ASSESSMENT OF MUSCULOSKELETAL DISCOMFORTS EXPERIENCED BY THE ROSE FARM WORKERS OF VADODARA DISTRICT

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ELIZA UPADHYAYA

ASSESSMENT OF MUSCULOSKELETAL DISCOMFORTS EXPERIENCED BY THE ROSE FARM WORKERS OF VADODARA DISTRICT

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By

ELIZA UPADHYAYA

Department of Family and Community Resource Management

Faculty of Family and Community Sciences

The Maharaja Sayajirao University of Baroda

Vadodara

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Eliza Upadhyaya

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CHAPTER 1

INTRODUCTION

“In joy or sadness, flowers are our constant friends.”

— Okakura Kakuzo

Introduction

Floriculture is the part of the horticulture industry, concerned with commercial production, marketing, and sale of bedding plants, cut flowers, potted flowering plants, foliage plants, flower arrangement, and noncommercial home gardening **(Jebessa,2018).**

Since ancient times, flowers and ornamental plants have always remained a fundamental part of the social fabric of human life. Man has traditionally used flowers for revealing his innermost feelings to God and deities or presenting to the beloved ones or complimenting anyone or versifying any conceivable emotion. Whereas, gardens with ornamental and flowering plants are being noted in most of our historical references. Garlands of olive leaves were worn by the roman soldiers and Lotus blossoms decorated the Egyptian royalty. Backyards growing of flower dates back to ancient times like the Ramayana and the Mahabharata. Flowers and plants are cultivated for aesthetic purposes for their fragrance, perfumes and Medicines. Therefore, it can be said that floriculture is a primitive farm activity with immense potential for generating remunerative self–employment among small and marginal farmers **(Sharma,2015).**

India has a long tradition of floriculture. References to flowers and gardens are found in ancient Sanskrit classics like the Rig Veda (C3000-2000 BC), Ramayana (C1200-1300BC), Mahabharata (before 4th century BC), Shudraka (100BC), Ashvagodha (C100AD), Kalidas (C400 AD) and Saraghdhara (C1200 AD) **(Dadlani,2019).** The social and economic aspects of flower growing were, however, recognized much later. The offering and exchange of flower on all social occasions, in place of worship and their use for the adornment of hair by women

and home decoration, have become an integral part of human living. The changing lifestyles and increased urban affluence, floriculture has assumed a definite commercial status in recent times and during the past three decades particularly. Appreciation of the potential of commercial floriculture has resulted in the blossoming of this field into a viable agri-business option **(Dadlani,2019)**.

Availability of natural resource like diverse agro-climate condition permits the production of a wide range of temperature and tropical flowers, almost throughout the year in some part of the country. Improved communication facilities have increased their availability in every part of the country. The commercial activity of production and marketing of floriculture product is also a source of gainful and quality employment to scores of people **(Yilmaz,2011).**

Among flowers, Rose (Rosa indicia) is one of nature's beautiful creations and is universally commended as the “Queen of Flower”, commonly belongs to family Rosacea. Roses have the everlasting beauty and true essence of nature, always inspire to be glorious, and charming. William Shakespeare (20^{th} century), the famous poet, praise Rose as a sweet-smelling flower which takes us to an altogether different world. Undoubtedly, Rose is the most beautiful and complement flower, which talks about love and happiness. It signifies love beauty and selflessness and is a perfect gift to show gratitude and care. Rose is a woody and thorny shrub plant and has more than hundreds of species **(Horn, 1992)** and over 2000 cultivars **(Kim et al.,2003).** They form a group of plants that can be erect shrubs, climbing, or trailing with stems that are often armed with sharp spikes. Rose plants range in size from compact, miniature Roses, to climbers that can reach seven meters in height. Different species hybridize easily and are used in the development of the wide range of garden Roses.

Roses are the oldest fragrant flowers propagated as ornamental and commercial plants by the Rose farm workers. There are many varieties of Roses that are cultivated all over the world like Hybrid Tea, Floribunda, Miniature, Climbers, Gladiators, Queen Elizabeth, Bull's red, Grand gala **(Mboleza,2020)**. Different types of Rose having the different attractive shape, sizes, bewitching

colours and most delightful fragrance are used as ornamental plants. Roses are the most important perennial garden plants which are used in almost all parts of the world as bushes, standards, climbers, hedges and edges and hangers in rock gardens. Similarly, Roses are offered for its medicinal property used in Ayurveda. Roses are also used for various commercial purpose like, Rosewater is an important commercial product made from Rose petals which are used as an eye drop and have been shown to have excellent benefits for people with eye problems. Rosewater has antiseptic and antibacterial properties, which mean it can help wounds heal faster, by keeping them clean and fighting injections **(Saymour,2017).** Researches have shown that Rosewater has antidepressant and anti-anxiety properties. It is believed to induce sleep and to have a mesmerizing effect similar to that of the pharmaceuticals drug diazepam. It has been used to treat several mental health conditions, including depression, grief, stress, tension. It is also used as a perfume and confectionery. It has the property of cooling the body and is often used in eye lotions and eye drops for its soothing qualities. It is also used in drinking water and sprinkled on the guests at weddings, feasts and other social functions (**Hogan, 2019**).

Bulgarian Rose is largely used in perfuming soaps and cosmetics. Apart from its medicinal property Roses are also used in food consumption. Rose petals are also preserved for direct consumption, by making Gulkand which is prepared by pounding equal proportions of petals and white sugar. It is considered both tonic and laxative. Dried Rose petals are known as “Pankhuri” which is occasionally used for preparing sweetened cold drinks. Rose are also used for making potpourri, Rose vinegar, Rose petal wine, jams, jellies etc. That is why the commercial cultivation of Rose has earned its due importance throughout the present era as compared to other flowering plants. Therefore, farm workers are very much interested to grow Roses due to its high demand to get a good amount of profit by Rose cultivation.

Rose Cultivation in Gujarat

Rose is one of the top-selling flowers in the global flower trade and stands first among the commercial cut flowers. As far as in Gujarat state, the majority of

the land area is under traditional flower cultivation like Desi Rose, Kashmiri Rose, Marigold, Lily and Jasmine. The major Rose growing districts of Gujarat are Bharuch, Vadodara, Ahmedabad, Kheda, and Chota Udaipur, where Roses are Cultivated in 4178 hectares and production is 38865 MT (Director of Horticulture, Government of Gujarat, Year-Wise Estimated Area, Production and Productivity Annual Report 2018-19).

Vadodara being the second-highest district known for Rose production mainly cultivate two types of Roses namely Kashmiri Rose and Desi Rose which are very much in demand. In Kashmiri Rose plants numerous buds and flowers are grown in one branch of the flowering plant and spikes. Due to which in the least investment the production of Kashmiri Roses is done in huge amount and it is also beneficial for the cultivators. Kashmiri Rose is cultivated in every season and it requires very less maintenance for growing Rose plants. The height of the Kashmiri Rose plants is minimum 2ft. and have fewer thrones compared to other Rose crops. Whereas, the Desi Gulab is about 2-3 inches wide, very delicate and sturdier-looking and requires lots of maintenance. Therefore, the farmers in Vadodara district are more engrossed in the production of Kashmiri Roses.

Musculoskeletal Discomforts faced by Rose Farm Workers

In most of the countries, farming is recognized as one of the most hazardous industries because farming activities have the highest risks of work-related musculoskeletal discomforts than other occupational activities. The nature of farming activities is leading to awkward body posture including leaning, Kneeling, crawling, bending, twisting to one side, lifting and carrying heavy loads and repeated motions that can result in physical stress and traumatic injuries. Musculoskeletal discomforts are one of the most common types of injuries developed due to damage of tissue, muscles, nerves, tendons, ligaments, joints, cartilage or spinal discs.

According to Kroemer, (1989)

> "Musculoskeletal discomforts (MSDs) are described as a 'discomfort, impairment, disability or persistent pain in joints, tendons, muscles and other soft tissues with or without physical manifestations".

According to the Workplace Health and Safety Regulations (WHS, 2019)

> "A musculoskeletal discomfort, as defined in the Workplace Health and Safety (WHS) Regulations, means an injury to, or a disease of, the musculoskeletal system, whether occurring suddenly or over time. It does not include an injury caused by crushing, entrapment (such as fractures and dislocations) or cutting resulting from the mechanical operation of plants".

It takes several weeks, months or years to develop the musculoskeletal discomforts which result from one-time trauma or cumulative traumas such as repetitive motion, excessive force, awkward or prolonged sitting and standing postures **(Ansari and Sheikh, 2014).**

The Rose farm workers of Floriculture Industry performs numerous labour-intensive jobs such as land preparation, removing of stalks and stubbles, levelling, making of field compartment, preparation of channels for irrigation, digging of Rose crop into land, manuring, weeding (plant to plant), pruning and budding, spraying of pesticides on Rose crop and lastly, harvesting of Rose crops in which Rose farm workers are involved in the task like of plucking, gathering, heaping of the Rose crop. Therefore, Rose cultivation and harvesting is considered to be a drudgery prone activity. Rose farm workers experience types of musculoskeletal discomforts due to repetitive task and physical load, which affect their health and productivity. In Rose harvesting, plucking, heaping and gathering of the Rose flower is considered as the severe most drudgery prone activity, where workers have to keep their posture in bending position from the back facing towards the ground for plucking the Roses. It leads them to severe pain in their backbone, leg, thighs and feet **(Ergonomics Practices, 2003).** According to **Jyotsna et al., (2005),** during Rose harvesting activity from morning till evening, workers usually adapts squatting posture and they continue to work in this posture for a long duration without adapting any other posture due to which they face severe pain in lower back and

knees. Whereas, **Osborne et al., (2012),** articulates that lower back pain is the most common MSD among the farmers and at the same time, some physical injuries also occur while working in a Rose farm because of plenty of thorns on Rose plants.

Vadodara being the second major district engaged in Rose cultivation, the present study emphases on the assessment of the Musculoskeletal Discomforts experienced by the Rose farm workers of Floriculture Industry in Vadodara.

Justification

Since primaeval periods flowers and ornamental plants have always remained an essential part of the social fabric of human life. Flowers and plants are cultivated for tempting purposes like the home decoration, fragrance, perfumes and Medicines. Therefore, it can be said that floriculture is a primaeval farm activity with immense potential for generating remunerative self–employment among small and marginal farmers. India as a long tradition of floriculture, but the social and economic aspect of flower growing was recognized much later. Among the flowers Roses are propagated as ornamental as well as commercial plants. The cultivation of Roses has grossed its due importance throughout the present era as compared to other flowering plants. Therefore, the farm workers are very much interested to invest in Rose cultivation due to its high demand to gain a good amount of profit.

The Rose farm workers of floriculture Industry performs abundant labour intensive jobs such as land preparation, removing of stalks and stubbles, levelling, compartment, preparation of channels for irrigation, digging of Rose crop into land, manuring, weeding of Rose crop (plant to plant), pruning and budding, pesticides spraying on Rose crop and lastly, harvesting the Rose in which Rose farm workers are involving in the task of plucking, gathering, heaping of the Rose crop. Therefore, Rose cultivation and harvesting is considered to be a drudgery prone activity.

Rose farm workers experience types of musculoskeletal discomforts due to repetitive task and physical load, which affect their health and productivity. In Rose

farm, plucking, heaping and gathering of the Rose flower is considered to be the severe most drudgery prone activity, where workers have to keep their posture in bending position from the back facing towards the ground for plucking the Rose due to which it can lead to severe pain in their backbone, leg and thigh and feet.

During the review of literature, it was found that various studies are done in abroad which focuses on “Assessment of Musculoskeletal Disorder among flower harvesters and processing workers of the Flower Industry in Kenya”(**Njue et al.,2017),** “Impact of Socio-Economic significance, Environmental view of Floriculture Industries and Economic implication of Floriculture in Ethiopia” (**Gobie,2019**)**,** "Musculoskeletal Disorder in the Flower Industry" **Mburu et al., (2017).**

Similarly, related studies have also been conducted in India focusing on research areas such as “Production Technology of Rose in Greenhouse” **(Kumari and Choudhary,.2014),**“Assessment of Drudgery in Rose Cultivation among Farmers of Rajsamand District”**(Sharma, 2016)**,“Assessment of Musculoskeletal Disorder and Occupational Hazard carried out by flower plucking women engaged in Floriculture in Faizabad District of Uttar Pradesh**”(Mishra and Singh,2017)**, “Determination of Work Posters with different Ergonomics Risk Assessment Methods in Forest Nurseries”(**Unver-Okan,et.al,.2017**), “Risk Factors for Musculoskeletal Disorders in Manual Harvesting Farmers of Rajasthan” **(Jain et.al,.2018**), “Assessment of the Health problems of Workers engaged in different Floriculture activities in Fatehabad, Hisar and Panipat District of Haryana”(**Shilla and Sehgal,2018).**

Whereas, studies like “Work posture analysis and Musculoskeletal problems experienced by the students of Architecture profession”(**Datar, 2003**), "Ergonomic Assessment and Modification of Technologies used by Women in Organic Farming" (**Chauhan,2005**), "Ergonomic Assessment of Occupational health Hazards faced by Health Care Workers of selected Hospitals"(**Krishna,2006**), "Ergonomic Assessment of Farming activities performed by Women Farm workers during Harvesting of Kharif Paddy Crops in Vadodara”(**Makwana, 2012**), were

conducted earlier in the Department of Family and Community Resource Management, Faculty of Community Science, The Maharaja Sayajirao University of Vadodara.

However, a dearth was found in researches done on musculoskeletal discomforts experienced by the Rose farm workers of the floriculture industry of Gujarat. Vadodara being the second major district involved in cultivation of Kashmiri Rose Crop, the present research study aims to assess the Musculoskeletal Discomforts experienced by the Rose farm workers of Vadodara district in Gujarat.

The present study will be helpful to the floriculture farm workers those who are continuously engaged in cultivation and harvesting of flowers to increase their productivity and at the same time, it will help in reducing their Physical Workload and Musculoskeletal Discomforts.

The present study will also be valuable to the Krishi Vigyan Kendras who are involved in imparting knowledge and awareness to the Rose farm workers.

The present study will also contribute to the field of Ergonomics as it dealt with ergonomic problems and postural difficulties of Rose farm workers.

Lastly, the present study will be beneficial to the Family and Community Resource Management as, Ergonomics, Human Resource Management, Extension in Resource Management taught at Master's levels.

Statement of the Problem

The present investigation was aimed to assess the Musculoskeletal Discomforts experienced by the Rose farm workers during Rose harvesting process of selected farms of Vadodara District.

Specific objectives of the Study

1. To collect the background information (age, height and weight) of the Rose farm workers engaged in Rose harvesting process (Plucking, Gathering and Heaping) of selected Rose farms.
2. To examine the duration of maintaining the adopted postures by the Rose farm workers during Rose harvesting process (Plucking, Gathering and Heaping) of selected Rose farms of Vadodara District.
3. To analyze the frequency and duration of rest pauses taken; distance covered; time spent; the quantity of Rose harvested and frequency of repetition of the task done by the Rose farm workers during Rose harvesting process (Plucking, Gathering and Heaping) of selected Rose farms.
4. To assess the extent of Musculoskeletal Discomfort experienced by the Rose farm workers due to the distance covered; time spent; the quantity of Rose harvested and frequency of repetition of the task done by the Rose farm workers during Rose harvesting process (Plucking, Gathering and Heaping) of selected Rose farms.
5. To suggest the coping strategies to overcome Musculoskeletal Discomfort experienced by the Rose farm workers of selected Rose farm of Vadodara District.

Delimitations of the Study

For Rose Farms:

1. The present study was limited to the selected Rose farms of Vadodara districts having a minimum of ten farm workers engaged in rose harvesting process.
2. The present study was limited to the selected Rose farms of Vadodara districts engaged in Kashmiri Rose cultivation.
3. The present study was limited to those Rose farms having minimum production of Rose crops above 70 kg/day.

For Rose Farm workers:

1. The present study was limited to, those Rose farm workers who were above 18 years.
2. The present study was limited to those Rose farm workers who were engaged in Rose harvesting process (Plucking, Gathering and Heaping) and had a minimum of two years of work experience with the same crop.
3. The present study was limited to those Rose farm workers who were physically and mentally normal (not physically or mentally challenged) and especially females, not in the pregnancy stage.
4. The present study was limited to those Rose farm workers who were willing to participate in the research study.

Hypotheses of the Study

1. The situational variables (viz. time duration spent, distance covered, the quantity of Rose harvested, Repetition of the task performed while Rose harvesting process) vary with the personal variables (viz. gender, age, BMI and work experience) of the Rose farm workers.
2. There exists a difference in the intervening variable (duration of maintaining adopted posture during Rose harvesting) due to personal variables (viz. gender, age, BMI and work experience) of the Rose farm workers.
3. There exists a relationship between the intervening variable (duration of maintaining adopted posture during Rose harvesting process) and the situational variables (viz. time duration spent, distance covered, the quantity of Rose harvested and frequency of repetitive task performed while Rose harvesting process).
4. There exists a difference in the musculoskeletal discomfort experienced by the Rose farm workers during Rose harvesting process due to their personal variable (Gender).

5. There exists a relationship between the extent of musculoskeletal discomfort experienced by the Rose farm workers during Rose harvesting process with their personal variables (viz. age, BMI and work experience) and the situational variables (viz. time spent, distance covered, the quantity of Rose harvested and the frequency of repetitive task performed during harvesting process).


