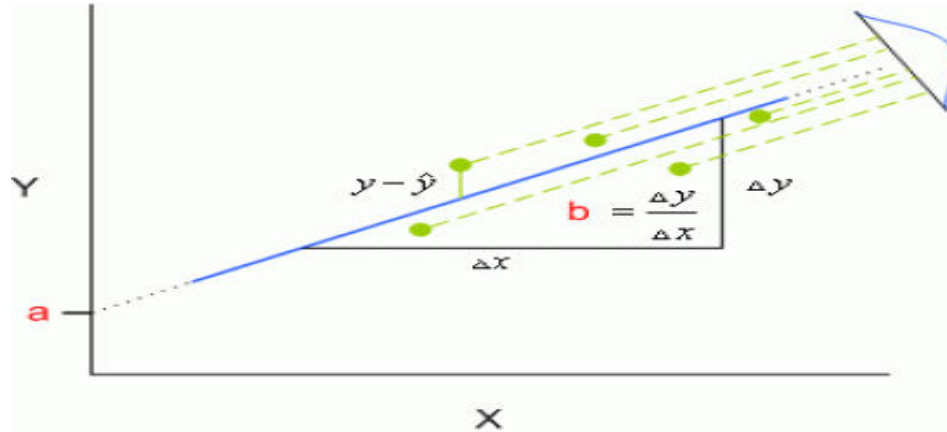
Thus, for a unit change in the value of x, there is a constant change in the corresponding values of y and the above data can be expressed by the relation

$$y = 3x + 1$$

In general two variables x and y are said to be **linearly related**, if there exists a relationship of the form

$$y = a + bx$$

where 'a' and 'b' are real numbers. This is nothing but a straight line when plotted on a graph sheet with different values of x and y and for constant values of a and b. Such relations generally occur in physical sciences but are rarely encountered in economic and social sciences. Thus, if the quantum of change in one variable has a ratio of change in the quantum of change in the other variable then it is known as linear relationship. Graphical representation of the linear relationship is given below:



It is assumed that the x-y scatter graph of points for the two variables being correlated can be better described by a straight line than by any curvilinear function. To the extent that a curvilinear function would be better, Pearson's r and other linear coefficients of correlation will understate the true correlation, sometimes to the point of being useless or misleading. Linearity can be checked visually by plotting the data.

- **Homoscedasticity:**

That is, the error variance is assumed to be the same at any point along the linear relationship. Otherwise the correlation coefficient is a misleading average of points of higher and lower correlation,

- **No outliers:**

Outlier cases can attenuate correlation coefficients. Scatterplots may be used to spot outliers visually. A large difference between Pearsonian correlation and Spearman's ρ may also indicate the presence of outliers.

- **Minimal measurement error:**

It is assumed since low reliability attenuates the correlation coefficient. By definition, correlation measures the systematic covariance of two variables. Measurement error usually, with rare chance exceptions, reduces systematic covariance and lowers the correlation coefficient. This lowering is called attenuation.

- **Similar underlying distributions:**

Similar underlying distributions are assumed for purposes of assessing strength of correlation. That is, if two variables come from unlike distributions, their correlation may be well below +1 even when data pairs are matched as perfectly as they can be while still conforming to the underlying distributions. Thus, the larger the difference in the shape of the distribution of the two variables, the more the attenuation of the correlation coefficient and the more the researcher should consider alternatives such as rank correlation. This assumption may well be violated when correlating an interval variable with a dichotomy or even an ordinal variable.

- **Normal distributions:**

Common underlying normal distributions should be there, for purposes of assessing significance of correlation. Also, for purposes of assessing strength of correlation, note that for non-normal distributions the range of the correlation coefficient may not be from -1 to +1. The central limit theorem demonstrates, however, that for large samples, indices used in significance testing will be normally distributed even when the variables themselves are not normally distributed, and therefore significance testing may be employed. The researcher may wish to use Spearman or other types of nonparametric rank correlation when there are marked violations of this assumption, though this strategy has the danger of attenuation of correlation.

- **Interval level data:**

Scores on all the variables should at least be on interval scale.

2.4.7.2 Limitations

While 'r' (correlation coefficient) is a powerful tool, it has to be handled with care due to following limitations.

- It only measures linear relationship. It is therefore perfectly possible that while there is strong non linear relationship between the variables, r is close to 0 or

even 0. In such a case, a scatter diagram can roughly indicate the existence or otherwise of a non linear relationship.

- One has to be careful in interpreting the value of 'r'. For example, one could compute 'r' between the size of shoe and intelligence of individuals, heights and income. Irrespective of the value of 'r', it makes no sense and is hence termed chance or non-sense correlation.
- 'r' should not be used to say anything about cause and effect relationship. Put differently, by examining the value of 'r', we could conclude that variables X and Y are related. However the same value of 'r' does not tell us if X influences Y or the other way round. Statistical correlation should not be the primary tool used to study causation, because of the problem with third variables.

Self Check Exercise

Q1: What do you mean by correlation coefficients?

Q2: what are the various types of correlations?

Q3: What are the basic assumptions regarding data for applying correlation analysis?

2.4.8 Let us sum up

Correlation Analysis involves various methods and techniques used for studying and measuring the extent of the relationship between the two variables. Statistical correlation is a statistical technique which tells us if two variables are related. If the change in one variable is accompanied by a change in the other, then the variables are said to be correlated. If the values of the two variables deviate in the same direction i.e. if an increase (or decrease) in the values of one variable results, on an average, in a corresponding increase (or decrease) in the values of the other variable the correlation is said to be positive. Correlation between two variables is said to be negative or inverse if the variables deviate in opposite direction. When the two variables are independent and the change in one variable has no effect in other

variable, then the correlation between these two variables is known as Zero Correlation. The correlation coefficient, r , quantifies the direction and magnitude of correlation. A correlation coefficient is a number between -1 and +1 that measures the degree of association between two variables (call them X and Y). The correct use of the coefficient of correlation depends heavily on the assumptions made with respect to the nature of data to be correlated and on understanding the principles of forming this index of association. While ' r ' (correlation coefficient) is a powerful tool, it has to be handled with care due to its limitations.

2.4.9 Keywords

1. Statistics – it refers to methods and rules for organizing and interpreting quantitative observations. Statistics is a collection of a bunch of mathematical techniques that help to analyze and present data.

2. Correlation- is a statistical tool which studies the relationship between two variables and Correlation Analysis involves various methods and techniques used for studying and measuring the extent of the relationship between the two variables. It determines the extent to which values of the two variables are "proportional" to each other.