REVIEW
OF
LITERATURE

CHAPTER 2

REVIEW OF LITERATURE

A review of the literature is a description of the work done on the topic by accredited scholars and researchers. It is a condensed version of an exhaustive literature survey of technical writing and data from previous journals, articles, books, papers, and other researchers giving insight into the work done in the same area as that of the present study. Hence, a thorough review of the literature was undertaken to get familiarize with the prior work done in the area of the selected topic for research. This exercise substantiated fruitful in systematically planning the execution of the present study.

To make the presentation easier to understand, the chapter is presented under two heads viz. Theoretical Orientation with Empirical Research Studies.

2.1: Theoretical Orientation

2.1.1: Historical References and Origin of Rose Flower in the World

2.1.2: History of Floriculture Industry and Rose Cultivation in India

2.1.3: Rose Cultivation in Gujarat

2.1.4: Rose Cultivation Process and Tools Utilized

2.1.5:Musculoskeletal Discomforts and Postural Problems Experienced by Farm Workers of Floriculture Industry

2.1.6: Musculoskeletal Discomforts Experienced by the Rose Farm Workers

2.2: Empirical Research Studies

2.2.1: Research Studies conducted Abroad

2.2.2: Research Studies conducted in India

Conclusion

2.1 Theoretical Orientation

2.1.1: Historical References and Origin of Rose Flower in the World

Evidence of flowers dating back to the prehistoric era has been revealed through Flower Fossils. The traces of the association of flowers with humans were found during the Paleolithic age. Scientists have documented over 270,000 species of flowers that are living in the 21st Century (**Jermey,2004**).

The first fossils of flowering plants found were woody magnolia-like plants dating back 93 million years. Fossils of the tiny herb-like flower were found dating back 120 million years. Flowering plants, called angiosperms by scientists, were said to be varied and were found in most locations by the middle of the Cretaceous era more than146 million years ago. Numerous images of preserved flowers and flower parts have been found in fossils placed in Sweden, Portugal, England, Eastern, and Gulf coasts of the United States **(Ravinath, 2007).**

From the most primitive times, indeed throughout the history of civilization, people from around the world have held the rose close to their hearts. In the earliest time gardening was known as the planting of roses along the most travelled routes of early nomadic humans. Molecular biologists, using DNA molecules to estimate age, traced roses back some 200 million years ago. It is said that Cloris, goddess of flowers, crowned the rose as a queen of the flowers. Aphrodite presented a rose to her son Eros, the God of love since then the rose became a symbol of love and desire. Eros gave the rose to Hippocrates, the god of silence, to induce him not to gossip about his mother's amorous indiscretions. Thus, the rose also became the emblem of silence and secrecy. In the middle ages, a rose was put off from the ceiling of a council chamber, promising all present to secrecy, or sub-Rosa, "under the rose" (**Seabrook**, **2004**).

The cultivated Roses first appeared in Asian gardens more than 5,000 years ago. In ancient Mesopotamia, Sargon I, King of the Akkadians (2684-2630, B.C.) brought "vines, figs, and Rose trees" back from a military expedition beyond the River Tigris. Confucius wrote that during his life (551-479 B.C.), the Emperor of China owned over 600 books about the culture of Roses [1.]

The Chinese extracted oil of roses from the plants grown in the Emperor's garden. The oil was only used by nobles and dignitaries of the court. If a commoner were found in possession of even the smallest amount, he was condemned to death. Roses were introduced to Rome by the Greeks. During feasts, young men and women in Athens decorated a crown of roses and danced around the temple of Hymen to symbolize the innocence of the golden age. During Roman public games all the pathways were strewn with rose petals. Rich Romans provided for the maintenance of huge rose gardens for their gravesites, believing they were pleasing the Spirits of the Dead[2].

Egyptian wall paintings depicting roses have been found in tombs dating from the fifth century B.C. to Cleopatra's time. Cleopatra had a passion for everything Roman, and she is said to have scattered rose petals before Mark Anthony's feet. Nero was wild about roses. During lavish Roman dinner parties rose petals rained down from the ceilings of his banquet halls.

Roses were introduced to Europe during the Roman Empire, where they were mainly used for ornamental purposes. Early Christians saw the rose as a symbol of paganism, orgy, and lust. Tertullian wrote an entire volume against the flower and about 202A.D., and Clement of Alexandra forbade Christians to adorn themselves with roses. Slowly the Church absorbed some aspects of paganism by changing them into Christian. In Catholic litanies, the Virgin Mary is called "Rosa Mystica" **(Marianna,2007).**

King Childebert I, had a rose garden planted for the Queen in Paris. Charlemagne ordered the cultivation of Roses at many. Leo IX elected Pope in 1084, sent a Golden Rose to favoured monarchs, masterpieces created by the goldsmiths. Returning from the Seventh Crusade, Thibaut IV, Count of Brie and Champagne, and King of Navarre-1201-1253 brought back Rose bushes from Syria for his wife. Thereafter, the French embraced the cultivation of roses, especially the town of Rouen. The rose became an important heraldic symbol (**Marianna,2007**).

During the "War of the Roses," the house of work was symbolized by a white rose, and the House of Lancaster was symbolized by a red rose. Empress Josephine of

France started her rose collection at Malmaison in 1804 and within 10 years, she had collected every known species. By 1829 her garden contained 2,562 different roses. Passion for roses spread from France to the British Isles, then throughout Western Europe, and finally to America and Australia.

Rosehips, the fruit produced after the flowing season, were used for the prevention of scurvy, and today we make rose hips teas[3]. Interestingly oranges are looked up to for vitamin C supplements. Science has established that oranges contain 49 mg of vitamin C per 100 grams of pulp. However, rose hips from the species, Rosa rugose, contain 2,275 to 6,977 mg of vitamin C per 100 grams of pulp **(Ravinath.D, 2007).**

Mythological and Spiritual Significance of Rose Flowers

Flowers hold a very imperative position in our Hindu culture. Flowers, especially roses are seen as the supreme offering to divinity in its ideal form. Rose is referred to as 'Shivpriya' in our ancient Hindu scriptures, which means, the beloved of Lord Shiva, the destroyer of evil, and one of the holy trinities. Thus, there are numerous events, depicting the importance of Rose flowers to humanity, in their pursuit of divine growth, light, and salvation (**Ravinath.D, 2007**).

Another legend presents an interesting highlight of the significance of the flower in Hindu mythology. Once, Lord Vishnu was said to be bathing in a lake on earth when a Lotus bloomed, and from within, emerged Pithamaha Brahma who claimed that the Lotus was the prettiest flower one had ever seen. Accepting the claim of Brahma, Vishnu guided Brahma to Vaikunta and showed him a Rose bloom as a moonbeam, full of fragrance. Brahma had to change his views and accept the rose, as the prettiest bloom in the universe. Apart from Hinduism, in Christianity too, rose flowers are set in a high pedestal symbolizing purity and love. Therefore, rose flowers are a symbol and an instrument of human spirituality as well as mythological.

2.1.2 History of Floriculture Industry and Rose Cultivation in India

Floriculture is a discipline of horticulture concerned with commercial production, marketing, and sale of bedding plants, cut flowers, potted flowering plants, foliage plants, flower arrangements, and noncommercial home gardening.

According to **Getu, (2009),** flowers are luxurious crops with high Social, Cultural, and Religious value, and the growing of flowers has been practised in India from Centuries. The history of flower gardening began in India, with the arrival of the Mughals. Babar laid the foundation of the Mughal Empire in India in the year 1526 AD. Mughals used to celebrate their victories by laying down beautiful gardens, as a result, Babar established a garden at Panipat, after the victory over Ibrahim Lodi in 1526 AD. The garden at Agra called “Rambaugh Garden” is a memorial to Babar. The classic design of Mughal gardens was also established by Babar. The great Mughal ruler is also credited with the introduction of Persian rose in India. Akbar (1556-1605AD) built a new capital at Fatehpur Sikri, full of gardens, trees, and flowers. He was the first Mughal emperor to enter Kashmir and established a garden-Nasim Bagh, close to the Dal Lake. Jahangir (1605-1627AD) and Noor Jahan were great admirers of gardens and flowers. The “Tomb Garden” in Agra, the gardens at Shalimar, and Verinag in Kashmir were their establishments. Shah Jahan (1627-1658AD), was the architect of several beautiful gardens. The garden at Red Fort in Delhi, the garden around the Taj Mahal in Agra is his eternal gifts to the people of India. Shah Jahan's floral masterpiece was the Shalimar Gardens at Lahore, in Pakistan. Thus, the saga of the mighty Mughal Emperors is closely intertwined with the beautification of their cities and kingdoms with magnificent, well-laid flower gardens that endure till today.

In this context, the city of Jaipur, which was founded by Raja Sawai Jai Singh II (1727 AD) and was adorned with beautiful gardens around the prince palace. The ruler of Bundi in Rajasthan was also very fond of creating magnificent gardens. The Colonial rule of the British in India brought in a major change in the pattern of gardening. The British brought with them beautiful annual and bi-annual flowers such as carnation, verbena, dahlia, etc. Formal flower arrangements for interior decoration are the legacy of the British era. Even today, the English style is evident in the gardening patterns in India. The historical fame and grandeur of flowers and gardens in India have a long way to go before they reach a level of significance in modern times.

During the Mughal period, Babar and Jahangir introduced not only the Damask Rose from Persia, and trees like Chinar, Weeping Willows, Cyprus but also flowers like

roses, carnations, lilies, and tulips respectively. In 16th and 17th centuries the Europeans, notably the British, have laid the foundations for an organized growth of flower plants by setting up botanical gardens as under The Lalbagh Botanical Garden, Bangalore (1779), The Indian Botanical Garden, Sibpur, Kolkata (1787), The Lloyd Botanical Garden, Darjeeling (1878), and Botanical Garden, Ootacamund (1884). The existence of these gardens has not only contributed to the appreciation of gardens but also the richness of the variety of flora that our country has got endowed with over the years. These gardens not only stand as evidence of our nation's history but also as the rich endowments of flora that have come to India through these gardens.

Today, according to Indian Floriculture Market Forecast of 2019-2024 **(IMARC,2019)**, the Indian Floriculture market further is projected to reach INR 472 Billion by 2024, growing at a CAGR of 20.1 per cent during 2019-2024. A strong increase in the demand for cut and lose flowers has made floriculture as one of the important commercial trades in Indian agriculture [(4)]**.** Enormous genetic diversity, varied agro-climatic conditions, versatile human resources, etc., offers India a unique scope for judicious employment of existing resources and exploration of avenues yet untouched in the flower industry.

Rose Cultivation in India

Among flowers, rose (Rose Indica) is one of nature's beautiful creations and is universally commended as the "Queen of Flowers". Rose is certainly the best known and most popular of all garden flowers throughout the world and has been growing on this earth for millions of years. Rosacea is a huge plant family, which has hundreds of classes and over thousands of species including rose shrubs, Rose herbs, and Rose trees **(Leghari et, al, 2016).** Rose is a leading cut flower, that is grown commercially all over the world. It ranks first in the global cut flower trade. This flower has a worldwide consumption of more than 40 billion **(Singh,2009).** Rose has not only mentioned its position as the "Queen of Flowers" but also as the world's most favourite flower (**Kumari and Choudhary, 2014**).

Rose is a very momentous flower from various aspects. It is widely used throughout the world for love moments, medical purposes, cosmetics use, perfumes and allied products, food tonic supplement **(Leghari, et al., 2016)**.

In India, commercial cultivation of several species of roses has increased through the last three decades which has led to extensive use on all possible occasions. Modernization and growing western cultural influences have driven consumers to buy flowers on several occasions like valentine's day, marriages, anniversaries, birthdays, friendship day, Mother's Day, Father's Day, etc. Large scale consumption of flowers is also carried out throughout the country during religious festivals **(IMARC, 2019).**

According to the Agricultural & Processed Food Products Export Development Authority **(APFED,2015),** in India, the major flower producing areas are Maharashtra, Karnataka, Andra Pradesh, Haryana, Tamil Nadu, Rajasthan, Gujarat, and West Bengal. The total area under various floriculture cultivation was 249 thousand hectares in 2015-16. Production in 2015-16 of the loose and cut flower is estimated to be 1659 thousand tones and 484 thousand tones respectively, out of which, two varieties of Rose are grown in more than 400 acres of land. 10,000 Dutch and Kashmiri Rose are sent daily to different parts of the country from different regions. The Rose flowers are retailed at 70 per kg in peak season like October, November, December, and January. The flower is in huge demand in markets of Delhi, Mumbai, Bhopal, and some south Indian cities too **(Lakhani,2014).**

The successful commercial Rose cultivation process mostly depends on the varieties of Rose flowers. Various factors play a significant role in Rose cultivation like, the temperature is an important factor regulating the growth of the Rose plant. During the night time, the best temperature to keep the rose plant is between 15-18 ^{o}C, and during the day time temperature is between 20-25^{o}C. During winters, because of the low temperature, the quality of the rose flower is good. Similarly, humidity also plays an important role in the occurrence of pests and diseases affecting the growth and flowering. In case of higher humidity in the atmosphere, water drops accumulate on the Rose leaves which remain over there for a longer period leads to many fungal diseases.

Preparation of the soil is also the key to success in Rose cultivation. The ideal soil is preferred to be medium loam having sufficient organic matter, with a PH of 6.0 to 7.5. and free from gravel, stones, brick pieces, and other foreign materials. Normally Roses are planted at 60x60cm spacing. The beds or pits for Rose planting are prepared at least a month before the date of planting rose, preferably during May and June, so that the soil gets a thorough exposure to sun and air, and during the rainy season, it gets a chance to settle down before planting. The beds are prepared to a depth of 60-75 cm and a trench of 45-60 cm across is dug to 30 cm depth. Rose crops are harvested when the flower buds are in the half-open stage. For cut flowers, they are harvested at tight bud's stage and Harvesting is done by hand (**Aksh,2017**).

2.1.3 Rose Cultivation in Gujarat

In Gujarat state, the majority of the land area is under traditional flower cultivation like Desi rose, Kashmiri rose, Marigold, Lily, and Jasmine. The major Rose growing districts of Gujarat are Bharuch, Vadodara, Ahmedabad, Kheda, and Chota Udaipur, where roses are Cultivated in 4178 hectares and production is 38865 MT **(**Director of Horticulture, Government of Gujarat, year-wise estimated Area, Production and Productivity annual report 2018-19).

Vadodara being the second-highest district known for Rose production mainly cultivated two types of roses are cultivated such as Kashmiri rose and Desi rose which are very much in demand. In Kashmiri Rose plants numerous buds and flowers are grown in one branch of the flowering plant and spikes. Due to which in the least investment the production of Kashmiri roses is done in huge amounts and it is also beneficial for the cultivators. Kashmiri rose is cultivated in every season and it requires very less maintenance for growing rose plants. The height of the Kashmiri rose plants is a minimum of 2 ft. and have fewer thrones compared to other rose crops. Whereas, the desi Gulab is about 2-3 inches wide, very delicate, and sturdier-looking and requires lots of maintenance. Therefore, the farmers in the Vadodara district are more engrossed in the production of Kashmiri Roses.

Area wise Production of Roses in Gujarat.			
Sr. No	**Districts**	**Area (Ha)**	**Production (MT)**
South Gujarat			
1	Surat	60	573
2	Narmada	46	431
3	Bharuch	650	**6175**
4	Dang	55	452
5	Navsari	108	950
6	Valsad	253	**2004**
7	Tapi	50	450
Middle Gujarat			
1	Ahmedabad	446	**4451**
2	Anand	245	**2247**
3	Kheda	450	**4293**
4	Panchmahal	97	843
5	Dahod	232	**2227**
6	Vadodara	564	**5482**
7	Mahisagar	56	601
8	Chhota Udaipur	255	**2387**
North Gujarat			
1	Banaskantha	25	225
2	Patan	49	427
3	Mehsana	60	502
4	Sabarkantha	28	247
5	Gandhinagar	10	85
6	Aravalli	11	98
Saurashtra – Kutch			
1	Kutch	63	558
2	Surendranagar	15	125
3	Rajkot	26	224
4	Jamnagar	60	560
5	Porbandar	18	146
6	Junagadh	88	776
7	Amrelli	23	163
8	Bhavnagar	71	606
9	Morbi	12	116
10	Boated	8	64
11	Gir Somnath	27	220
12	Devbhumi Dwarka	17	159
	GRAND TOTAL	**4178**	**38865**

Source: ***https://doh.gujarat.gov.in, retrieved on 12 January 2020***

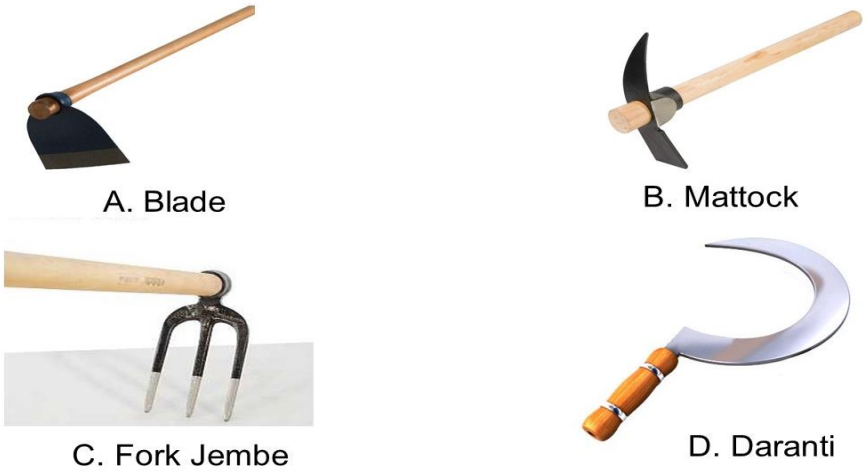
At present, approximately 300 boxes of 500 flowers are sent from Vadodara by train and road to other states daily. There is a very high demand for Kashmiri roses. Hence, the cultivation area of roses has increased tremendously **(Lakhani,2014).**

2.1.4 Rose Cultivation Process and Tools Utilized

Stage I: Removing of Stalks and Stubbles

The preparation of the soil is the key to success in roses. The ideal soil should be medium loam having sufficient organic matter, with a pH of 6.0 and 7.5. The soil should have a fine tilt up to a depth of 50 cm and good drainage facility. The soil must be free from gravel, stones, brick pieces, and other foreign material and exposed to the sun for at least a week. For carrying out the task different types of tools like Blade Jembe/Hoe, Mattock, Fork Jembe, Daranti are used for removing of stalks and stubbles, gravel, stones, brick pieces and foreign material during the Rose Cultivation **(Reddy,2015)**

Fig 1:Tools used for Removing of Stalks and Stubbles



Source:https://www.planetnatural.com/organic-gardening/rose-gardening (2012)

Stage II: Levelling of Soil

The soil should be ploughed and levelled. Levelling of soil break up the hard cultivation plot dirt and clear leaves or spread mulch during rose cultivation. Wooden Leveler is the indispensable tools used for levelling of soil.

Fig 2 : Tools used for Leveling of Soil

A. Wooden Leveller

B. Leveller Attached in Tractor

Source:https://www.planetnatural.com/organic-gardening/rose-gardening (2012)

Stage III: Compartment Binding of Soil

The beds or pits for planting are prepared at least a month before the date of planting. The preparation of beds taken up during May or June so that the soil gets exposure to sun and air, and during the rainy season, it gets a chance to settle down before planting. The beds are prepared to a depth of 60-75 cm and a trench of 45-60 cm across is dug to 30 cm depth. The soil should be thoroughly ploughed 20-30 cm deep and kept open to the sun for at least 15 days. Subsoiler and Iron ploughing are farming tools used for loosening or turning the soil before planting the Rose crops. A plough may have a wooden, iron, or steel frame, with a blade attached to cut and loosen the soil. **(Reddy,2015)**

Fig 3:Tools used for Compartment Binding of Soil

A. Subsoiler

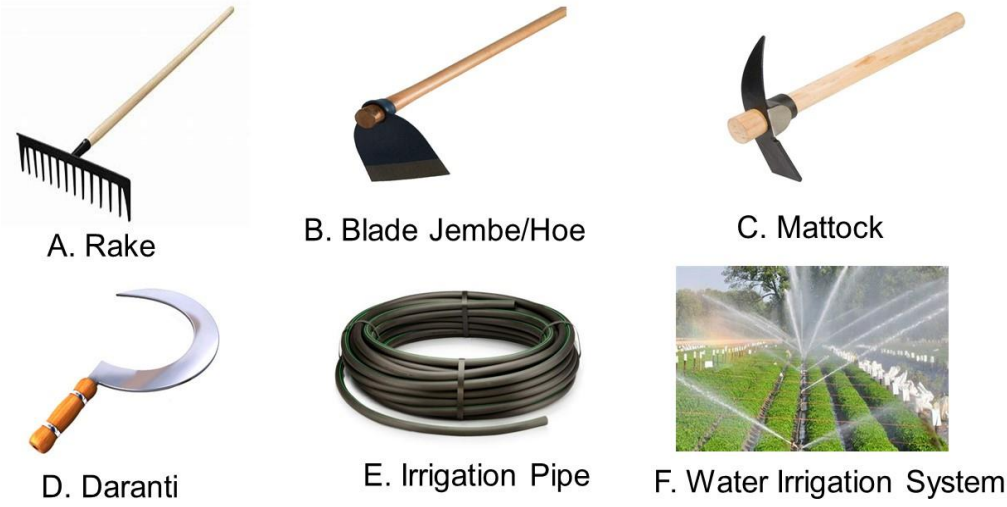
B. Iron Ploughing

Source:https://www.planetnatural.com/organic-gardening/rose-gardening (2012)

Stage IV: Preparation of Channels for Irrigation

Water requirement of roses depends upon soil type and seasons. Light soils always require more frequent irrigation than heavy soils. During summer, water requirement is more than winter. Therefore, irrigation is adjusted in a way that soil is moist but not wet. During the rainy season, watering is generally not done except during drought period. During winter, irrigation is done at about 7-10 days interval whereas during summer it should be done at an interval of 5-6 days. Heavy watering at comparatively long intervals is more useful than frequent light watering. There are many irrigation systems available in the latest technology like drip irrigation, sprinkler irrigation, micro jet, and basin irrigation. Tools used for the preparation of channels for irrigation during the Rose cultivation are Rake, Blade jembe/Hoe, Mattock, Daranti, Irrigation pipe **(Leghari,2016).**

Fig 4: Tools used for Preparation of Channels for Irrigation



Source:[https://www.planetnatural.com/organic-gardening/rose-gardening (2012)](https://www.planetnatural.com/organic-gardening/rose-gardening)

Stage V- Manuring

Roses should be fed with both organic and inorganic matter. To make the soil rich, supplement with well-decomposed farmyard manure at every 3 months interval while preparing the land. So that well rotten cow dung manure and a double handful of bone meal mixed in the soil. Manuring tools used for Rose cultivation are Manuring Trolley, Blade Jembe/Hoe, Shovel and Iron Pan are suitable.

Fig 5 :Tools used for Manuring

A. Manuring Trolley

B. Blade Jembe/Hoe

C. Shovel

D. Iron Pan

Source:[https://www.planetnatural.com/organic-gardening/rose-gardening (2012)](https://www.planetnatural.com/organic-gardening/rose-gardening)

Stage VI: Digging Rose Crop into the land (Planting)

Planting was avoided during hot summer and heavy rains. In plains, roses can be planted during September and October after the cessation of the rains. In hills, planting is done during October and November or February and March depending upon the temperature. The planting distance of 60 x 30 cm is recommended. Normally roses are planted at 60 x 60 cm spacing. Before planting, the top 30 cm soil from the pits should be removed. The plant along with the earth ball may be gently lowered into the pit, keeping the main stem in the centre of the pit. The bud union point where the scion joins the stock is kept just above the ground level. Generally, the bud union point is kept below the ground level. While planting it is necessary to spread out the roots evenly. The soil is returned to the pit and firmed towards the centre. The plant must

be watered abundantly immediately after planting. Digging of Rose crop (planting) into land is done manually by the barre hands (**Aksh,2017**).

Care after Planted Rose Crops

The newly planted roses require frequent watering in the beginning. After that, they may be watered once in five days during summer, and once in ten days during winter. If the soil is sandy, more frequent watering may be necessary. On the other hand, if the soil is heavy and retentive of moisture the watering interval may have to be increased. Care should be taken to avoid 'wet feet', i.e. to avoid stagnation of water too long in the beds or near the base of the plants as it is harmful to the roots. Suckers originating from the rootstock must be removed frequently to prevent the loss of vigour of the plants. (**Aksh,2017**).

Stage VII: Weeding (Plant to plant)

Weeds are usually the suckers which are different in shape and colour appear near the base on the stem or come from the roots underground. Weeds should be pinched during initial stages so that rose plants attain good growth. faded, dead, or diseased flowers regularly. Tools used for weeding are Khurpi, Scythe, Secateurs, Mattock, and Daranti.

Fig 6:Tools used for Weeding (Plant to plant)

Source:[https://www.planetnatural.com/organic-gardening/rose-gardening (2012)](https://www.planetnatural.com/organic-gardening/rose-gardening)

Stage VII: Budding and Pruning

Budding and Pruning is done to remove unwanted and unproductive portions of the plant and makes the plant more vigorous and productive. Rose plants require pruning in the second year of their planting and subsequent year. The time of pruning is exactly 45 days before the date of the requirement of flowers majorly during October and December. Pruning is necessary when the yield and quality declines. Tools used for Budding and Pruning are Secateurs and Shear.

Fig 7:Tools used for Budding and Pruning

A. Secateurs

B.Shear

Source:[https://www gardening (2012)]

Stage VIII: Spraying Pesticides on Rose Crop

When preparing land for the rose farming mostly organic fertilizer is used then the chemical fertilizer. After one month, the pesticide is spread on the rose plants. Pesticides spraying tool used for rose cultivation is Spraying Pumps (Knapsack Sprayer).

Fig 8 :Tool used for Spraying of Pesticides on Rose Crops

A.Spraying Pumps (Knap- Sack Sprayer)

Source:[https://www.planetnatural.com/organic-gardening/rose-gardening (2012)]

Stage IX: Harvesting of Rose Crops

In the first year, rose plants are prepared for the flowering. In the second Rose, plants obtained the flowers in during the month of March after the 45 to 50 days of pruning and stay for 40 days on the plant. Then Rose flowers are ready for harvesting when the flower gets the bright colour petals. The rose flowers mostly picked by hands in the early morning. However, some rose farm workers use tools also for Rose harvestings like Rose Plucking Trolley, Urea Bag, Secateurs, and Hand Gloves **(Reddy,2015)**

Fig 9 :Tools used for Harvesting of Rose Crops

A. Farming Boots

B.Rose Plucking Trolley

C. Urea Bag

D. Secateurs

E. Hand Gloves

Source:[https://www.planetnatural.com/organic-gardening/rose-gardening (2012)](https://www.planetnatural.com/organic-gardening/rose-gardening)

2.1.5 Musculoskeletal Discomforts and Postural Problems Faced by Farmers of Floriculture Industry

Musculoskeletal discomfort is an injury or disorder of the musculoskeletal system resulting from repeated exposure to various hazards or risk factors in the workplace **(OHSCO,2007**). The musculoskeletal system includes all muscles, bones, tendons, tendon sheaths, ligaments, bursa, blood vessels, joints, intervertebral discs, **(Osborne,2010).** Musculoskeletal discomfort is associated with a physical disability, repetitive strain injury, cumulative trauma disorder, occupational overuse syndrome, strain or sprain which affect the health-related quality of life. This type of disorder takes a more serious dimension when it becomes chronic. Floriculture is

becoming one of the most important sectors for generating a source of employment in the agricultural sector. The flower crops have the inherent advantage of providing higher productivity per unit of land resulting in higher income. Therefore, it can be said that due to the high demand for flowers and ornamental plants makes marketing of flowers a profitable sector which leads to the high involvement of labourers in this sector **(Singh et.al,1997**).

The agriculture sector is considered one of the most hazardous sectors in which vulnerable groups are daily wagers, seasonal workers, and temporary workers. Workers engaged in floriculture faces many health challenges and one of the most prevalent health problems is the occurrence of musculoskeletal disorders. Health conditions of flower farm workers get worse due to long hours of working in awkward postures and repetitive nature of work which leads to musculoskeletal disorders and postural problems. The awkward posture adopted by the floriculture farm workers while performing the various activities during the flower cultivation process, can lead to postural problems such as stiffness of joints and unable to stand properly and they might further develop severe pain and strain (**Myers, 1998**).

Activities carried out during flower cultivation mainly require forward bending posture during work with the repetitive and forceful movements. Floriculture farm workers are at greater risk of musculoskeletal disorders of upper extremities especially wrist, hand, upper back, and cervical. Other health-related problems of floriculture workers include headaches, skin rashes and respiratory problems. Therefore, the health of Floricultural farm workers is a matter of concern due to the high and rising occurrence of health problems in this sector.

Posture and Body Discomforts:

The word “postures” origin from the Latin verb “pioneer” meaning “to put and place”. Posture is relatively orientations of the body parts. To maintain such an orientation over some time, muscles must be used to counteract any external forces acting upon the body **(6).**

According to (Bridger,1995)

"Postures means the carriage of the body as a whole, the attitude of the body, or the position of the limbs, the arm and the legs".

The posture that a person adopts when performing a particular task is determined by the relationship between the dimensions of the person's body and the dimensions of the various task performed at the workplace. The extent to which posture is constrained is dependent upon the number and nature of the connections between the person and the workplace **(Pheasant,2001).**

A good Ideal and balanced postures are considered to be a mechanical body balance, which can prevent mechanical problems, dysfunction, and pain from structures that are mechanically stressed, in which positioning is centred and relaxed and unnecessary tension can be released. The major hazards prone activity in the cultivation of flower is harvesting. Different types of postures are adopted during the flower harvesting process which is described as under.

- **Standing and forward bending posture:** Standing at rest means upright, symmetrical position, the body weight evenly distributed on right and left feet and arms hanging by the sides. In bending forward or backward from a neutral standing posture, the muscle activity closely follows the pattern of motion, since it is a two-part movement involving both the spine and the pelvis. Working while bent over places a lot of strain on the muscles in your back **(Josh,1998).**

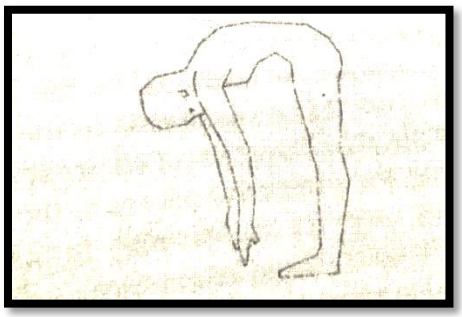


Fig. 10: Standing and Bending Posture Handgrips

Source: Bridger, R. S (1995). Introduction to Ergonomics. McGraw-Hill, Inc. New York.

- **Standing Posture:** A good standing posture is the one in which the head, neck, chest, and the abdomen are one upon another so that the weight is carried

mainly by the body framework and a minimum of effort and strain upon muscles and ligaments. When the body is well balanced in the standing position, the centre of gravity will pass through the middle ear, shoulder, in and outside of knee and ankle" (Argan, 1956

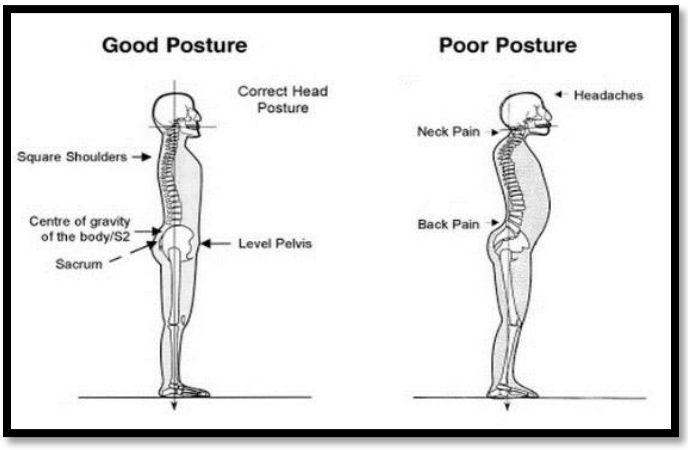


Fig. 11: Standing Posture

Source: https://www.houlechiropractic.com/ergonomics.html (2015)

Postural stress is the term used to denote mechanical load on the body by its posture. Posture may be defined as the average orientation of the body parts, concerning each other, over time. Task-included stress in that which results from the performance of the task itself. An astronaut in space under the condition of zero gravity is “weightless” and experience minimal postural stress. When using a wrench to tighten a nut, the astronaut would be subject to task-related stress caused by gripping the wrench and generating a torque to tighten the nut while stabilizing the body **(Bridger,1995).**

The relationship between work posture and operator’s efficiency is often found to be existing. The field study also suggests that poor posture adopted to perform the task could lead to postural stress, fatigue, and pain which may, in turn, stop the work till muscles recover. The complaints may be caused or aggravated due to continuous movement of legs and a forward inclined posture of the trunk and with hands are holding crop against rotating cylinder. A varied working posture is better than a fixed working posture., but if circumstances demand that one work in a fixed position (as in practice will very often be the case), then the deleterious effects that ensure will

increase with the degree of static work required to maintain the position concerned **(Pheasant, 2001).**

Posture for doing an activity spells about the muscular effort required, work performance as well as the musculoskeletal problems faced by the worker. In the floriculture sector, most of the Rose farm workers suffer from musculoskeletal disorders. Owing to the use of unnatural body posture during work. Hence, the ergonomic intervention of technology should offer a good working posture to perform the task effectively and with the least muscular discomfort **(Gandhi,2005).**

Posture is categorized into static and dynamic. Static posture is also known as extreme posture and when retained for a very long duration the risk of injury to muscle-the joint system is greatest. The position of the body with the movement of joints is found in dynamic posture here joints and muscles are functioning, depending upon the task requirement. The following joints are in movement namely shoulder joints, hip, joints, elbow, wrist joint. A certain task requires continuous static posture for sometimes as well as frequently changing from one dynamic posture to another. Such quick sifting may cause fatigue and in cases injuries to specific muscles and joints. Such are called mechanical risks. Condition, as mentioned above, leads to postural discomfort.

Suggested Correct Posture in Flower Harvesting.