3. Positive correlation- If the values of the two variables deviate in the same direction i.e. if an increase (or decrease) in the values of one variable results, on an average, in a corresponding increase (or decrease) in the values of the other variable the correlation is said to be positive.

4. Normal distributions:

Common underlying normal distributions should be there, for purposes of assessing significance of correlation. Also, for purposes of assessing strength of correlation, note that for non-normal distributions the range of the correlation coefficient may not be from -1 to +1.

2.4.10References

- Statistics in Psychology and Education by S.K. Mangal.
- Statistics in Psychology and Education by H.E. Garrett.

Web Links

<http://www.edugyan.in/2017/03/correlational-research-and-its.html>

<https://www.simplypsychology.org/correlation.html>

<https://byjus.com/jee/correlation-coefficient/>

LESSON NO. 2.5

**TYPES OF CORRELATION: PRODUCT MOMENT
CORRELATION
AND RANK ORDER CORRELATION**

Lesson Structure

- 2.5.0 Objective
- 2.5.1 Introduction
- 2.5.2 Pearson's product moment correlation
 - 2.5.2.1 Assumptions of Pearson's product moment correlation coefficient
 - 2.5.2.2 Calculations of Pearson product-moment correlation:
 - 2.5.2.3 Example
 - 2.5.2.4 Testing the Significance of a Correlation
- 2.5.3 Rank Order Correlation:
 - 2.5.3.1 Assumptions of the Spearman's rank correlation coefficient
 - 2.5.3.2 Calculations of rank order correlation
 - 2.5.3.3 Example
 - 2.5.3.4 Significance and Interpretation
 - 2.5.3.5 Merits and demerits of Rank order correlation
- 2.5.4 Let us sum up
- 2.5.5 Keywords
- 2.5.6 References

2.5.0 Objective

As mentioned in previous chapter, Correlation' is a statistical tool which studies the relationship between two variables and it determines the extent to which values of the two variables are "proportional" to each other. Correlation Analysis involves

various methods and techniques used for studying and measuring the extent of the relationship between the two variables. The present chapter would primarily be focused on two such methods to calculate correlation coefficients. First is the Pearson's product moment correlation and second is the Spearman's rank order correlation. In this chapter, the procedure to calculate and interpret correlation coefficients would be discussed.

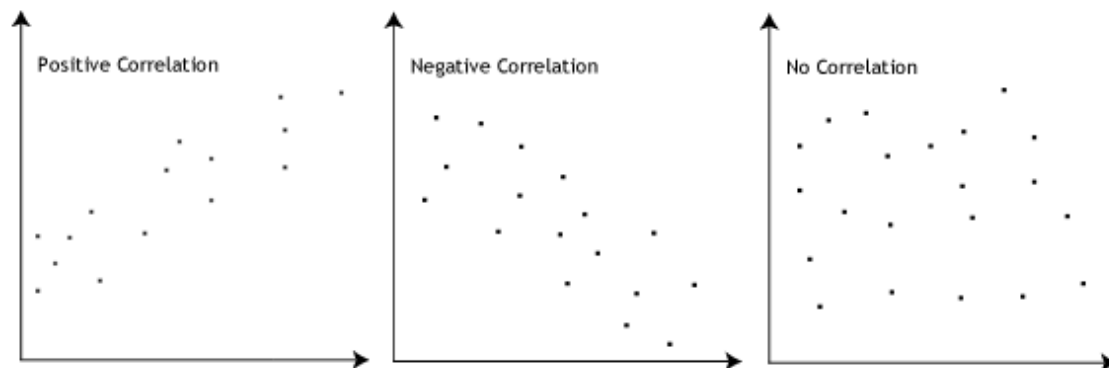
2.5.1 Introduction

Statistical correlation is a statistical technique which tells us if two variables are related. If the change in one variable is accompanied by a change in the other, then the variables are said to be correlated. If the values of the two variables deviate in the same direction i.e. if an increase (or decrease) in the values of one variable results, on an average, in a corresponding increase (or decrease) in the values of the other variable the correlation is said to be positive. Correlation between two variables is said to be negative or inverse if the variables deviate in opposite direction. That is, if the increase in the variables deviate in opposite direction. That is, if increase (or decrease) in the values of one variable results on an average, in corresponding decrease (or increase) in the values of other variable. When the two variables are independent and the change in one variable has no effect in other variable, then the correlation between these two variables is known as Zero Correlation. The statistics used to measure the relationship is called correlation coefficient or 'r' which measures the degree of association between the two values of related variables given in the data set. The correlation coefficient, r , quantifies the direction and magnitude of correlation. A correlation coefficient is a number between -1 and +1 that measures the degree of association between two variables (call them X and Y). Several different correlation coefficients can be calculated, but the two most commonly used are Pearson's product moment correlation coefficient and Spearman's rank correlation coefficient. Descriptions of both the coefficients are given below.

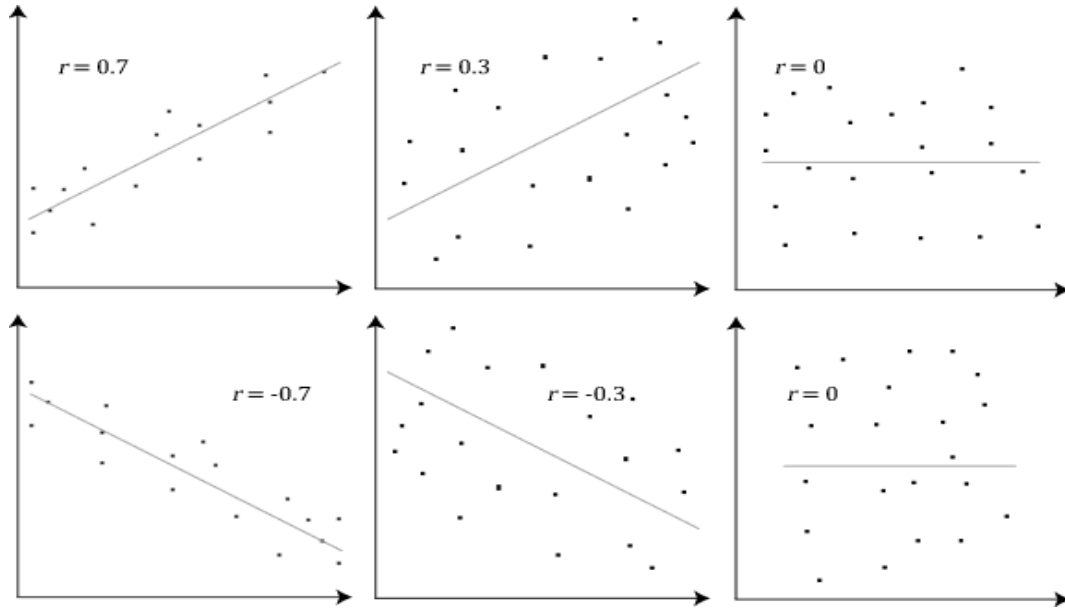
2.5.2 Pearson's product moment correlation