A correct posture is one that places the least amount of stress on joints and muscles which is referred to as a neutral posture. Having correct posture means keeping each part of the body in alignment with the neighbouring parts so that all the body parts are balanced and supported. Appropriate posture (When standing) should be possible to draw a straight line from the earlobe, through the shoulder, hip, knee, and into the middle of the ankle. It takes out the strain from muscles, joints and it allows them to work efficiently (**Schafer,1983**).

Not maintaining good posture and adequate back support can add strain to muscles and put stress on the spine. Over time, the stress of poor posture can change anatomical characteristics of the spine, leading to the possibility of constricted blood

vessels and nerves, as well as problems with muscles, discs, and joints. All of these can be major contributors to back and neck pain, as well as headaches, fatigue, and possibly even concerns with major organs and breathing [7].

Standing or forward bending for long periods can cause increased spinal pressure especially if the person slouches. Bending over with straight legs increased the pressure in the lower back. when standing and bending forward with the legs straight causes a loss of the three natural spinal curves and puts undue stress on the lower portion of your back. Prolonged bending forward at the same time puts great strain on the muscles and increases the pressure inside the discs (the spongy materials between the bones of your spine) even more. When bending forward, keeps your back straight while bending at the knees and hips (**Wagner,2013**)

A Spine that is in “balance” helps to feel better by reducing muscle tension and stress on the joints as well as helping support all those organs that are controlled by the spinal nerves. The human spine is a biomechanical marvel made up of an interconnected system of bones (vertebra), ligaments, interposed cartilages, muscles, and nerves. It is the principle structure of the body providing support to the pelvis, legs, rib cage, arms, and skull. The spine consists of blocks of hollow bones called the vertebrae stacked one on top of the other to form a loose S shape. Sandwiched between the vertebrae are spongy but tough compressible pads are known as the intervertebral disc. Low back pain strikes eight out of ten adults at some point in their lives. It affects men and women alike and cuts across barriers of age, size, and ethnic groups. It is more common among 20 to 50 years old. Although both sexes are equally susceptible, low back pain in women lasts longer and results from several factors like work, health, and fashion-related issues, in men, low back pain often results from injury (**Johnson,2019**).

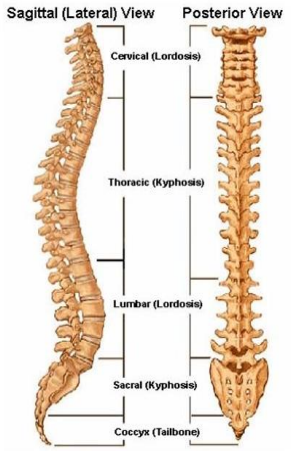


Fig 12:Lateral side Spinal Cord

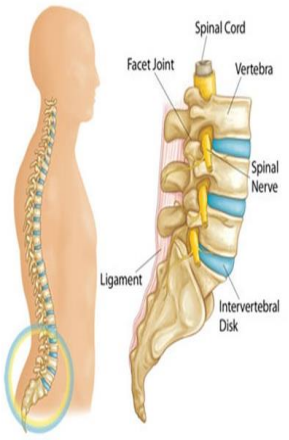


Fig 13: Lumbar spine

Source: [https://www.houlechiropractic.com/ergonomics.html (2015)](https://www.houlechiropractic.com/ergonomics.html)

The Factors Which Place the Rose Farm Workers at A Higher Risk

Various factors that place rose farm workers at higher risk are Work-related factors; repetitive and stressful tasks twisting, movements and those involve in standing and forward bending for long periods.

Repetitive Motion Disorder

Tissue damage caused by repeated trauma usually associated with the use of hand tools or vibrating tools is identified as repetitive motion disorder. Almost any form of activity that produces repeated trauma to a particular area of soft tissue, including tendons may cause this type of injury. Repetitive and forceful work activities, awkward or static postures and mechanical pressure associated with work tasks have been cited as important etiological factors for WMSDs (**Bernard et al. 1993**). Some movements that may lead to repetitive motion injuries include-

- The Repetitive action of the hand or arm
- Bending at the wrist
- Grasping or pinching objects
- Frequently raising the arm and/or the shoulder
- Applying force with the hand or arm

Hand Grips

Anatomists have made several attempts to classify the infinite variety of actions of which the human hands are capable. The most basic distinction is between gripping actions of various kinds, known – gripping actions (such as poking, pressing, stroking, slapping, etc.). In gripping action, the hand forms a closed chain which encompasses the objects in question; in a non-gripping action the hands in gripping action, the hand forms a closed chain which encompasses the objects in question; in a non-gripping action, the hand is used in an 'open chain' configuration. Few common everyday actions fall between these two categories, in that the kinetic chain of the hand is one the point of closing **(Napier, 1956).** Dividing griping actions into main categories.

- Power grips, in which the fingers (and sometimes the thumb) are used to clamp the object against the palm.,
- Precision grips, in which the object is manipulated between the tips (pads or
- sides) of the fingers and thumb.

Hand and Wrist Postures

Some hand tools may force the wrist to assume awkward postures. The wrist position affects the effective strength of the contracting muscles. Therefore, as the angle of the joint increases or decreases from the neutral position, there is more stress on the tendons. Particularly stressful hand and arm position. Ulnar deviation is the bending of the wrist toward the little finger, and radial deviation is the bending of the wrist towards the thumb (**Khayal,2019**).

In basic power grip, the thump wraps around the back of the fingers to provide extra stability and gripping force. As the need for precision extra control and the possibility of both power gripping and precision manipulates as the situation may demand **(Pheasant,2001).**

A job requiring repeated ulnar deviation, extension or flexion can lead to tenosynovitis of the tendons of the back of the hand. Similarly, the severe radial deviation can cause elbow soreness.

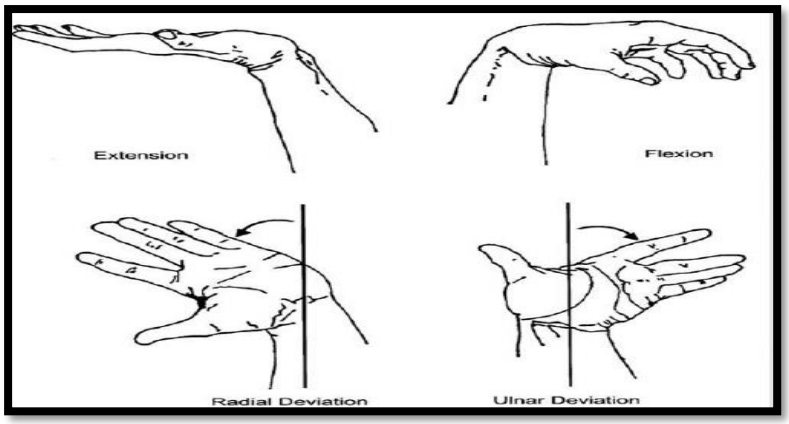


Fig 14: Hand movement (Khayal,2019)

Source: http://www.bodylanguagecommunication.com/hands-and-hand-movements (2019).

Finger and Hand Grips The grips used most frequently to hold objects. The tip grip (pinching) is a position grasp used for precise manipulates. The side grip is also classified as a precision grip. Repeated use of these grips creates stress on the two tendons controlling the thumbs and fingers. The power grip requires the thumb to align with the long axis of the forearm and the wrist assumes a slight ulnar deviation. The posture may be stressful when combined with high repetition and extreme force (**Khayal,2019**)

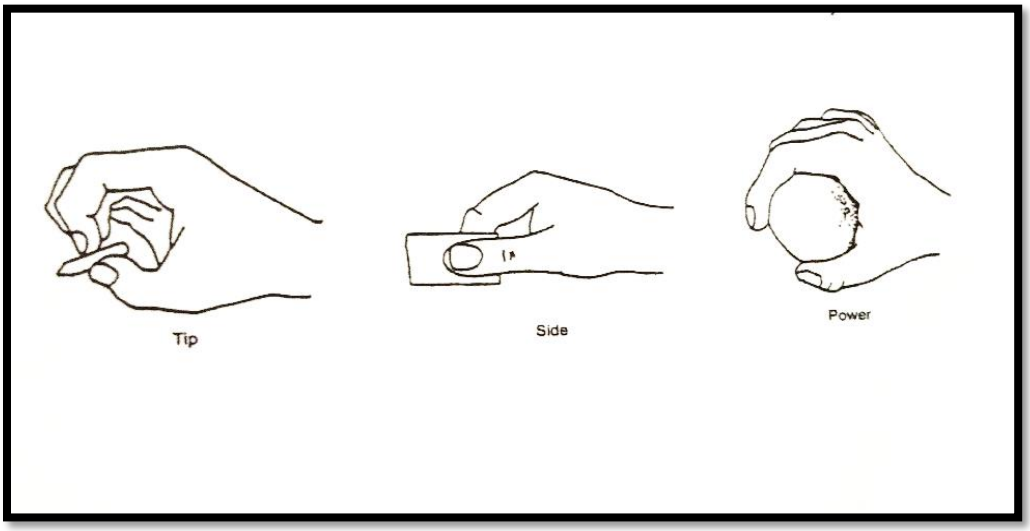


Fig. 15: Handgrips

Source: Bridger, R. S (1995). Introduction to Ergonomics. McGraw-Hill, Inc. New York.

Body Discomforts: Discomfort results in an “urge to move” caused by several physical and physiological factors **(Bridger, 1995)**

Rest Pauses: Every function of the human body can be seen as a rhythmical balance between energy consumption and energy replacement, or simply, between work and rest. This dual process is an integral part of the operation of muscles, of the heart, and if all the biological functions of the organism as a whole are taken into account, rest is indispensable as a physiological requirement if performance and efficiency are to be maintained. If heavy work was combined with frequent work conditioned pauses, absenteeism is less than if the work is continuous. Introducing rest pauses speeds up the work, and this compensates for the time lost during prescribed pauses, as well as leading to fewer disguised and spontaneous pauses. Various studies have shown that if prescribed pauses are introduced, the appearance of fatigue symptoms is postponed and the loss of production through fatigue is less. The rest pauses serve the following purposes: (i) preventing fatigue, (ii) allowing opportunities for refreshment (iii) time for social contacts.

The rest pauses are categorized as follows:

- **Spontaneous Pauses:** The obvious pauses for rest that the workers take on their own. These are not usually very long but maybe frequent if the job is strenuous.
- **Disguised Pauses:** The worker occupies himself with some easier, routine task to relax his concentration on the job, such as cleaning some parts of the machine, tidying the workbench, sitting down comfortably, blowing his nose, or even leaving his place on the pretext of consulting a workmate or the forearm.
- **Work–Conditioned Pauses:** These pauses arise from the nature of work. These are the interruptions that arise either from the operation of the machine or the organization of the work. For example, waiting for the machine to complete a phase of its operation or for a tool to cool down. These are very common in the service industries also, as they have to wait for customers or orders.

- **Prescribed Pauses:** These are the pauses in the work that are laid down by the management, for example, Breakfast break, Tea break, etc. These four types of rest pauses are to some extent interrelated. The introduction of prescribed pauses reduces spontaneous and disguised pauses. In general, it can be said that all the different types of rest pauses should amount to 15 Per cent of the working time. Often, a percentage of 20-30 is allowed depending on the job. Therefore, it is necessary to make a detailed study of work activity, the stress involved, energy expenditure, and thereby establish rest pauses. Much work has to be done in our country in this regard **(Joshi, 1998)**

Body Mass Index (BMI): The body mass index is the measure of body weight relative to height. It can be used to determine if people are at a normal weight, overweight, or obese. The BMI was invented by the Belgian Adolphe Quetelet (1796-1874). It is equal to the weight, divided by the square of the height [(8):] The following are common definitions of BMI thresholds:

- Underweight less than 18.5
- Ideal: greater than or equal to 18.5 but less than 25
- Overweight: greater than or equal to 25 but less than 30
- Obese Class I: greater than or equal to 30
- Obese Class II: greater than or equal to 35

Capacity to work varies from individual to individual. Factors determining physical work capacity include age, gender, training, health status and motivation. Body mass index is one of the parameters to judge status. An individual with an acceptable BMI value is categorized as those with good health status **(Bridger, 1995).**

2.1.6 Musculoskeletal Discomforts faced by Rose Farm Workers

Roses are the oldest fragrant flowers propagated as ornamental and commercial plants by the Rose farm workers. Rose is a woody and thorny shrub plant and has more than hundreds of species (Horn, 1992) and over 2000 cultivars (Kim et al., 2003). Rose plants range in size from compact, miniature roses, to climbers that can reach seven meters in height. They form a group of plants that can be erect shrubs, climbing,

or trailing with stems that are often armed with sharp spikes. There are many varieties of roses cultivated all over the world like Hybrid Tea, Floribunda, Miniature, climbers, gladiators, Queen Elizabeth, Bull's red, Grand gala.

In Gujarat state, Vadodara being the second-highest district known for Rose production mainly cultivated two types of roses are cultivated such as Kashmiri rose and Desi rose which are very much in demand. In Kashmiri Rose plants numerous buds and flowers are grown in one branch of the flowering plant and spikes. Due to which in the least investment the production of Kashmiri roses is done in huge amounts and it is also beneficial for the cultivators. Kashmiri rose is cultivated in every season and it requires very less maintenance for growing rose plants.

The height of the Kashmiri rose plants is a minimum of 2 ft. and have fewer thrones compared to other rose crops. Whereas, the desi Gulab is about 2-3 inches wide, very delicate, and sturdier-looking and requires lots of maintenance. Therefore, the Farmers in the Vadodara district are more engrossed in the production of Kashmiri Roses. The height of the Kashmiri rose plants is a minimum of 2 ft. and have fewer thrones compared to other rose crops. Whereas, the desi Gulab is about 2-3 inches wide, very delicate, and sturdier-looking and requires lots of maintenance. Therefore, the Farmers in the Vadodara district are more engrossed in the production of Kashmiri Roses.

India being an agricultural country, where the majority of people live in rural areas, mainly associated with different types of farming. Both men and women work very hard in the floriculture fields, they have to perform numerous labour-intensive jobs such as weeding, grass cutting, plucking, roses flower, cleaning, bagging, etc.

Rose farm workers experience types of musculoskeletal discomforts due to repetitive tasks and physical load, which affect their health and productivity. In rose harvesting plucking, heaping and gathering of the rose flower is considered as the severe most drudgery prone activity, where workers have to keep their posture in bending position from the back facing towards the ground for plucking the rose. It leads them to severe pain in their backbone, leg, thighs, and feet **(Ergonomics Practices, 2003).**

According to **Jyotsna et** al., (**2005),** during rose harvesting activity from morning till evening, workers usually adapt squatting posture and they continue to work in this posture for a long duration without adapting any other posture due to which they face severe pain in lower back and knees. Whereas, **Osborne et. al., (2012),** articulates that lower back pain is the most common MSD among the farmers and at the same time, some physical injuries also occur while working in a rose farm because of plenty of thorns on rose plants and its stem causing physical injuries.

Therefore, Rose cultivation and harvesting is considered to be a drudgery prone activity. Rose farm workers experience types of musculoskeletal discomforts due to repetitive tasks and physical load, which affect their health and productivity.

2.2 Empirical Research Studies

The reviewed literature of empirical research studies contains researches conducted Abroad and in India.

2.2.1 Research Studies conducted Abroad

Baris and Uslu (2009), conducted a research study on “Cut flower production and marketing in Turkey”, The objectives of the study were to assess the current status, marketing structure, and policies pursued in the Turkish cut flower industry; which can be classified according to the technology used, as well as the structure and the ecological characteristics of production areas. Enterprises in this sector were further classified into two groups as enterprises with export-oriented production (modern enterprises) and with domestic market-oriented production (small-family enterprises). The result revealed that the Turkish cut flower industry heavily focused on the production of carnation. Almost eighty per cent of the total cut flower production was meant for export and consists of spray carnations. Collectively spray and standard carnations constitute eighty-eight percent of the total production. The cut flower segment has shown great improvements in Turkey during recent years despite the existence of some problems in the stages of production, marketing, and transportation.

Defar and Ali (2013), conducted a research study on “Occupational induced health problems in floriculture workers in Sebeta and surrounding areas of Ethiopia”. Floriculture is a booming sector in Ethiopia; nevertheless, there are certain concerns regarding the health status of the workers. To address this issue, an effort was made to outline the outstanding health problems that have manifested in some of the floriculture farms in the designated area of the study. The objective of the study was to assess the health problems encountered in the farms, and their determinants among floriculture workers in Sebeta and surroundings. A Cross-sectional study design, using qualitative and quantitative methods, was used for conducting research among floriculture workers in Sebeta Town and surrounding areas from December, 2010, to February 30, 2011. A sample of 612 workers was selected using systematic random sampling techniques entered using EPI Info. The result of the study revealed that, the majority of the workers were females (74.9%), having one health symptoms (93%) in the last 12 months before the study period, had at least one skin problem (67.8%) and had at least one respiratory health symptom (81.1%) in the last 12 months. The highly prevalent disease symptoms were fatigue (76.5%), followed by headache (73.4%) and sleepiness (63.5%).