An important aspect of correlation is how *strong* it is. The strength of a correlation is measured by the **correlation coefficient r** . Another name for r is the **Pearson product moment correlation coefficient** in honor of Karl Pearson who developed

it about in 1900. The Pearson product-moment correlation coefficient (or Pearson correlation coefficient for short) is a measure of the strength of a linear association between two variables and is denoted by r . Basically, a Pearson product-moment correlation attempts to draw a line of best fit through the data of two variables, and the Pearson correlation coefficient, r , indicates how far away all these data points are to this line of best fit. The Pearson correlation coefficient, r , can take a range of values from +1 to -1. A value of 0 indicates that there is no association between the two variables. A value greater than 0 indicates a positive association, that is, as the value of one variable increases so does the value of the other variable. A value less than 0 indicates a negative association, that is, as the value of one variable increases the value of the other variable decreases. This is shown in the diagram below



The stronger the association of the two variables the closer the Pearson correlation coefficient, r , will be to either +1 or -1 depending on whether the relationship is positive or negative, respectively. There is considered a strong correlation if the correlation coefficient is greater than 0.8 and a weak correlation if the correlation coefficient is less than 0.5. Different relationships and their correlation coefficients are shown in the diagram below.



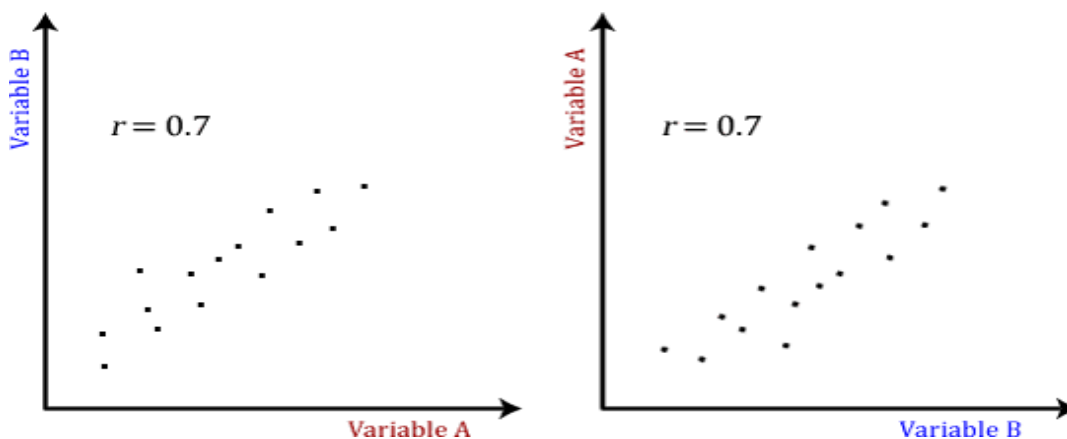
12.2.1 Assumptions of Pearson's product moment correlation coefficient

There are five assumptions that are made with respect to Pearson's correlation:

- The variables must be either interval or ratio measurements
- The variables must be approximately normally distributed
- There is a linear relationship between the two variables.
- Outliers are either kept to a minimum or are removed entirely.
- There is homoscedasticity of the data, that is, the error variance is assumed to be the same at any point along the linear relationship. Otherwise the correlation coefficient is a misleading average of points of higher and lower correlation,

To calculate Pearson's correlation, two variables can be measured in entirely different units. For example, you could correlate a person's age with their blood sugar levels. Here, the units are completely different; age is measured in years and blood sugar level measured in mmol/L (a measure of concentration). Indeed, the calculations for Pearson's correlation coefficient were designed such that the units of measurement do not affect the calculation - this allows the correlation coefficient to be comparable and not influenced by the units of the variables used. 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. For example, you might want to find out whether basketball performance is correlated to a person's height. You might, therefore, plot a graph of performance against height and calculate the Pearson correlation coefficient. Lets say, for example, that $r = .67$. That is, as height increases so does basketball performance. This makes sense. However, if we plotted the variables the other way around and wanted to determine whether a person's height was determined by their basketball performance (which makes no sense) we would still get $r = .67$. This is because the Pearson correlation coefficient makes no account of any theory behind why you chose the two variables to compare. This is illustrated below:



2.5.2.2

Calculations of Pearson product-moment correlation:

To calculate a correlation coefficient, you normally need three different sums of squares (SS). The sum of squares for variable X, the sum of square for variable Y, and the sum of the cross-product of XY. The **sum of squares for variable X** is:

The **sum of squares for variable Y** is:

$$SS_{YY} = \sum (y_i - \bar{y})^2 \quad SS_{XX} = \sum (x_i - \bar{x})^2$$

The **sum of cross product** is:

$$SS_{XY} = \sum (x_i - \bar{x})(y_i - \bar{y})$$

The **correlation coef**

$$r = \frac{SS_{XY}}{\sqrt{(SS_{XX})(SS_{YY})}}$$

One another formula is derived from the formula mentioned above is :

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

Where:

- N = number of pairs of scores
- $\sum xy$ = sum of the products of paired scores
- $\sum x$ = sum of x scores
- $\sum y$ = sum of y scores
- $\sum x^2$ = sum of squared x scores
- $\sum y^2$ = sum of squared y scores

2.5.2.3 Example

Let's assume that we want to look at the relationship between two variables, height (in inches) and self esteem. Perhaps we have a hypothesis that how tall you are effects your self esteem Let's say we collect some information on twenty individuals Height is measured in inches. Self esteem is measured based on the average of 10 1-to-5 rating items (where higher scores mean higher self esteem). Here's the data for the 20 cases:

Person	Height	Self Esteem
1	68	4.1
2	71	4.6
3	62	3.8
4	75	4.4
5	58	3.2
6	60	3.1
7	67	3.8
8	68	4.1
9	71	4.3
10	69	3.7
11	68	3.5

12	67	3.2
13	63	3.7
14	62	3.3
13	60	3.4
16	63	4.0
17	65	4.1
18	67	3.8
19	63	3.4
20	61	3.6

Now we're ready to compute the correlation value with the formula mentioned above
Let's look at the data we need for the formula. Here's the original data with the other necessary columns:

Person	Height (x)	Self Esteem (y)	x*y	x*x	y*y
1	68	4.1	278.8	4624	16.81
2	71	4.6	326.6	5041	21.16
3	62	3.8	235.6	3844	14.44
4	75	4.4	330	5625	19.36
5	58	3.2	185.6	3364	10.24
6	60	3.1	186	3600	9.61
7	67	3.8	254.6	4489	14.44
8	68	4.1	278.8	4624	16.81
9	71	4.3	305.3	5041	18.49
10	69	3.7	255.3	4761	13.69
11	68	3.5	238	4624	12.25
12	67	3.2	214.4	4489	10.24
13	63	3.7	233.1	3969	13.69
14	62	3.3	204.6	3844	10.89
13	60	3.4	204	3600	11.56
16	63	4	252	3969	16

17	65	4.1	266.5	4225	16.81
18	67	3.8	254.6	4489	14.44
19	63	3.4	214.2	3969	11.56
20	61	3.6	219.6	3721	12.96
Sum =	1308	75.1	4937.6	85912	285.45

The first three columns are the same as in the table above. The next three columns are simple computations based on the height and self esteem data. The bottom row consists of the sum of each column. This is all the information we need to compute the correlation. Here are the values from the bottom row of the table (where N is 20 people) as they are related to the symbols in the formula:

Now, when we put these values into the formula given above, we get the following (I show it here tediously, one step at a time) :

$$r = \frac{20(4937.6) - (1308)(75.1)}{\sqrt{[20(85912) - (1308*1308)][20(285.45) - (75.1*75.1)]}}$$

$$r = \frac{98752 - 98230.8}{\sqrt{[1718240 - 1710864][5709 - 5640.01]}}$$

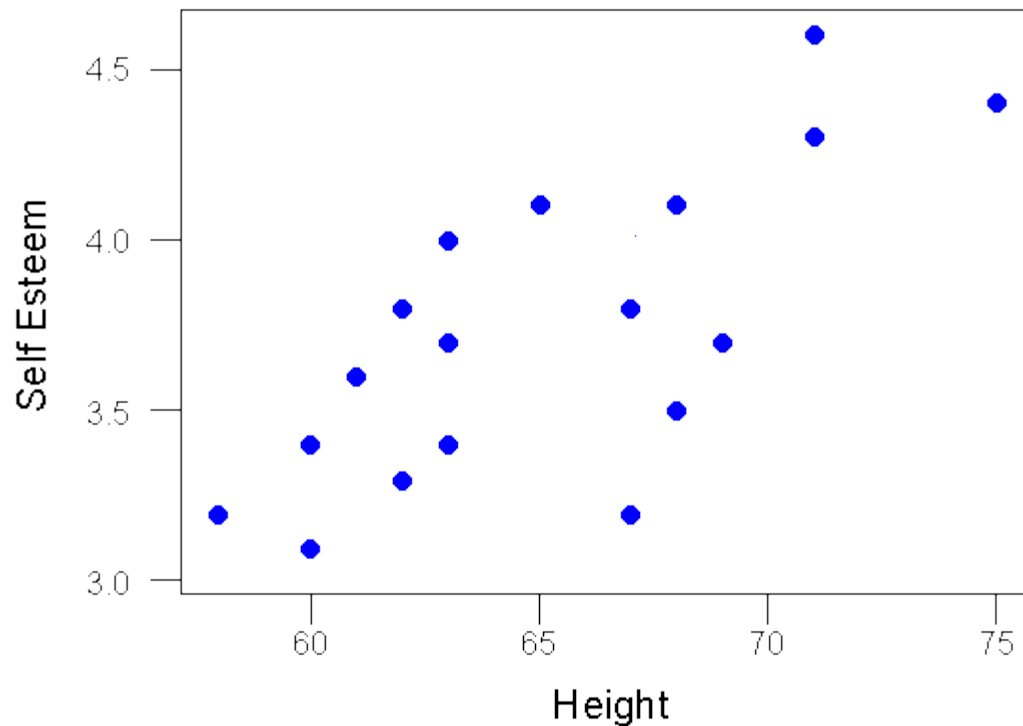
$$r = \frac{521.2}{\sqrt{[7376][68.99]}}$$

$$r = \frac{521.2}{\sqrt{508870.2}}$$

$$r = \frac{521.2}{713.3514}$$

$$r = .73$$

So, the correlation for our twenty cases is 0.73, which is a fairly strong positive relationship. It can also be observed in the following graph that both variables have positive relationship as the data line is move up from left to right.



2.5.2.4 Testing the Significance of a Correlation

Once you've computed a correlation, you can determine the probability that the observed correlation occurred by chance. That is, you can conduct a significance test. Most often you are interested in determining the probability that the correlation is a real one and not a chance occurrence. In this case, you are testing the mutually exclusive hypotheses:

Null Hypothesis:	$r = 0$
Alternative Hypothesis:	$r < > 0$

The easiest way to test this hypothesis is to find a statistics book that has a table of critical values of r . Most introductory statistics texts would have a table like this. As in all hypotheses testing, you need to first determine the significance level. Here, I'll use the common significance level of $\alpha = .05$. This means that I am conducting a test where the odd that the correlation is a chance occurrence is no more than 5 out of 100. Before we look up the critical value in a table, the degrees of freedom or

df has to be computed. The df is simply equal to $N-2$ or, in this example, is $20-2 = 18$. Finally, it has to be decided whether we are doing a one-tailed or two-tailed test. In this example, since we have no strong prior theory to suggest whether the relationship between height and self esteem would be positive or negative, we'll opt for the two-tailed test. With these three pieces of information -- the significance level ($\alpha = .05$), degrees of freedom ($df = 18$), and type of test (two-tailed) --we can now test the significance of the correlation we found. When we look up this value in the handy little table at the back of any statistics book we find that the critical value is .4438. This means that if our correlation is greater than .4438, we can conclude that the odds are less than 5 out of 100 that this is a chance occurrence. Since our correlation of .73 is actually quite a bit higher, we conclude that it is not a chance finding and that the correlation is "statistically significant" (given the parameters of the test). I can reject the null hypothesis and accept the alternative.