Hoogendoorn, et.al (2014), studied “Physical load during work and leisure time as risk factors for back pain”. The study assessed aspects of physical load during work and leisure time as risk factors for back pain. Several reviews on this topic are available, but this one is based on a strict systematic approach to identify and summarize the evidence, comparable with that applied in the clinical literature on the efficacy of intervention for back pain. A computerized bibliographical search was made of several databases for studies with a cohort or case-referent design. Cross-sectional studies were excluded. A rating system was used to assess the strength of the evidence, based on the methodological quality of 28 cohorts and 3 case-referent studies and the consistency of the findings. Strong evidence exists for manual materials handling, bending and twisting, and whole-body vibration as risk factors for back pain. The evidence was moderate for patient handling and heavy physical work,

and no evidence was found for standing or walking, sitting, sports, and total leisure-time physical activity.

Ajayi, et.al (2015), researched on "Assessment of the Impact of Musculoskeletal Disorders on Nigerian Construction Workers". The purpose of the study was to assess the impact of construction activities as construction work entails non-ergonomic activities, range of in-situ work at various levels and construction workers. The sample was drawn from registered general contractors with the Ministry of Works and housing in six states of South-West Nigeria. A total of 100 contractors were surveyed. All the respondents were working as a fulltime contractor within the construction industry. The study revealed that baseline knowledge regarding the WMDs is inadequate as there is major concern about safety procedures and feedback from site employees. The result of the study indicated, there was a need for an increase in training, knowledge on strategies to reduce the onset of WMDs among construction workers. However, there was an improvement in baseline knowledge, but the need to address the knowledge areas of health and safety of construction workers was significant. Regrettably, there was no evidence of medical surveillance mechanism in the study to show how the health status of workers was monitored. Furthermore, the study confirmed that construction activities impact negatively on the construction worker as a result of various body actions and affects the physical nature of the workers.

Keawduangdee, et.al (2015), conducted a research study on **"**Prevalence of Low Back Pain and Associated Factors among Farmers during the Rice Transplanting Process". The study aimed to investigate the prevalence of low back pain and associated factors in Thailand rice farmers during the rice transplanting process. Three hundred and forty-four farmers, aged 20–59 years old, were asked to answer a questionnaire modified from the Standard Nordic Questionnaire (Thai version). The findings of the study suggested that Low Back Pain (LBP) is a serious problem for rice farmers during the rice transplanting process. Farmers were required to work in postures which had a high-risk factor for Low Back Pain (LBP), causing soft tissue injuries around their spinal structures. The tissues most particularly linked to Low Back Pain (LBP) in this study arose from muscles and joints. Low Back Pain (LBP) was

associated not only with working postures but also with age, the number of days in the field, and the stress. Low Back Pain (LBP) was mostly reported by younger farmers with less experience of working in the field. These results indicated the need to prevent and manage Low Back Pain (LBP) experienced by rice farmers during the rice transplanting process. As practical suggestions, exercise, massage therapy, and lumbar supports are effective treatments and tools to release muscle stiffness, decrease pain, and improve physical functions. These combinations of physical therapy can provide beneficial effects on muscle relaxation and spinal alignment for Low Back Pain (LBP) in rice farmers.

Kearney, et.al (2016), conducted “A Descriptive Study of Body Pain and Work-related Musculoskeletal Disorders among Latino farm workers Working on Sweet Potato Farms in Eastern. The aimed of the study was to describe the prevalence of work-related musculoskeletal disorders (WMSDs) and self-reported pain among Latino farm workers who work extensively in hand-harvesting sweet potatoes. The data were obtained from a cross-sectional survey of farm workers 120 in eastern North Carolina. Univariate and bivariate analyses were used to describe personal, work characteristics, and self-reported pain associated with musculoskeletal injuries. Overall, seventy-nine percent of farm workers reported any type of pain or discomfort. The highest reported areas of pain were in the back (66%) and shoulder areas (31%).

Mburu, et. al (2017), conducted a research study on "Musculoskeletal Disorders in the Flower Industry in Kenya." The study aimed to evaluate the most common MSDs among flower harvesters and processing workers. Primary data was obtained from questionnaires and secondary data from document review. Descriptive and inferential statistics were used for data analysis. The study established that sixty-seven percent of the workers had experienced work-related MSDs in the 12 months preceding the study. Work-related MSDs occurrence was highest among processing workers at 86 percent. Further, the study established that the occurrence of MSDs increased with several years on the job. MSDs were reported more among those who had worked for 11-15 years (70.6%), compared to those who had worked between 0 and 5 years (58.5%). The result revealed that the most prevalent MSD affected wrists and hands

of the workers (68%). This was consistent with observations made during the study that tasks in the flower industry are manual and the majority involve wrists and hands including harvesting, weeding, and making flower bouquets. The task repetitiveness and awkward working postures were also perceived to be detrimental to the workers' health. More than half of the respondents reported Lower back pains (65%) and shoulders (62%) were reported by the workers.

Mahto, et.al (2018), conducted a research study on "Prevalence of work-related musculoskeletal disorders in agricultural farmers of Bhaktapur District, Nepal". The study aimed to find out the prevalence of musculoskeletal disorders in Bhaktapur district of Nepal. The descriptive cross-sectional study design was undertaken. A convenience sample of 246 farmers from Bhaktapur district, Nepal aged between 24-65 years, were included in the study. The Nordic musculoskeletal questionnaire was adapted to measure MSDs in the farmers. Descriptive analysis of data was done. The results revealed that farmers reported pain in all the nine areas of the body mentioned in the questionnaire. More than seventy per cent of farmers have some kind of musculoskeletal disorders. However, six major areas of pain were identified as: Neck-(12.6 %), Shoulder (10.6%), Elbow (12.2%), Low back (36.2%), Knee (21.5%) and Ankle (13%). The prevalence of musculoskeletal disorders in farmers was very high due to lack of awareness about the MSDs and ergonomics problems.

Kim, et.al (2019), researched on **"**Prevalence of Upper Extremity Musculoskeletal Diseases and Disability among Fruit Tree Farmers in Korea". The study aimed to examine the prevalence of upper extremity musculoskeletal (MSK) diseases and to identify factors influencing disability among fruit tree farmers in Korea. This study was conducted as a part of the Namgaram study. Four hundred and sixty fruit tree farmers completed a questionnaire and underwent clinical evaluations, including physical assessments, laboratory tests, simple radiographic examinations, and magnetic resonance imaging studies of the upper extremities. Disability was assessed using the Disabilities of the Arm, Shoulder, and Hand outcome measure. The result revealed that mean DASH score in fruit farmers was fourteen per cent (range 0 to 81.67). Some farmers had experiences of injuries to the hands (8.7%), arms (5.7%), and shoulders

(11.5%). Majority of the respondents (89.6%) had at least one MSK disease. More specifically, the prevalence of various upper extremity MSK diseases were as follows: 60.4% for rotator cuff tear, 20.9% for golf elbow, 40.9% for tennis elbow, and 58.0% for hand osteoarthritis. Fruit tree farmers remain at risk for MSK diseases of the upper extremities. Disability tended to worsen with more MSK diseases. Thus, it was found necessary to educate farmers about prevention strategies but also to develop an effective management system for agricultural work-related MSK diseases and a surveillance system at the government level for the health problems of farmers

2.2.2 Research Studies conducted in India

Trivedi (2004), conducted a research study on “Adoption of Rose Cultivation”. The objectives of the study were to know the characteristics of rose growers, to assess the relations between selected personal, social, economic and psychological characters of the rose growers and their adoption of rose production technologies. These studies were undertaken in Padra and Karjan talukas of Vadodara district of Gujarat state. A random sample of 150 farmers from 10 villages was selected for the study. The data was collected with the help of interview schedule. The study revealed that majority (82 %) of the rose growers were from middle age, educated up to the primary level (89 %), and were having 3 to 4 years (86 %) experience of rose cultivation. Majority of the rose growers (82%) had medium knowledge about rose cultivation. The major constraints faced by the rose growers in the adoption of rose cultivation were lack of availability of improved varieties of the rose crop, supply of loan was not timely and were lacking knowledge about the timely application of fertilizers.

Kaur and Sharma (2009), conducted a survey regarding the level of work-related body disorders in agriculture industry by women by selecting 200 farm women from Punjab state. The results showed regarding the level of work-related body disorders in agriculture by women included pain in many parts of body followed by numbness or stiffness, some farm women also felt itching and swelling in hands while working in the fields and some felt burning in abdomen and chest especially during spraying of pesticides in the fields due to inhalation. The reasons for pain or stiffness may be due to poor body posture while performing certain farm operations and lack of awareness

regarding the right body posture. Sometimes, they did not even take rest in between which is essential to make our body stress free.

Goswami et.al (2012), conducted study on “Evaluation of Work-Related Musculoskeletal Disorder and Postural Stress among Female Rice Cultivators Engaged in Post Harvesting Tasks”, In rice cultivation, post-harvesting tasks are essential for the preparation of rice. Mainly females are engaged in post-harvesting tasks and they perform a sequential work through manual efforts. The study aimed to evaluate musculoskeletal disorder (MSD) and postural stress of workers during performing two post-harvesting tasks. The study was conducted on 70 adult female subjects. The MSDs were assessed by modified Nordic questionnaire method. Posture analysis was made by video graphic technique. Center of gravity (CG) and spinal curvature and of the workers were measured in normal erect posture and different working postures. The results showed that the prevalence of MSDs was very high among the workers and the most affected area was back, wrist, shoulder, calf and knee etc. The incidence of MSDs was comparatively higher in the threshing task than that of the parboiling task. The subjects had to adopt different stressful postures during performing post-harvesting tasks. The CG and spinal curvature in working posture significantly deviated from neutral posture. The awkward work posture might be related to the MSD of the workers. From this study, it has been recommended that workers should avoid bad work postures as far as possible during their work for reducing job-related health hazards.

Suryavanshi and Parvez (2014), researched on the “Production of Rose and Marigold Flower in Allahabad City”. The study aimed to know the number of harvesters in block Chaka of Allahabad city and to know the income which comes from the production of rose and marigold. A sample of 106 farmers, 53 from each harvesting of Rose and Marigold respectively will be selected for the study. The result revealed that commercial activity of production and marketing of floriculture products is also a source of gainful and quality employment to the farmers. The harvesting processes of these crops are very drudgery prone. India being an agricultural country, where the majority live in rural areas, both men and women work very hard in the fields. The

harvesting of rose comes under the severe drudgery prone activity for the rural women because Rose thorns make them bleed from their hands and overall body and their dress got torn. At the same time of harvesting of Marigold, women feel pain in their backbone, thighs, and legs, neck etc. because bending position from the back facing the ground during harvesting causes pain.

Kaur and Sharma (2014), conducted a research on **"**Ergonomic assessment of existing methods of harvesting flowers from the fields". The field survey was conducted to know the existing flower plucking practices followed by farm women and the constraints face by them during plucking of rose and marigold flowers. A total sample of 60 farm women was intensively involved in flower plucking from Doraha block were purposively selected as respondents. The results of the study revealed that farm women were plucking the flowers (rose and marigold) with only one hand while the other hand was used for holding the polythene bag used for collecting the plucked flowers. It was observed that more time was needed to pluck the flowers as plucking was done with only one hand. It was found that this way of plucking flowers very tedious which also reduces the output of work. Further, no appropriate tools/devices either for plucking or for collecting the plucked flowers was being used which led to decreased efficiency in performing the household activities as reported by all the respondents. Keeping in view, there is a great need to design women-friendly tools keeping in view the ergonomic parameters of women involved in flower plucking activity. One such technology (harvest bag for collection of plucked flowers) was developed for the women to reduce their drudgery in this activity. The harvest bag for collection of plucked flowers was having adjustable straps uniformly and evenly distributed over the shoulders and waist and shaped pocket in the front which makes the bag friendlier and reduces drudgery while putting plucked flowers in the bag. It also saved time as both hands were free to pluck the flowers which increased the output.

Sharma (2015), conducted a research study on "Drudgery in Rose Cultivation among Farmers" The objective of the study was to assess the Drudgery in rose cultivation and improved rose cultivation practices followed by the farmers. This study was

conducted in the Rajsamand district in Udaipur, Rajasthan. The result of the study revealed that majority of the respondents were in the age group of 20-60 years (79%); belonged to OBC category (75%); had a medium-size family with 5-8 members (76%) and were engaged in farming since the last 6-10 years (79%). The study revealed that twenty- two per cent of respondents were marginal farmers, forty-five per cent were small farmers while only 32.5 per cent of the farmers possessed large landholding. The crop calendar of rose cultivation starts from October with land preparation to March onwards with bagging & storage, when the drudgery of rose cultivation among farmers was assessed it was found that removing of stalks and stubbles, levelling, transportation of manure, spreading of manure and storage were 100 per cent drudgery prone activities as perceived by the respondents. Because almost all the activities were performed manually either by hands or using some manually operated traditional tools.

Nelson (2016), researched on "Work-related health problems of female workers engaged in Cashew Processing Industries-across-sectional study from Kollam district, Kerala, southern India". The data was collected related health-issues from 301 female cashew processing workers. The results of the study revealed that Low back pain was the predominant problem (48.8%) followed by hand and wrist pain (46.6%), knee pain (37.8%) and neck pain (32.5%). Among the workers engaged in roasting, 86.6 per cent had experienced a burn. Workers engaged in roasting (53.3%) and shelling (43.7%) had blackish staining of their palms and fingers. The study revealed that Health-related issues about the musculoskeletal system, respiratory system, and skin conditions were highly prevalent among women engaged in the cashew processing industry.

Mishra and Singh (2017), studied a "Musculoskeletal Disorder in Flower Plucking Women." The aim of this study was to investigate the role performed by farm women engaged in floriculture and to find out the musculoskeletal (MSD) disorder and occupational Hazards among the women. The results of the study depicted that, Women plays a significant and crucial role in Agriculture development, Livestock production and Floriculture as a manager decision-maker and skilled farm worker. The

study was conducted in Faizabad District in U.P. wherein, 100 women involved in flower management were studied. It was found that the preferred activities by women were grading of flower (42%) as first followed by Deeping of flowers (34%), plucking of flower (12%) and storage flower (11%) respectively. Further, it was observed that less than half (40 %) of respondents suffered from the back pain, twenty per cent of women suffered Knee pain and nearly half (48 %) were having poor postures and finger nodes. The researcher observed that stressful work, unawareness of new techniques in the use of equipment and unawareness for safety measures were the reason for musculoskeletal discomforts.

Nandy et.al, (2017), conducted a study on “Musculoskeletal Disorders among the Gardeners”. Gardeners are at increased risk of occupational hazards and musculoskeletal disorders are common as they are exposed to high risk factors like unhealthy posture and lifting of heavyweight. The study was conducted on 60 gardeners. General information of the worker and work-related history was enquired using "Modified Nordic questionnaire. Anthropometric parameters were recorded. Examination of the gardeners was done. Analysis of working posture was done using OWAS method. The result revealed that low back pain was the commonest musculoskeletal disorder in gardeners followed with thigh, ankle and neck pain due to uncomfortable gardening posture during their work.

Pal and Dhara (2018), conducted a study on **“**Work-Related Musculoskeletal Disorders and Postural Stress of the Women Cultivators Engaged in Uprooting Job of Rice Cultivation”. The study was aimed to evaluate postural stress and prevalence of musculoskeletal disorder (MSD) of women cultivators engaged in uprooting job of rice cultivation. The cross-sectional study was conducted on 166 women cultivators from different districts of West Bengal State, India. Prevalence and intensity of MSDs of the cultivators were evaluated by the Nordic questionnaire and 10-point body part discomfort scale. Work rest pattern and postural pattern were studied by direct observation method. Postural stress was assessed by OVAKO Working Postures Analysis System (OWAS), Rapid Entire Body Assessment (REBA), Rapid Upper Limb Assessment (RULA), and Quick Exposure Checklist (QEC) methods and as well as

by measuring the centre of gravity. MSD was highly prevalent among the study participants. Lower back, hip, wrist, shoulder, and knee were highly affected. Higher prevalence of MSDs among the cultivators may be because of prolonged working hours and awkward postures. The women cultivators had to start their day before dawn to finish off their household chores such as cooking, cleaning, washing clothes and dishes, etc., before they moved off to the fields, which altogether impose them under additional stress.

Shilla and Sehgal (2018), conducted a research study on "Health problems of workers in Floriculture". The main objective was to assess the health problems for farm workers engaged in different activities. Floriculture includes several activities such as land preparation, planting, manuring, Picking, and transportation activities. The working method and workplace conditions at the floriculture farms lead to numerous problems for farm workers engaged in different activities. The study was conducted in Hisar and Panipat district of Haryana by conducting a personal interview with 68 respondents selected through simple random sampling technique and pretested interview schedule was used to collect the data. In the present study, main problems were identified were physical problems, postural problems, problems related to high temperature, injuries and problems related to biological conditions in the workers engaged in floriculture activities. The study revealed that more than half of the respondents were suffering from backache (67.65%) and cervical pain (54.41%), pain in the body due to stiffness of joints (69.11%) and pain in the body due to forward bending to perform the work (61.76%). Similarly, more than half (64.71%) of the respondents were unable to stand properly due to working in the same posture for a longer duration. Whereas, less than half (42.64%) of the respondents reported cuts in various body parts especially in hands, faced insect biting (36.76%) and faced infection risk from fungi and parasites (36.86%).