The given type of correlation we have illustrated here is known as the Pearson Product Moment Correlation. It is appropriate when both variables are measured at an interval level and fulfill other assumptions. However there are a wide variety of other types of correlations for the circumstances where these assumptions are not fulfilled. For instance, if you have two ordinal variables, you could use the rank order correlation (ρ) or the Kendall rank order Correlation (τ). When one measure is a continuous interval level one and the other is dichotomous (i.e., two-category) you can use the Point-Biserial Correlation. Here, in this chapter let us discuss about the most commonly used type, i.e. Spearman rank Order Correlation

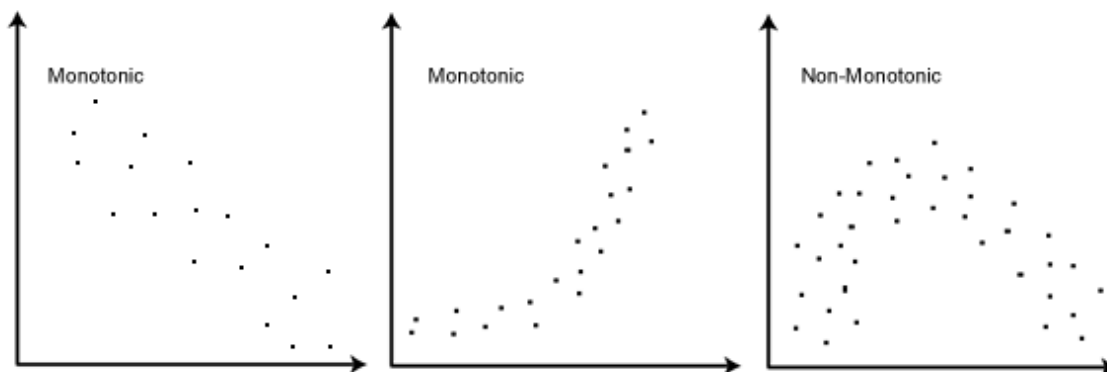
2.5.3 Rank Order Correlation:

Rank correlation coefficient is also a technique which can be used to summarize the strength and direction (negative or positive) of a relationship between two variables. The rank order correlation coefficient uses the *ranking* of the data, i.e. what position (rank) the data point takes in an ordered list from the minimum to maximum values, rather than the actual data values themselves. In statistics, rank order correlation is also known as **Spearman's rank correlation coefficient** or **Spearman's ρ** , named after Charles Spearman and often denoted by the Greek letter ρ (ρ). It is a non-parametric measure of statistical association between two

variables because it can be used with data that violate some assumptions of parametric tests. For instance, to test for a rank order relationship between two quantitative variables when concerned that one or both variables is ordinal (rather than interval) and/or not normally distributed or when the sample size is small. Thus, it is used in the same data situation as a Pearson's correlation, except that it is used when the data are either importantly non-normally distributed, the measurement scale of the dependent variable is ordinal (not interval or ratio), or from a too-small sample.

2.5.3.1 Assumptions of the Spearman's rank correlation coefficient

Two variables that are ordinal, interval or ratio are required. Although you would normally hope to use a Pearson product-moment correlation on interval or ratio data, the Spearman correlation can be used when the assumptions of the Pearson correlation are markedly violated. A second assumption is that there is a monotonic relationship between your variables. Monotonic relationship is a relationship that does one of the following: (1) as the value of one variable increases so does the value of the other variable or (2) as the value of one variable increases the other variable value decreases. Examples of monotonic and non-monotonic relationships are presented in the diagram below.



A monotonic relationship is an important underlying assumption of the Spearman rank-order correlation. It is also important to recognize the assumption of a monotonic relationship is less restrictive than a linear relationship (an assumption that has to be met by the Pearson product-moment correlation). The middle image

above illustrates this point well: A non-linear relationship exists but the relationship is monotonic and is suitable for analysis by Spearman's correlation but not by Pearson's correlation.

2.5.3.2 Calculations of rank order correlation

Calculation of Spearman's rank-order correlation depends on two conditions i.e. whether: (1) your data does not have tied ranks or (2) your data has tied ranks. The formula for when there are no tied ranks is:

$$\rho = 1 - \frac{6 \sum d_i^2}{n(n^2 - 1)}$$

where d_i = difference in paired ranks and n = number of cases.

Steps of calculations:

- Create a table from your data.
- Rank the two data sets. Ranking is achieved by giving the ranking '1' to the biggest number in a column, '2' to the second biggest value and so on. The smallest value in the column will get the lowest ranking. This should be done for both sets of measurements.
- Tied scores (if any) are given the mean (average) rank. For example, the three tied scores of 62 are ranked fifth in order of price, but occupy three positions (fifth, sixth and seventh) in a ranking hierarchy of ten. The mean rank in this case is calculated as $(5+6+7) \div 3 = 6$.
- Find the difference in the ranks (d): This is the difference between the ranks of the two values on each row of the table. The rank of the second value (price) is subtracted from the rank of the first
- Square the differences (d^2) to remove negative values and then sum them ($\sum d^2$).
- Calculate the coefficient using the formula given above. The answer will always be between 1.0 (a perfect positive correlation) and -1.0 (a perfect negative correlation).

2.5.3.3 Example

A teacher is interested in those who do the best at English also do better in Math (assessed by exam) students in English are also the best performers in Math. She records the scores of her 10 students as they performed in end-of-year examinations for both English and Math. Let us find out the Spearman rank-order correlation between scores on English and math with the help of data given below. There are no ties on any scores.

English	56	75	45	71	62	64	58	80	76	61
Math	66	70	40	60	65	56	59	77	67	63

To find our required values of formula, we will complete the following table:

English (marks)	Math (marks)	Rank (English)	Rank (math)	d	d ²
56	66	9	4	5	25
75	70	3	2	1	1
45	40	10	10	0	0
71	60	4	7	3	9
62	65	6.5	5	1	1
64	56	5	9	4	16
58	59	8	8	0	0
80	77	1	1	0	0
76	67	2	3	1	1
61	63	6.5	6	1	1

Where d = difference between ranks and d² = difference squared.

We then calculate the following:

$$\sum d_i^2 = 25 + 1 + 9 + 1 + 16 + 1 + 1 = 54$$

We then substitute this into the main equation with the other information as follows:

$$\rho = 1 - \frac{6 \sum d_i^2}{n(n^2 - 1)}$$

$$\rho = 1 - \frac{6 \times 54}{10(10^2 - 1)}$$

$$\rho = 1 - \frac{324}{990}$$

$$\rho = 1 - 0.33$$

$$\rho = 0.67$$

Hence, we have a ρ of 0.67. This indicates a strong positive relationship between the ranks individuals obtained in the math and English exam. That is, the higher you ranked in math, the higher you ranked in English also, and vice versa.