Zend and Revanwar (2019), conducted a research study on the “Assessment of Drudgery Load of farm workers Involved in Flower Harvesting Activity and Technology Intervention”. The study aimed to know the existing flower plucking practices followed by farm workers & constraints faced by them during plucking and collecting of

Gaillardia & Marigold flowers. The total sample of 120 farm workers intensively involved in flower plucking of aster & marigold were purposively selected as respondents. The result revealed that Prevalence of health problems reported by farm workers was maximum while performing harvesting of aster due to lower height of the plants below the waistline of the worker, followed by allergy/ skin infection & seasonal workload. Classification of drudgery load indicated that drudgery level of farm workers involved in marigold and aster harvesting was heavy. Time load in flower harvesting was decreased due to the use of developed customized harvesting bags for all the selected flowers. Rated perceived exertion (RPE) was highly decreased in improved method while performing flower harvesting in case of all the two selected flowers. Hence, it was concluded that developed customized harvesting bags for aster and marigold were suitable technologies for mitigating drudgery & required for flower harvesting.

Conclusion

An overview of the researches reviewed reflected that much work has been done in the field of agriculture regarding occupational health problems of agriculture farm workers, health problems of female workers engaged in cashew processing industries, postural stress among female cultivators engaged in post-harvesting, musculoskeletal symptoms among the corn and soybean growing farmers, body pain and work-related musculoskeletal disorders among farm workers working on sweet potato farms.

Based on an extensive review of literature, a limited number of researches were found in floriculture farming both Abroad and in India, such as health problems of workers in floriculture, the muscleskeletal disorder in flower plucking women, drudgery in rose cultivation among farmers, adoption of Rose cultivation, of Rose cultivation, However, a dearth of literature found on the musculoskeletal discomforts experienced by Rose farm workers during rose harvesting both in India and abroad. So, the present research area is sought to be the most significant and unexplored in India. Therefore, a research topic “Assessment of Musculoskeletal Discomforts Experienced by the Rose Farm Workers” was taken for the present study.

METHODOLOGY

CHAPTER III

METHODOLOGY

The purpose of the research is to discover the answer to the question through the application of scientific procedures. A research methodology is a science of studying how research is done systematically (Kothari,2012). The present chapter deals with the methodological procedure adopted for the assessment of Musculoskeletal Discomforts experienced by the Rose farm workers during the harvesting of Rose crops in selected Rose farms of Vadodara District. To facilitate systematic presentation, it is divided into various sections which are explicitly described here:

3.1. Research Design

3.2. Operational Definition

3.3. Conceptual Framework of the Study

3.4. Locale of the Study

3.5. Unit of Inquiry

3.6. Sample Size and Sampling Procedure

3.7. Construction and Description of the Tool

3.8. Establishment of the Content Validity of the Tool

3.9. Data Collection

3.10. Data Analysis

3.11. Suggestions of Coping Strategies to overcome Musculoskeletal Discomforts experienced by the Rose Farm Workers

3.1. Research Design

A research design is an arrangement or condition for collection and analysis of data in a manner that aims to combine significance to the research purpose with the scientific procedure **(Kothari, 2004**). It consists of an organization of methods for inquiring the information required. The research design selected for the present investigation was descriptive in nature.

A descriptive research design describes and interprets “What is”. It is concerned with the condition or relationship that exist, opinions that are held, processes that are going on, evident effects, or trends that are developing. It is primarily concerned with the present, although it often considers past events and influence as they to current conditions (**Best and Khan, 2008**).

Since the present investigation aims to assess the musculoskeletal discomforts experienced by the Rose Farm Workers of Vadodara District, a descriptive research design was considered to be the most appropriate method to carry out the present investigation. To reach the objective of the study an exhaustive plan of work and consecutive procedures adopted are explained here.

3.2. Operational Definitions for the Present Study:

3.2.1: Rose Farm Workers: For the present study, the Rose farm workers represents the farm workers (males and females) engaged in rose harvesting process (plucking, gathering and heaping).

3.2.2: Duration of Maintaining Adopted Posture: For the present study, it referred to the actual time taken in hours for Rose harvesting process with adopted posture by the respondents. The **adopted posture** included standing and forward bending posture adopted by the respondents for plucking, gathering and heaping of Rose during harvesting process.

Plate 1: Standing and Forward Bending Posture Adopted by the Rose Farm Workers

3.2.3: Time Duration Spent on Rose Harvesting Process: For the present study**,** it referred to the actual time spent in hours by the respondents for Rose harvesting process (Plucking, Gathering and Heaping).

3.2.4: Frequency of Repetition of Task While Performing Rose Harvesting Process: For the present study**,** it referred to the rate of recurrence of task viz. plucking, gathering and heaping of Roses by the respondents during Rose harvesting process.

Plate 2: Farm Workers Engaged in Plucking , Gathering and Heaping task during Rose Harvesting Process

Plucking denoted plucking the Rose from the plant, **Gathering** denoted collecting the plucked Rose in collecting bag and **Heaping** denoted unloading of the collected Rose from the collecting bag carried by the farmers to main Rose collecting bag.

3.2.5: Distance Traveled During Rose Harvesting Process: For the present study, it referred to the distance covered (in meter) by the respondents during Rose harvesting process (Plucking, Gathering and Heaping).

3.2.6: Quantity of Rose harvested while performing Rose Harvesting Process: For the present study**,** it referred to the sum of Rose (in Kg) harvested by the respondents during Rose harvesting process (Plucking, Gathering and Heaping).

3.2.7: Extent of Musculoskeletal Discomfort: For the present study, it referred to the extent of **Body Discomfort** measured through following parameters;

3.2.7.1: The Extent of Exhaustion experienced by the respondents due to Time Duration Spent was measured on five continuum scale viz. Not Exhausted, Little Exhausted, Moderately Exhausted, Extremely Exhausted and Completely Exhausted and the ascribed scores were1,2,3,4,5 respectively.

3.2.7.2: The Extent of Exhaustion experienced by the respondents due to Distanced Covered which was measured on five continuum scale viz. Not Exhausted, Little Exhausted, Moderately Exhausted, Extremely Exhausted and Completely Exhausted and the ascribed scores were1,2,3,4,5 respectively

3.2.7.3: The Extent of Body Pain experienced by the respondents due to Quantity of Rose harvested was measured on five continuums viz. Very Severe Pain, Severe Pain, Moderate Pain, Mild Pain and No Pain and the ascribed score was 5,4,3,2,1 respectively.

3.2.7.4: The Extent of Frequency and Severity of Body Pain was measured through **Psychophysical Corlett and Bishop's Body Part Discomfort Standardized Scale (1976).** The scale is a subject symptom survey tool that evaluates the respondent's direct experience of frequency and severity of discomfort at different body parts. The **extent of frequency** of body discomforts experienced in upper and lower body parts by the respondents engaged in Rose harvesting process, was measured on the frequency index. The responses of the frequency index were Always, Sometimes, Never and the ascribed score for responses were 3, 2, 1 respectively. The possible Minimum and maximum score for upper body parts was 09 and 27 respectively and the possible Minimum and maximum score for lower body parts was 18 and 54 respectively. The **extent of severity** of body discomforts experienced in upper and lower body parts by the respondents engaged in Rose harvesting process, was measured on the severity index on five continuum scale viz. Very Severe Pain, Severe Pain, Moderate Pain, Mild Pain and No Pain and the ascribed score was 5,4,3,2,1 respectively. The possible minimum score was 18 and the maximum score was 76 for upper body parts and the possible minimum score was 09 and the maximum score was 38 for the lower body parts (**kindly refer page 185-187**)

3.3. Conceptual Framework of the Study

Variables Under the Study

Variables are the conditions or the characteristics that the experimenter manipulates, controls or observes. Explaining the concepts of variables, Kothari and Garg (2015) articulate that, the variable that is antecedent to the dependent variable is termed as "Independent Variable", which cannot be

changed. Accordingly, the variable that depends upon or is a consequence of the other variable is termed as "Dependent Variable". The intervening variables are extraneous independent variables, not related to the purpose of the study but affects the dependent variable of the study. For the present study, the independent, dependent and Intervening variables identified are described as follows.

I. Independent Variables of the Respondents:

1. **Personal Variables**
   - Gender
   - Age (in years)
   - BMI (Body Mass Index)
   - Work Experience
2. **Situational Variables of the Respondents:**

- **Time Duration** spent on Rose Harvesting process (Plucking, Gathering and Heaping).
- **Frequency of Repetition of the task** while performing Rose harvesting process (Plucking, Gathering and Heaping).
- **Distance Covered** during Rose harvesting process (Plucking, Gathering and Heaping).
- **Quantity (Kg) of Rose harvested** by the Rose farm workers during Rose harvesting process (Plucking, Gathering and Heaping).

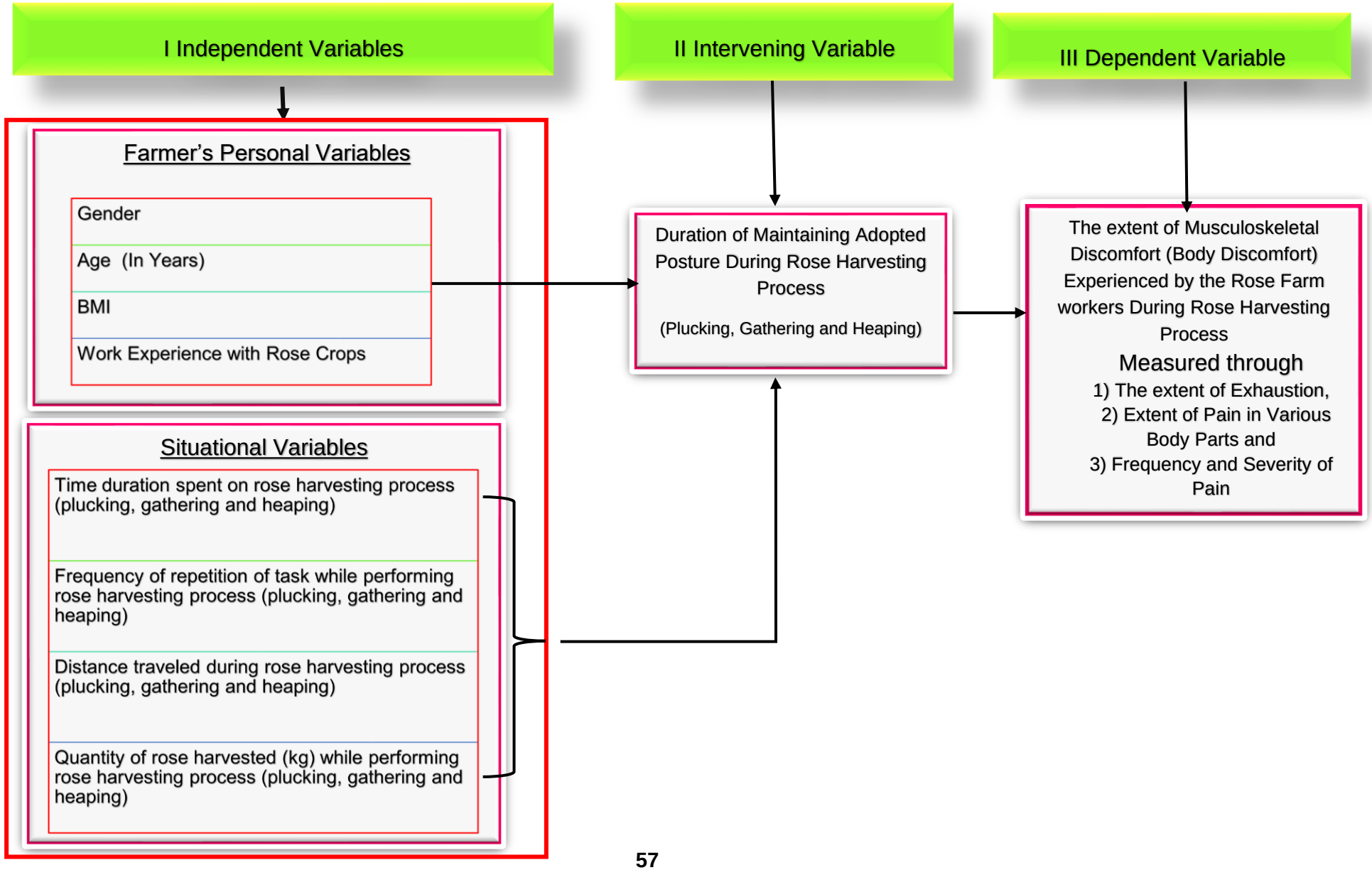
II. Intervening Variable of the Respondents:

- Duration of maintaining the adopted posture by the Rose farm workers during Rose harvesting process (Plucking, Gathering and Heaping).

III. Dependent Variable of the Respondents:

- The Extent of Musculoskeletal Discomfort (Body Discomfort) experienced by the Rose farm workers during Rose harvesting process (Plucking, Gathering and Heaping).

Fig.16: Schematic Diagram of the Variables selected under the study



Explanation of the Conceptual Framework of the Study

The conceptual framework of the study shows that the independent variables i.e. personal variables of Rose Farm Workers Viz. Gender Age, BMI and Work Experience with the Rose crops and Situational Variables Viz. time duration spent on Rose harvesting, Frequency of repetition of the tasks (Plucking, Gathering and Heaping) done while Rose harvesting process, distance covered during Rose harvesting and quantity of Rose harvested with maintaining adopted posture affect the extent of Musculoskeletal Discomfort (Body Discomfort) experienced by the Rose Farm Workers during Rose harvesting process.

3.4. Locale of the Study

The locale of the present study was Vadodara District in the state of Gujarat. Vadodara is the cultural capital of Gujarat [(9),] which is the second-highest Kashmiri Rose growing district amongst the five major Rose growing district of Gujarat with 5482 MT production of Rose crops [(10).] The sample of the present study was collected from the selected three villages having maximum Rose farm Viz. Etola, Karali and Samiyala in Vadodara district of Gujarat. The distance of the locale (Etola) from the Vadodara city by Road is approx. 22.8 km via nh48 and approx.18km by train. The nearest Airport from the locale is located at a distance of approx. 33.3 km [(11).] The distance of the locale (Karali) from the Vadodara city by Road is approx. 33 km via nh48 and approx.28km by train. The nearest Airport from the locale is located at a distance of approx. 9 km [(12)] and the distance of the locale (Samiyala) from the Vadodara city by Road is approx. km via nh48 and approx. 9km by train. The nearest Airport from the locale is located at a distance of approx. 13 km [(13).]

3.5. Unit of Inquiry

The unit of inquiry for the present study were those Rose farm workers engaged in Rose harvesting process (Plucking, Gathering and Heaping), having experience of minimum two years with the Rose crops, who were physically and mentally normal (not physically and mentally challenged and females, not in the pregnancy stage) and were willing to participate in the research study.

3.6 Sampling Size and Sampling Procedure

3.6.1: Selection Criteria for the Rose Farms

For the present study, the criteria set for the selection of the Rose farms were as follows:

1. The present study was limited to the selected Rose farms of Vadodara districts having a minimum of ten farm workers.
2. The present study was limited to the selected Rose farms of Vadodara districts indulged in Kashmiri Rose cultivation.
3. The present study was limited to those Rose farms having minimum production of Rose crops above 70 kg/per day.

3.6.2: Selection Criteria for the Rose Farms Workers

For the present study, the criteria set for the selection of the Rose farm worker were as follows:

1. The present study was limited to those Rose farm workers who were above 18 years.
2. The present study was limited to those Rose farm workers who were involved in Harvesting process (Plucking, Gathering and Heaping) of Rose crops and maintenance of Rose Plants and have minimum two years of work experience with the same crop.
3. The present study was limited to those Rose farm workers who were physically and mentally normal (not physically or mentally challenged) and especially females, not in the pregnancy stage.
4. The present study was limited to those Rose farm workers who were willing to participate in the research study.

3.6.3: Sample Size:

The sample size for the present study comprised of 60 Rose farm workers (male and female) engaged in Rose harvesting process (Plucking, Gathering and Heaping) and had minimum two years of experience with the same crop.

3.6.4: Sampling Procedures of Rose Farms:

For the present study, purposive sampling technique was used for the selection of Rose farms and Rose farm workers. Under this procedure in the first stage amongst the five Major Rose growing Districts of Gujarat, Vadodara District was selected as it had maximum Kashmiri Rose farms. In the second stage, those villages of Vadodara District were selected purposively which had Kashmiri Rose farms having minimum 70 kg /per day Rose crop production and had minimum ten farm workers engaged in Rose harvesting process. For the selection of Rose farm workers , only those workers were selected who were above 18 years, had minimum two years of work experience with the same Crop, who were physically and mentally normal (not physically or mentally challenged) and especially females were not in the pregnancy stage and were willing to participate in the research study.