2.5.3.4 Significance and Interpretation: What does this value of 0.67 mean?

The closer value is to +1 or -1, the stronger the likely correlation. A perfect positive correlation is +1 and a perfect negative correlation is -1. The R value of 0.67 suggests a fairly strong positive relationship. A further technique is now required to test the significance of the relationship. The value of **0.67** must be looked up on the Spearman Rank significance table below as follows:

- Work out the 'degrees of freedom' you need to use. This is the number of pairs in your sample minus 2 (n-2). In the example it is 8 (10 - 2). Now plot your result on the table.
- If it is below the line marked 5%, then it is possible your result was the product of chance and you must reject the hypothesis.
- If it is above the 0.1% significance level, then we can be 99.9% confident the correlation has not occurred by chance.
- If it is above 1%, but below 0.1%, you can say you are 99% confident.
- If it is above 5%, but below 1%, you can say you are 95% confident (i.e. statistically there is a 5% likelihood the result occurred by chance).

In the example, the value 0.67 gives a significance level of slightly less than 5%. That means that the probability of the relationship you have found being a chance event is **about 5 in a 100**. You are 95% certain that your hypothesis is correct. The reliability of your sample can be stated in terms of how many researchers completing the same study as yours would obtain the same results: 95 out of 100.

2.5.3.5 Merits and demerits of Rank order correlation

Merits

- It is easy to calculate.
- It is simple to understand.
- It can be applied to any type of data. Qualitative or Quantitative. Hence correlation with qualitative data such as honesty, beauty can be found.
- This is most suitable in case there are two attributes.

Demerits

- It is only an approximately calculate measure as actual values are not used for calculations.
- For large samples it is not convenient method.
- Combined r of different series cannot be obtained as in case of mean and S.D.
- It cannot be treated further algebraically.

Rank order correlation provides a very quick and easy to use method of modeling correlation between variables. The technique is 'distribution independent', i.e. it has no effect on the shape of the correlated distributions. One is therefore guaranteed that the distributions used to model the correlated variables will still be replicated. But the fact that two variables correlate cannot prove anything - only further research can actually prove that one thing affects the other, make its use somewhat doubtful. Despite the inherent disadvantages of rank order correlation, its ease of use and speed make it a very practical technique.

Self Check Exercise

1. The following are the heights and weights of 13 students of a class. Calculate Pearson's r .

Sr no.	Heights (Cms)	Weights(Kgs)
1	170	65
2	172	66
3	181	69
4	137	55
5	130	51
6	168	63
7	166	61
8	175	67
9	177	70
10	165	75
11	163	72
12	132	64
13	161	71
14	173	52
13	174	60

2. The ranks of two sets of variables (Heights and Weights) are given below. Calculate the Spearman rank difference correlation coefficient r .

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	13
Heights	9	10	13	3	1	8	7	13	14	6	5	2	4	11	12
Weights	8	9	11	3	1	6	5	10	12	13	14	7	13	2	4

Exercise :

Write short answers on :

- (a) Define Correlation Coefficient.
- b) Write any two characteristics of correlation.
- (c) Formula for calculating Pears on product moment correlation.

2.5.4 Summary

Correlation Analysis involves various methods and techniques used for studying and measuring the extent of the relationship between the two variables. Several different correlation coefficients can be calculated, but the two most commonly used are Pearson's product moment correlation coefficient and Spearman's rank correlation coefficient. The Pearson product-moment correlation coefficient (or Pearson correlation coefficient for short) is a measure of the strength of a linear association between two variables and is denoted by r . Basically, a Pearson product-moment correlation attempts to draw a line of best fit through the data of two variables, and the Pearson correlation coefficient, r , indicates how far away all these data points are to this line of best fit. The Pearson correlation coefficient, r , can take a range of values from +1 to -1.

There are a wide variety of other types of correlations for the circumstances where these assumptions are not fulfilled. For instance, if you have two ordinal variables, you could use the rank order correlation (ρ) or the Kendall rank order Correlation (τ). When one measure is a continuous interval level one and the other is dichotomous (i.e., two-category) you can use the Point-Biserial Correlation. Rank order correlation or spearman's rank order correlation is a non-parametric measure of statistical association between two variables because it can be used with data that violate some assumptions of parametric tests. For instance, to test for a rank order relationship between two quantitative variables when concerned that one or both variables is ordinal (rather than interval) and/or not normally distributed or when the sample size is small. Thus, it is used in the same data situation as a Pearson's correlation, except that it is used when the data are either importantly non-normally distributed, the measurement scale of the dependent variable is

ordinal (not interval or ratio), or from a too-small sample. Rank order correlation provides a very quick and easy to use method of modeling correlation between variables.

2.5.5 Keywords

1. Pearson's product moment correlation

An important aspect of correlation is how *strong* it is. The strength of a correlation is measured by the **correlation coefficient r** . The Pearson product-moment correlation coefficient (or Pearson correlation coefficient for short) is a measure of the strength of a linear association between two variables and is denoted by r .

2. Rank Order Correlation:

Rank correlation coefficient is also a technique which can be used to summarize the strength and direction (negative or positive) of a relationship between two variables. The rank order correlation coefficient uses the *ranking* of the data, i.e. what position (rank) the data point takes in an ordered list from the minimum to maximum values, rather than the actual data values themselves.

3. Merits of Rank order correlation

- It is easy to calculate.
- It is simple to understand.
- It can be applied to any type of data. Qualitative or Quantitative. Hence correlation with qualitative data such as honesty, beauty can be found.
- This is most suitable in case there are two attributes.

2.5.6 References

- Statistics in Psychology and Education by S.K. Mangal.
- Statistics in Psychology and Education by H.E. Garrett.

Web links

<https://www.youtube.com/watch?v=fPEwt4lpdOg>

<https://www.statisticshowto.com/probability-and-statistics/correlation-coefficient-formula/spearman-rank-correlation-definition-calculate/>

https://en.wikipedia.org/wiki/Spearman%27s_rank_correlation_coefficient

Significance Between Means (Large Sample, Correlated And Uncorrelated)

- 2.6.0 Objective
- 2.6.1 Introduction.
- 2.6.2 Standard Error of difference between independent or uncorrelated means.
 - 2.6.2.1 Steps involved in calculating Standard Error of difference between two independent means.
 - 2.6.2.2 Examples for calculating Standard Error of difference between two independent means.
- 2.6.3 Standard Error of difference between two correlated means.
 - 2.6.3.1 Steps involved in calculating standard error of difference between two independent means.
 - 2.6.3.2 Examples for calculating standard error of difference between two independent means.
- 2.6.4 Summary

STANDARD ERROR OF DIFFERENCE BETWEEN MEANS

2.6.0 Objective

The objective of this chapter is to understand the concept of significance of difference between means. Earlier we covered topic of standard error of mean. But in this case, we are dealing with two groups, and roughly we intent to know whether these two groups differ significantly in their means or not. We shall be covering numerical examples on standard error of difference between means in case of large sample (independent and correlated).

2.6.1 Introduction

It is to discover whether two groups differ significantly in mean performance. To enable us to say with confidence that there is a difference between the means of the population from which the samples were drawn, we need to know the standard error of difference of mean of the two samples-

Formula:

$$SE_{M1-M2} = \sqrt{SE_{M1}^2 + SE_{M2}^2}$$

M_1 = Mean of first group

M_2 = Mean of second group

SE_{M1-M2} = Standard error of a difference between mean one and mean two.

2.6.2 Standard Error of difference independent or uncorrelated mean

Means are uncorrelated or independent when computed from different samples or from uncorrelated test administered to the same sample. The formula for

calculating standard error in this case is $SE_{M1-M2} = \sqrt{SE_{M1}^2 + SE_{M2}^2}$

Where $SE_{M1} = \frac{\sigma_1}{\sqrt{N1}}$ $SE_{M2} = \frac{\sigma_2}{\sqrt{N2}}$

σ_1 = standard deviation of first group, σ_2 = SD of second group

N_1 = sample size of first group

N_2 = sample size of second group

SE_{M1} = standard error of mean of first group

SE_{M2} = standard error of mean of second group

2.6.2.1 Steps involved in calculating Standard Error of difference between two independent means:

- | | |
|---|--|
| <p>Group I</p> <p>N_1</p> <p>M_1</p> <p>σ_1</p> | <p>Group II</p> <p>N_2</p> <p>M_2</p> <p>σ_2</p> |
|---|--|
- 1) $SE_1 = \frac{\sigma_1}{\sqrt{N_1}}$ $SE_2 = \frac{\sigma_2}{\sqrt{N_2}}$
 - 2) $SE_{M1-M2} = \sqrt{(SE_{M1})^2 + (SE_{M2})^2}$
 - 3) $t = \frac{M_1 - M_2}{SE_D}$
 - 4) If $N_1 = N_2$ then $df = N-1$
If $N_1 \neq N_2$ then $df = (N_1 - 1) + (N_2 - 1)$
 - (5) Refer to t-table (Table D in Garret and Woodworth (1981)) at 0.05 level of significance and at 0.01 level of significance, corresponding to your df value.

If calculated (t) is greater than table value of t then there is significant difference between the two means.

If calculated (t) is lesser than table value of t then there is non-significant difference between the two means.

2.6.2.2 Examples for calculating Standard Error of Difference between independent means.

Question Girls sample

$N = 95, M = 29.21, \sigma = 11.56$

Boys sample,

$N = 83, M = 30.92, \sigma = 7.81.$

Find the standard error of difference between means & check its significance.
First steps is to find the standard error of M_1 and M_2 .

Formula:-

$$SE_{M1} = \frac{\sigma_1}{\sqrt{N_1}} \quad SE_{M2} = \frac{\sigma_2}{\sqrt{N_2}}$$

$$SE_{M1} = \frac{11.56}{\sqrt{95}} = 1.18 \quad SE_{M2} = \frac{7.81}{\sqrt{83}} = 0.85$$

Standard error of mean

$$SE_{M1-M2} = \sqrt{SE_{M1}^2 + SE_{M2}^2}$$

$$= \sqrt{(1.18)^2 + (0.85)^2}$$

$$= \sqrt{1.39 + 0.72}$$

$$= \sqrt{2.11} = 1.45$$

Significance

Next step is to find the value of t

$$t = \frac{D}{SE_{M1-M2}}$$

D = Difference in the given means of the two groups

$$= \frac{30.92 - 29.21}{1.45}$$

$$= 1.17$$

Because $N_1 \neq N_2$

$$df = N_1 + N_2 - 2$$

$$= 95 + 83 - 2 = 176$$

See table for checking significance of difference between means at $df = 176$, if calculated t value is higher then table value, there is a significant difference between mean of boys and girls.

Example : An intelligence test was administrated to science and arts students

Science students: $N = 75$, $M = 100$, $SD = 4.5$

Arts students: $N = 80$, $M = 90$, $SD = 3.5$

Find whether the difference between means of science and arts students on intelligence test are significant or not:

$$SE_{M1} = \frac{4.5}{\sqrt{75}} \quad SE_{M2} = \frac{3.5}{\sqrt{80}}$$

$$= \frac{4.5}{8.66} \quad = \frac{3.5}{8.94}$$

$$= 0.51 \quad = 0.39$$

Standard error of difference:

$$\begin{aligned}
 SE_{M1-M2} &= \sqrt{SE_{M1}^2 + SE_{M2}^2} \\
 &= \sqrt{(0.51)^2 + (0.39)^2} \\
 &= \sqrt{0.26 + 0.15} \\
 &= \sqrt{0.41} \\
 &= 0.64 \\
 t &= \frac{D}{SE_{M1} - SE_{M2}} \\
 &= \frac{100 - 90}{0.64} \\
 &= \frac{10}{0.64} = 15.62
 \end{aligned}$$

Next step is to check significance, $df = 75 + 80 - 2 = 153$. See the table and interpret the results.

2.6.3 To find the Standard Error of difference between two Correlated Means.

In this case, same groups administered the same test on two different occasions. It is also called single group method.

Formula:-

$$SE_{M1-M2} = \sqrt{SE_{M1}^2 + SE_{M2}^2 - 2r_{12} SE_{M1} \times SE_{M2}}$$

SE_{M1} = Standard error of mean of group 1.

SE_{M2} = Standard error of mean of group 2.

r_{12} = Correlation coefficient depicting correlation of group 1 and group 2.

2.6.3.1 Steps involved in calculating standard error of difference between two correlated means:

- | Group I | Group II |
|------------|------------|
| N_1 | N_2 |
| M_1 | M_2 |
| σ_1 | σ_2 |
- 1) $SE_{M1} = \frac{\sigma_1}{\sqrt{N_1}}$ $SE_{M2} = \frac{\sigma_2}{\sqrt{N_2}}$
 - 2) $SE_{M1-M2} = \sqrt{SE_{M1}^2 + SE_{M2}^2 - 2r SE_{M1} \times SE_{M2}}$
here (r) i.e. coefficient of correlation is given.
 - 3) $t = \frac{M_1 - M_2}{SE_{M1-M2}}$
 - 4) If $N_1 = N_2$ then $df = N - 1$

If $N_1 \neq N_2$ then $df = (N_1 - 1) + (N_2 - 1)$

- 5) Refer to t-table, at 0.05 level of significance and at 0.01 level of significance.