Schematic Diagram showing the Sampling Procedure Adopted for the Present Study

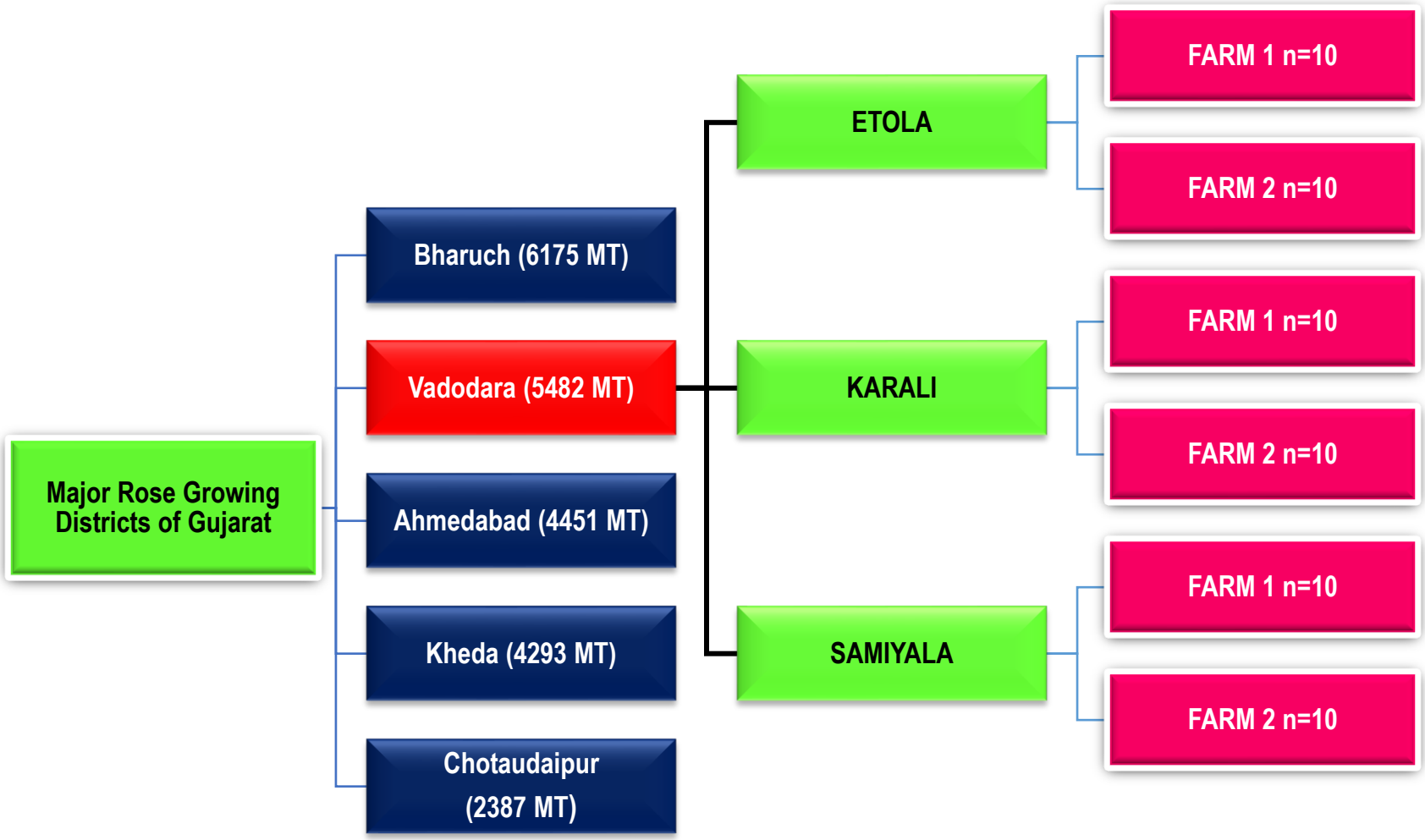


Fig.17: Schematic diagram showing the Sampling Procedure Adopted for the Present Study

3.7. Construction and Description of the Tool

The exhaustive review of literature survey helped the researcher to select and prepare the required tool to facilitate the data collection for the present research study.

3.7.1: Selection of Data Collection Tool

For the present study Interview Schedule and Observation Sheet was considered to be the most suitable tool for data collection for the following reasons.

Interview Schedule

Interview Schedule was sought to be the most suitable tool for data collection for the following reasons.

- It was anticipated that the educational level of the respondents would vary from illiterate to highly educated. Hence, the questionnaire would not be suitable as a tool.
- The language of the interview could be adapted according to the ability or educational level of the respondents interviewed and as such misinterpretations concerning questions could be avoided.
- A rapport with the respondents can be established that can help to stimulate authentic, complete and reliable information.
- Clarification of the doubts can be done if at all any, which in turns would facilitate the data collection.
- For the present study it was necessary to obtain the personal data of the respondents like Name, Age (in years), Gender, Type of family, Educational qualification, Monthly income, Work experience in Rose farms, medical background of Rose farmers, size of Rose farm, Production of Rose in kgs/per day, crop calendar of Rose cultivation, Frequency and Severity of Body Discomfort experienced by the Rose farm workers during Rose harvesting process. Thus, the interview schedule was thought to be the most appropriate tool to gather essential data.

Observation Sheet

Observation sheet is the most commonly scientific method used, in studies relating to behavioral sciences. It is the method of data collection which researchers use for observing the existing situation (**Kothari, 2014**). Since, present study involves an analysis of BMI of the farmers, the posture adopted by the Rose farm workers during Rose harvesting process, repetition of the tasks (Plucking, Gathering and Heaping) performed, time taken and distance covered during Rose harvesting, the quantity of Rose harvested and the extent of musculoskeletal discomfort (body discomfort) experienced by the respondents during Rose harvesting process (Plucking, Gathering and Heaping). The observation sheet was sought to be the most suitable tool for data collection. The observation sheet has the following advantages:

- The subjective bias is eliminated, if the observation is done accurately and the information obtained under this method relates to current situations.
- This method is independent of the respondent's willingness to respond and as such is relatively less demanding of active cooperation on the parts of respondents.

3.7.2: Construction and Description of Tools

Development of the Interview Schedule

Interview Schedule: The tool was constructed in compliance with the objectives of the study. The interview schedule was divided in two sections described as follows.

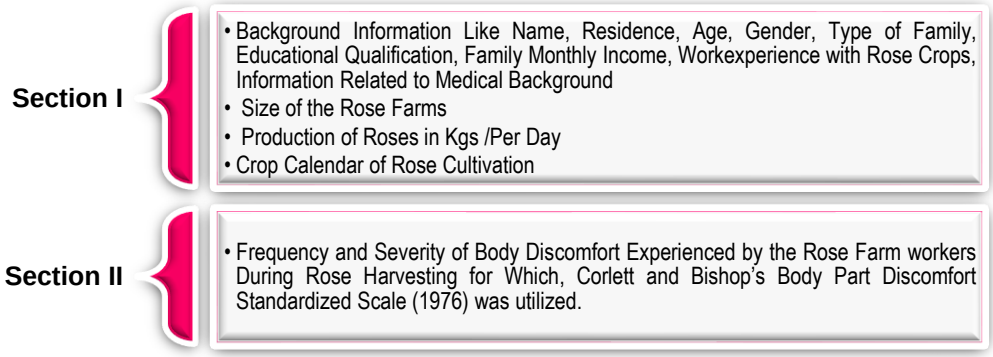


Fig. 18: Description of the Interview Schedule

- **Section I** sought information regarding the personal data of the rose farm workers like Name, Age (in years), Gender, Type of Family, Educational Qualification, Monthly Income, Work Experience in the Rose Farm, Medical Background of Rose Farm Workers, Size of the Rose Farm, Production of Roses in kgs/per day, Crop calendar of Rose cultivation.
- **Section II,** sought information regarding the frequency and severity of body discomfort experienced by the Rose farm workers during Rose harvesting process (Plucking, Gathering and Heaping) for which **Corlett and Bishop's Body Part Discomfort Standardized Scale (1976) was utilized.**

Development of Observation Sheet

Observation Sheet: The observation sheet was divided into two sections.

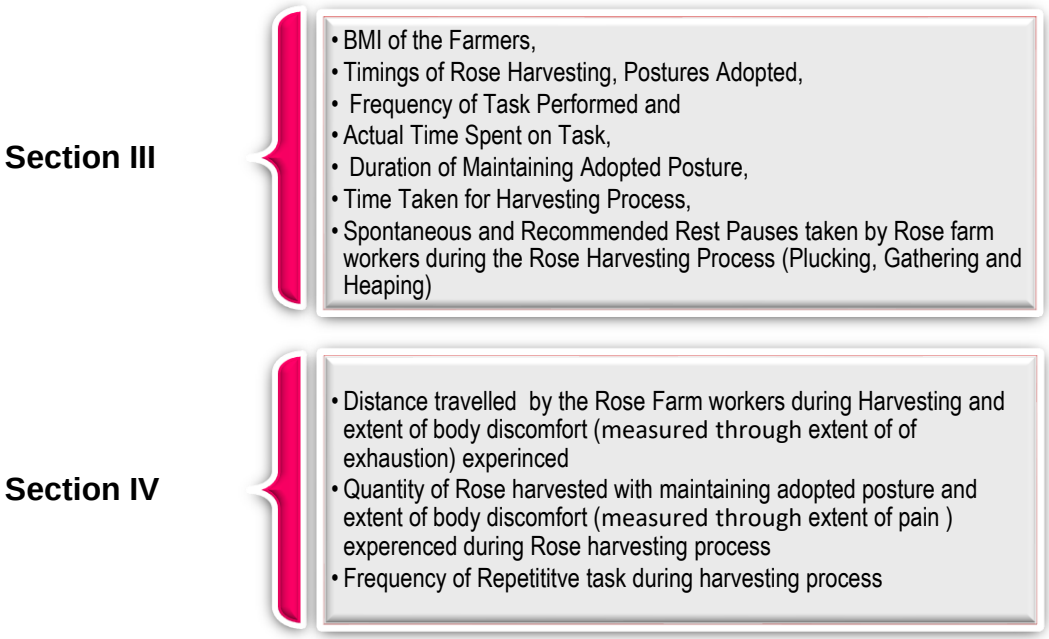


Fig. 19: Description of the Observation Sheet

Section I, congregated information regarding, BMI of the Rose farm workers, timings of Rose harvesting, posture adopted by the Rose farm workers during Rose harvesting and actual time spent (in hrs.) on Rose harvesting process (Plucking, Gathering and Heaping) by the Rose farm workers.

Section II: congregated information regarding extent of body discomfort experienced by the Rose farm worker caused due Distance covered (in meters) during rose harvesting, Frequency of Repetitive task (Plucking, Gathering and Heaping), Quantity of Rose harvested (in kg). For this purpose, three scales were developed described as follows:

- The Extent of body discomfort caused due to Time Duration spent on rose harvesting was measured through the extent of exhaustion experienced by the respondents on five continuum scale viz. Not Exhausted, Little Exhausted, Moderately Exhausted, Extremely Exhausted and Completely Exhausted and the ascribed scores were1,2,3,4,5 respectively.
- The Extent of body discomfort caused due to Distanced Covered was measured through the extent of exhaustion experienced by the respondents on five continuum scale viz. Not Exhausted, Little Exhausted, Moderately Exhausted, Extremely Exhausted and Completely Exhausted and the ascribed scores were1,2,3,4,5 respectively.
- The Extent of body discomfort caused due to due to Quantity of Rose harvested was measured through the extent of pain on five continuum scale viz. Very Severe Pain, Severe Pain, Moderate Pain, Mild Pain and No Pain and the ascribed score was 5,4,3,2,1 respectively.

3.8. Establishment of Content Validity of Tools

To establish the content validity of the data collection tools, it was given to the panel of 12 judges comprising the experts from the field of Ergonomics and the faculties of Department of Family and Community Resource Management, Faculty of Family and Community Sciences. The judges were requested to judge whether the listed items under each aspect were clear or ambiguous and relevant or irrelevant. Based on the

valuable suggestions given by the experts, the tool was modified and finalized for the data collection.

3.9. Data Collection

The data for the present study were collected by the researcher from October to January 2019-2020. The data collection was done in three steps described as follows:

1. **Interview:** for data collection, the researcher visited the Rose farms which were selected through Purposive sampling technique. The researcher stayed at the selected villages during the time of data collection because the Rose harvesting task was done in the early morning i.e. 3.00 am to 7.00 am, every day. The respondents (Rose Farm Workers) were interviewed personally by the investigator with the help of an interpreter (a fellow student who knew Gujarati language) and the responses were recorded on the interview schedule. It took almost 30 - 45 min to take an interview with a respondent. During the interview process, along with other developed scales by the researcher, **A Psychophysical Corlett and Bishop (1976) Standardized Body Discomfort Scale** was given to the Rose farm workers to point out the frequency and severity of pain in the different body parts. The personal attention was given to clarify the doubts of the respondents raised during the interview.
2. **Observation Sheet:** The observations were recorded in observation sheet regarding, BMI of the respondents, timings of Rose harvesting, duration of maintaining adopted posture by the Rose farm workers , extent of body discomfort (measured through the extent of exhaustion) experienced by the respondents caused by distance travelled and time spent on rose harvesting, frequency of the repetitive task performed while rose harvesting (Plucking, Gathering and Heaping), the extent of body discomfort (measured through the extent of pain) experienced by the respondents caused by the quantity of Rose harvested during Rose harvesting process.
    - The observation regarding the frequency of repetitive task and actual time spent on the rose harvesting task (Plucking, Heaping and Gathering) was done with the help of video recordings and stop watch.

- The observations regarding distance travelled was done with the help of measuring tape as well as Step Tracker-Pedometer & Calorie Tracker App.

The data were collected according to the schedule described as follows:

Selected Villages and Rose Farm for Data Collection	Dates of Visits	Number of Respondents Observed and Interviewed During the Visits
Karali Farm I	20/10/2019 to 24/10/2019	5 Respondents
	26/10/2019 to 30/10/2019	5 Respondents
Karali Farm II	1/11/ 2019 to 4/11/2019	4 Respondents
	10/12/ 2019 to 15/12/2019	6 Respondents
Samiyala Farm I	17/12/2019 to 20/12/2019	4 Respondents
	22/12/2019 to 27/12/2019	6 Respondents
Samiyala Farm II	29/12/2020 to 31/12/2020	3 Respondents
	2/1/2020 to 8/1/2020	7 Respondents
Etola Farm I	10/1/2020 to 14/1/2020	5 Respondents
	16/1/2020 to 20/1/2020	5 Respondents
Etola Farm II	21/1/2020 to 24/1/2020	4 Respondents
	26/1/2020 to 31/1/2020	6 Respondents

3.10. Data Analysis

The procedure to analyze the data, comprised of categorization, coding, tabulation and statistical analysis using SPSS.

Categorization of the Data (Interview Schedule)

SECTION I

Background Information

1. Age of the Respondents (in completed years).

- 21 - 36 years
- 37 - 52 years
- 53 - 68 years

2. Gender of the Respondents

- Male
- Female

3. Educational Qualification of the Respondents

- Literate
- Primary School
- Secondary School
- Higher Secondary
- Graduate

4. Monthly Income of the Respondents (in INR)

- ₹ 5000 – ₹10000
- ₹ 11000– ₹16000
- ₹17000-₹ 22000

5. Work Experience of the Respondents with Rose Crop (in years)

- 2- 6 years
- 7-11 years
- 12-17 years

6. Medical Background of the Respondents

Pattern of Score

To gather the information regarding the medical background of the Rose farm workers farmers engaged in Rose harvesting process the response pattern for this item were as follows:

Responses for Medical Problem	Scores
Yes	**01**
No	**02**

7. Size of the Rose farm (Bigha)

- 1 – 2 Bigha
- 3 – 4 Bigha

8. Production of Roses in (Kg/per day)

- 70-100 kg
- 101–131 kg
- 132–162 kg

SECTION II

1 A: Frequency Index of Body Discomforts Experienced by the Rose Farm Workers in Upper Body Parts (1-18) during Rose Harvesting Process (Plucking, Gathering and Heaping).

To assess the frequency of body discomforts experienced in upper body parts (1-18) by the Rose farm workers engaged in Rose harvesting process, the frequency index was categorized on the basis of equal distribution method, the pattern of the responses of the frequency index was Always, Sometimes, Never and the ascribed score for responses were 3, 2, 1 respectively. The possible minimum and maximum score were obtained and the range score was developed based on equal distribution method to express the frequency of body discomforts experienced in upper body parts (1-18) by the Rose farm workers during the Rose harvesting process.

Frequency Index of Body Discomfort For Upper Body Parts (1-18)	Range Score
Always	22 – 27
Sometimes	15 – 21
Never	9 – 14

1.B: Frequency Index for Body Discomforts Experienced by the Rose Farm Workers in lower body parts (19–27) during the harvesting process (Plucking, Gathering and Heaping) of Rose crops

To assess the frequency of body discomforts in lower body parts (19-27) experienced by the Rose farm workers engaged in Rose harvesting process, the frequency index was categorized basis of equal distribution method, the pattern of the responses of the frequency index was "Always", "Sometimes", "Never “and the ascribed score for responses were 3,2,1 respectively. The possible Minimum and maximum score were obtained and the range score was developed based on equal distribution method to express the frequency of body discomforts experienced in lower body parts (19-27) by the Rose farm workers during the Rose harvesting process.

Frequency Index of Body Discomfort For Lower Body Parts (19 – 27)	Range Score
Always	43 – 54
Sometimes	30- 42
Never	18 -29

2.A: The Extent of Body Discomforts Experienced by the Rose Farm Workers in (1-18) Upper Body Parts during Rose Harvesting Process (Plucking, Gathering and Heaping).

The extent of body discomfort (measured through the severity of pain) was categorized based on equal distribution method; the response was obtained on five continuum scale Viz. Very Severe Pain, Severe Pain, Moderate Pain, Mild

Pain and No Pain and the ascribed score was 5,4,3,2,1 respectively. The possible minimum and maximum score were obtained and the range score was developed based on equal distribution method to express the extent of body discomfort experienced by the respondents in the upper body parts (1-18) during Rose harvesting process.