If calculated (t) is greater than table value of t, tabulated (t), then the difference between means is significant.

If calculated t value is less than table value of t, then the difference between means is non-significant.

2.6.3.2 Examples for calculating Standard Error of difference between two correlated means:-

Question : At the beginning of school years the mean score of a group of 64 children on an educational achievement test was 45 with the standard deviation of 6. At the end of school year the mean scores on the same test was 50 with SD of 5. The correlation between scores on the initial and final test was 0.60. Has the class made significant improvement during the year?

Solution:-

$$\begin{array}{ll} SD_1 = 6 & SD_2 = 5 \\ N_1 = 64 & N_2 = 64 \\ M_1 = 45 & M_2 = 50 \end{array}$$

$$SE_{M_1} = \frac{\sigma_1}{\sqrt{N_1}} = \frac{6}{\sqrt{64}} = \frac{6}{8} = .75$$

$$SE_{M_2} = \frac{\sigma_2}{\sqrt{N_2}} = \frac{5}{\sqrt{64}} = \frac{5}{8} = .62$$

$$\begin{aligned} SE_{M_1-M_2} &= \sqrt{SE_{M_1}^2 + SE_{M_2}^2 - 2r_{12}SE_{M_1} \times SE_{M_2}} \\ &= \sqrt{(.75)^2 + (.62)^2 - 2 \times .60 \times .75 \times .62} \\ &= \sqrt{.56 + .38 - .558} \\ &= \sqrt{.32} \\ &= 0.62 \end{aligned}$$

$$t = \frac{50 - 45}{0.62} = \frac{5}{0.62} = 8.06$$

Because $N_1 = N_2$,

So $df = N - 1$

$$df = 64 - 1 = 63$$

See the table value of t, corresponding to $df = 63$ at 0.05 and 0.01 levels. If calculated t value is higher than table value, difference between the means is significant.

Example 2

In a first trial of practice period, 25 twelve years olds have a mean score of 80 and SD of 8 upon a digit-symbol learning test. On the tenth trial, the mean is

84 and standard deviation is 10. The r between scores is 0.40. Is the gain in scores significant across trials?

Group I

$$M_1 = 80$$

$$N_1 = 25$$

$$SD_1 = 8$$

$$r = 0.40$$

Group II

$$M_2 = 84$$

$$N_2 = 25$$

$$SD_2 = 10$$

$$SE_{M1} = \frac{\sigma_1}{\sqrt{N_1}}$$

$$= \frac{8}{\sqrt{25}}$$

$$= 1.6$$

$$SE_{M2} = \frac{\sigma_2}{\sqrt{N_2}}$$

$$= \frac{10}{\sqrt{25}}$$

$$= 2$$

$$SE_{M1-M2} = \sqrt{(1.6)^2 + (2)^2 - 2 \times 0.40(1.6 \times 2)} = \sqrt{2.56 + 4 - 0.8 \times 3.2}$$

$$= 2$$

$$t = \frac{M_1 - M_2}{SE_{M1-M2}} = \frac{80 - 84}{2} = \frac{-4}{2} = -2$$

Check significance at 0.05 and 0.01 levels and interpret the results.

Self Check Exercise

- Q.1. A test of creativity was given to artists and doctors. Find whether the two groups differ significantly on mean creativity?

Artists

$$N_1 = 30$$

$$M_1 = 27$$

$$SD_1 = 4$$

Doctors

$$N_2 = 30$$

$$M_2 = 20$$

$$SD_2 = 3$$

- Q.2. A group of 40 students were given anxiety test and their mean score on anxiety was 100, and $SD = 5$. After given counseling sessions for 2 months, the same group was given the same anxiety test, and mean score came out be 60, and $SD=2$. Find whether there is a significant difference in mean anxiety on two occasions.

Questions for Practice

Attempt any three Questions.

- Q1. Discuss the Characteristics of Correlation.
 Q2. Explain various types of Correlation.
 Q3. Find out Correlation with the help of rank difference method.

Sr. No.	Marks in Maths	Marks in English
1	64	72
2	52	60
3	45	50
4	68	66
5	76	80
6	85	80
7	90	85
8	72	65
9	48	40

- Q4. Write short notes on the following
 (a) Positive Correlation
 (b) Formula for Pearson Product Moment Method.
 (c) Zero Correlation

2.6.4 Let us sum up

In this lesson, we learnt the concept of standard error of difference between means. Also, we learnt how to apply this concept to data given to us. Numericals on standard error of difference between means were illustrated for independent and correlated samples.

2.6.5 Keywords

1. t- test:

A t-test is an inferential statistic that is used to see if there is a significant difference in the means of two groups that are related in some way. It's most commonly employed when data sets, such as those obtained by flipping a coin 100 times, are expected to follow a normal distribution and have unknown variances. A t-test is a hypothesis testing technique that can be used to assess an assumption that is applicable to a population.

2. Level of significance:

The significance level, also known as alpha or, is a measure of how strong the evidence must be in your sample before you can reject the null hypothesis and declare that the impact is statistically significant. Before starting the experiment, the researcher sets the significance level.

3. Degrees of Freedom:

The maximum number of logically independent values, or values with the ability to fluctuate, in a data sample is referred to as degrees of freedom.

Degrees of Freedom are frequently addressed in relation to several types of hypothesis testing in statistics, such as the Chi-Square test.

4. Standard Error:

The estimated standard deviation of a statistical sample population is the standard error (SE) of a statistic. The standard error is a statistical term that describes how well a sample distribution represents a population when standard deviation is used. In statistics, a sample mean differs from the population's real mean; this difference is known as the standard error of the mean.

References :

- 1 Garreett : Statistics in Psychology and Education.
- 2 Guilford and Fruchter : Fundamental Statistics in Psychology and Education.

Web Links

<https://www.investopedia.com/terms/t/t-test.asp>

<https://www.britannica.com/science/Students-t-test>

<https://www.sciencedirect.com/topics/medicine-and-dentistry/student-t-test>

<https://www.slideshare.net/kiran2512/t-test-27876640>

Type Setting :

Department of Distance Education, Punjabi University, Patiala.