The Extent of Discomfort Experienced in (Upper Body Parts)	Range Score
Discomfort to Great Extent	76 – 90
Discomfort to High Extent	61 – 75
Discomfort to Moderate Extent	48 – 60
Discomfort to Low Extent	33 – 47
Discomfort to No Extent	18 – 32

2.B: The Extent of Body Discomforts Experienced by the Rose Farm Workers in Lower Body Parts (19-27) during Rose Harvesting Process.

The response was obtained on five continuum scale Viz. “Very Severe Pain”, “Severe Pain”, “Moderate Pain”, “Mild Pain” and “No Pain” and the ascribed score was 5,4,3,2,1 respectively. The possible minimum and maximum score were obtained and the range score was developed based on equal distribution method to express the extent of body discomfort experienced by the respondents in lower body parts (19-27) during Rose harvesting process.

The Extent of Discomfort Experienced (Lower Body Parts)	Range Score
Discomfort to Great Extent	38 – 45
Discomfort to High Extent	30 – 37
Discomfort to Moderate Extent	25- 29
Discomfort to Low Extent	17- 24
Discomfort to No Extent	9 - 16

SECTION III

Categorization of the Data (Observation Sheet)

1: Height (meter) of the Respondents

- 1.49 – 1.60 meter
- 1.61 – 1.72 meter
- 1.73 – 1.84 meter
- 1.85 – 1.96 meter

2: Weight (Kgs) of the Respondents

- 45 – 55 Kgs
- 56 – 66 Kgs
- 67 – 77 Kgs
- 78 - 88 Kgs

3. Body Mass Index (BMI) of the Respondents (Kg/m2)

- Underweight 16.0 – 18.5
- Normal weight 18.5 – 24.9
- Overweight 25 – 29.9

4: Time of Rose Harvesting

- 3.00 am to 7.00 am daily

5: Posture Adopted During Rose Harvesting Process (Plucking, Gathering and Heaping).

- Standing and forward bending
- Only Standing

5.1: Frequency of Rose Harvesting Process.

- Daily (in hrs.)
- Alternate days (in hrs.)

5. 2: Actual Time Spent on Rose Harvesting Process

- 2 hrs. / per day
- 3-4 hrs. / per day

6.: Duration of Maintaining the Adopted Posture (in seconds per plant) during Rose Harvesting Process (Plucking, Gathering and heaping).

- 4-6 sec.
- 7-9 sec.
- 10 -12 sec.

6.1: Time Duration taken (in minutes) and Extent of Body Discomfort Experienced (measured through the extent of exhaustion) by the Rose Farm Workers during Rose Harvesting Process (Plucking, Gathering and Heaping).

To measure Time Duration (in minutes) taken during each trip by Rose farm workers during Rose harvesting process (Plucking, Gathering and Heaping). The possible minimum and maximum score were obtained and the range score was developed based on equal distribution method to express time duration taken per trip during Rose Harvesting Process (Plucking, Gathering and Heaping) by the Rose farm workers.

Time Duration Taken Per Trip During Rose Harvesting Process by the Rose Farm Workers

Time Duration (in minutes) ↓	**Trip 1**	**Trip 2**	**Trip 3**	**Trip 4**
Short Duration	**30** - 39	**35** - 43	**40** - 47	48 -52
Moderate Duration	40 - 49	44 - 52	48 - 55	53 -57
Long Duration	50 - **59**	53 - **61**	56 - **63**	58 - 62

Similarly, to measure time duration taken for overall Rose harvesting process by Rose farm workers , the possible minimum and maximum score were obtained and the range score was developed based on equal distribution method to express time duration taken per trip during Rose Harvesting Process (Plucking, Gathering and Heaping) by the Rose farm workers .

Overall Time Duration (4 trips) taken on Rose Harvesting Process Per Day by the Rose Farm Workers	
Time Duration	**Range Score (in min.)**
Short Duration	90-133
Moderate Duration	134-177
Long Duration	178-221

The extent of Body Discomfort experienced (measured through the extent of exhaustion) by the Rose farm workers Rose during harvesting (Plucking, Gathering and Heaping) process was assessed on a 5-point continuum rating scale with response structure as “Completely Exhausted”, “Extremely Exhausted”, “Moderately Exhausted”, “Little Exhausted and Not Exhausted”, and the ascribed score for responses was 5,4,3,2,1 respectively. The possible minimum and maximum scores were obtained and the range score was developed based on equal distribution method to express the extent of body discomfort (measured through the extent of exhaustion) experienced by the Rose farm workers during Rose harvesting process (Plucking, Gathering and Heaping).

Extent of Exhaustion	Range Score
Completely Exhausted	5
Extremely Exhausted	4
Moderately Exhausted	3
Little Exhausted	2
Not Exhausted	1

7: Number and Duration of Spontaneous Rest Pauses taken by the Rose Farm Workers during Rose Harvesting Process (Plucking, Gathering and Heaping).

Number of Spontaneous Rest Pauses	Duration of Spontaneous Rest Pauses (Min)
1	5 – 10
2	11- 16
3	17-20

7.1: The Pauses for Rest that are given by the Farm Owners during Rose Harvesting Process (Plucking, Gathering and Heaping)

Number of Recommended Rest Pauses given by the Rose Farm Owners	Duration of Recommended Rest Pauses (Min)
1	5 – 10
2	11- 16
3	`17-20

SECTION IV

1: Distance Covered and Extent of Body Discomfort Experienced (measured through the extent of exhaustion) by the Rose Farm Workers During Rose Harvesting Process (Plucking, Gathering and Heaping).

To measure the distance covered during Rose harvesting process was done with the help of measuring tape as well as Step Tracker-Pedometer & Calorie Tracker App. To measure the distance covered (in meter) by Rose farm workers during Rose harvesting process (Plucking, Gathering and Heaping), the possible minimum and maximum scores were obtained and the range score was developed based on equal distribution method to express distance covered (meter) for each trip by the Rose farm workers during Rose harvesting process (Plucking, Gathering and Heaping).

Distance Covered (in meter) for Each Trip During Rose Harvesting Process

Distance Covered ↓	**Trip 1**	**Trip 2**	**Trip 3**	**Trip 4**
Short Distance	**301** - 315	**609** - 625	**933** - 951	**1273** – 1291
Moderate Distance	316 - 330	626 - 641	952 - 969	**1273** – 1291
Long Distance	331 - **345**	642 - **625**	970 - **987**	1310 – **1327**

Similarly, to measure the distance covered (in meter) for overall Rose harvesting process by Rose farm workers, the possible minimum and maximum score were obtained and the range score was developed based on equal distribution method to express time duration taken for overall Rose harvesting (Plucking, Gathering and Heaping) by the Rose farm workers .

Overall Distance Covered (4-Trips) During Rose Harvesting Process Per Day by the Rose Farm Workers	
Distance Covered	**Range Score (in meter)**
Short Distance	643-871
Moderate Distance	872-1100
Long Distance	1101-1329

The Extent of Body Discomfort Experienced (measured through the extent of exhaustion) by the Rose Farm Workers due to Distance Covered During Rose Harvesting Process (Plucking, Gathering and Heaping).

Extent of Exhaustion	Ascribed Score
Completely Exhausted	5
Extremely Exhausted	4
Moderately Exhausted	3
Little Exhausted	2
Not Exhausted	1

The extent of body discomfort experienced (measured through the extent of exhaustion) by the Rose farm workers due to distance covered during Rose harvesting process, was assessed on a 5-point continuum scale with response structure as “Completely Exhausted”, “Extremely Exhausted”, “Moderately Exhausted”, “Little Exhausted and Not Exhausted”, and the ascribed score for responses was 5,4,3,2,1 respectively. The possible minimum and maximum score were obtained and the range score was developed based on equal distribution method to express the extent of body discomfort experienced by the Rose farm workers due to distance covered during Rose harvesting process.

2: Quantity of Rose Harvested (Kg) while performing Rose Harvesting Process (Plucking, Gathering and Heaping)

To measure the extent of body discomfort experienced (measured through the extent of pain) by the Rose farm workers on various body parts due to quantity (kgs) of Rose harvested during Rose harvesting process, was assessed on a 5-point continuum scale with response structure as “Very High”, “High”, “Moderate”, “Less”, “Very Less”, and the ascribed score was 5,4,3,2,1 respectively. The possible minimum and maximum score were obtained and the range score was developed based on equal distribution method to express the extent of body discomfort experienced due to Quantity of Rose harvested (Kgs) during Rose harvesting process.

Extent of Pain	Ascribed Score
Very High	5
High	4
Moderate	3
Less	2
Very less	1

3: Repetitive task Performed by the Rose Farm Workers during Rose Harvesting Process (Plucking, Gathering Heaping).

The frequency of repetition of task “**Plucking”** of Rose was assessed based on plucking of Rose done by the Rose farm workers repeatedly for completing 1 bag (4 kg). The possible minimum and maximum score were obtained and the range score was developed based on equal distribution method to express the frequency of repetition of task "**Plucking”** of Rose by the Rose farm workers during Rose harvesting process.

The frequency of repetition of task **“Gathering**” was assessed based on collecting the picked Roses in the collecting bag carried by Rose farm workers on their neck. The possible minimum and maximum score were

obtained and the range score was developed based on equal distribution method to express the frequency of repetition of task **"Gathering**" of Rose by the Rose farm workers during Rose harvesting process.

The frequency of repetition of task **"Heaping**" was assessed based on the frequency of emptying the Rose filled bags in the main Rose collecting bag. The possible minimum and maximum score were obtained and the range score was developed based on equal distribution method to express the frequency of repetition of task **"Heaping**" of Rose by the Rose farm workers during Rose harvesting process.

Frequency of Repetition of Task "Plucking"	Frequency of Repetition of Task "Gathering"	Frequency of Repetition of Task "Heaping"
Range Score	**Range Score**	**Range Score**
1660-2814	391-840	2
2815-3969	841-1290	3
3970-5124	1291-1740	4

3.11: Statistical Analysis

The data were analyzed through the Statistical Package for Social Sciences (SPSS).

- **Descriptive Statistics:** The data were presented in frequencies and percentage and weighted mean.
- **Relational Statistics:** Statistical analysis was carried out to test the hypothesis postulated for the study.

Personal Variables	Situational Variables	Relational Statistics Applied
Age	Time Duration Spent on Rose Harvesting Process	**(ANOVA) F- test**
	Distance Covered by the Farm Workers During Rose Harvesting Process	
	Quantity of Rose Harvested (Kg) By the Farm Workers During Rose Harvesting Process	
	Frequency of Repetition of Task (Plucking, Gathering and Heaping) Done by the Farm Workers During Rose Harvesting Process	
	The Frequency of Musculoskeletal Discomfort Experienced by the Rose Farm Workers During Rose Harvesting Process	
Gender	Time Duration Spent on Rose Harvesting Process	**t-test**
	Distance Covered by the Farm Workers During Rose Harvesting Process	
	Quantity of Rose Harvested (Kg) By the Farm Workers During Rose Harvesting Process	
	Frequency of Repetition of Task (Plucking, Gathering and Heaping) Done by the Farm Workers During Rose Harvesting Process	
	The Frequency of Musculoskeletal Discomfort Experienced by the Rose Farm Workers During Rose Harvesting Process	
BMI	Time Duration Spent on Rose Harvesting Process	**(ANOVA) F- test**
	Distance Covered by the Farm Workers During Rose Harvesting Process	
	Quantity of Rose Harvested (Kg) By the Farm Workers During Rose Harvesting Process	
	Frequency of Repetition of Task (Plucking, Gathering and Heaping) Done by the Farm Workers During Rose Harvesting Process	
	The Frequency of Musculoskeletal Discomfort Experienced by the Rose Farm Workers During Rose Harvesting Process	
Work Experience with Rose crops	Time Duration Spent on Rose Harvesting Process	**(ANOVA) F- test**
	Distance Covered by the Farm Workers During Rose Harvesting Process	
	Quantity of Rose Harvested (Kg) by the Farm Workers During Rose Harvesting Process	
	Frequency of Repetition of Task (Plucking, Gathering and Heaping) Done by the Farm Workers During Rose Harvesting Process	
	The Frequency of Musculoskeletal Discomfort Experienced by The Rose Farm Workers During Rose Harvesting Process	

Personal Variables	Intervening Variable	Relational Statistics Applied
Age	Duration of maintaining adopted posture during the harvesting process (Plucking, Gathering and Heaping) of Rose crops.	**(ANOVA) F- test**
Gender		**t-test**
BMI		**(ANOVA) F- test**
Work experience with Rose crops		**(ANOVA) F- test**

Situational Variable	Intervening Variable	Relational Statistics Applied
Time Duration Spent on Rose Harvesting Process	Duration of Maintaining Adopted Posture during Rose harvesting process	**Correlation Coefficient**
Distance Covered by the Farm Workers During Rose Harvesting Process		
Quantity of Rose Harvested (Kg) by the Farm Workers During Rose Harvesting Process		
Frequency of Repetition of the task (Plucking, Gathering and Heaping) Done by the Farm Workers During Rose Harvesting Process		

Situational Variable	Dependent Variable	Relational Statistics Applied
Time Duration Spent on Rose Harvesting Process	The Frequency of Musculoskeletal Discomfort Experienced by the Rose Farm Workers during Rose harvesting process.	**Correlation Coefficient**
Distance Covered by the Farm Workers During Rose Harvesting Process		
Quantity of Rose Harvested (Kg) By the Farm Workers During Rose Harvesting Process		
Frequency of Repetition of Task (Plucking, Gathering and Heaping) Done by the Farm Workers During Rose Harvesting Process		
Time Duration Spent on Rose Harvesting Process	The severity of Musculoskeletal Discomfort Experienced by the Rose Farm Workers during Rose harvesting process.	**Correlation Coefficient**
Distance Covered by the Farm Workers During Rose Harvesting Process		
Quantity of Rose Harvested (Kg) By the Farm Workers During Rose Harvesting Process		
Frequency of Repetition of Task (Plucking, Gathering and Heaping) Done by the Farm Workers During Rose Harvesting Process		

\Personal Variables	Dependent Variable	Relational Statistics Applied
Age	The Severity of Musculoskeletal Discomfort Experienced by the Rose Farm Workers During Rose Harvesting Process.	**(ANOVA) F- test**
	The Frequency of Musculoskeletal Discomfort Experienced by the Rose Farm Workers during Rose harvesting process (Plucking, Gathering and Heaping)	
BMI	The severity of Musculoskeletal Discomfort Experienced by the Rose Farm Workers during Rose harvesting process.	**(ANOVA) F- test**
	The Frequency of Musculoskeletal Discomfort Experienced by the Rose Farm Workers during Rose harvesting process	
Work experience with Rose crops	The severity of Musculoskeletal Discomfort Experienced by the Rose Farm Workers during Rose harvesting process.	**(ANOVA) F- test**
	The Frequency of Musculoskeletal Discomfort Experienced by the Rose Farm Workers during Rose harvesting process	
Gender	The severity of Musculoskeletal Discomfort Experienced by the Rose Farm Workers during Rose harvesting process.	**t-test**
	The Frequency of Musculoskeletal Discomfort Experienced by the Rose Farm Workers during Rose harvesting process	

3.12. The suggestions of Coping Strategies to Overcome Musculoskeletal Discomfort Experienced by the Rose Farm Workers

Need-based coping strategies were suggested based on frequency and severity of musculoskeletal discomfort experienced by the Rose farm workers during Rose harvesting process in various upper and lower body parts due to time spent on the Rose harvesting process, distance travelled during the Rose harvesting process, the quantity of rose harvested, frequency of repetitive task (Plucking, Gathering and Heaping).

FINDINGS AND DISCUSSION

CHAPTER IV

FINDINGS AND DISCUSSION

The chapter findings and discussion is the most important in a thesis as well in any type of research reports. The present chapter describes the analysis of data followed by the interpretation and discussion. For a systematic presentation, the chapter has been divided into the following sections.

4.1. Section I: Background Information of the Respondents

4. 2. Section II: Frequency and Severity Index of Body Discomforts Experienced by the Rose Farm Workers during Rose Harvesting Process

4.3. Section III:

- BMI of the Rose Farm Workers
- Timings of Rose Harvesting
- Frequency of Rose Harvesting task by the Rose Farm Workers.
- Actual Time Spent on Rose Harvesting
- Duration of maintaining Adopted Posture by the Rose Farm Workers.
- Extent of Body Discomfort Experienced by the Rose Farm Workers due to Time spent for Rose Harvesting Process.

4.4 Section IV:

- Extent of Body Discomfort Experienced by the Rose Farm Workers due to Distance Covered during Rose Harvesting Process.
- Extent of Body Discomfort Experienced during Rose Harvesting Process due to Quantity of Rose Harvested by the Rose Farm Workers.
- Frequency of Repetitive Task with Adopted Posture during Rose Harvesting Process by the Rose Farm Workers.

4.5 Section V: Testing of Hypotheses

4.6: Section VI: Suggested Coping Strategies to Overcome Musculoskeletal Discomforts of Rose Farm Workers

SECTION I

4.1: Section I: Background Information of the Rose Farm workers

This section deals with background information of the selected Rose farm workers engaged in Rose harvesting process (Plucking, Gathering and Heaping) such as Age (in years), Gender, Type of Family, Educational Qualification, Monthly Income (INR), Work Experience with Rose Crop (in years), Medical Background of the Respondents, Size of the Rose farms (in Bigha) and Production of Rose crops (in Kg/per day).

4.1.1. Age of the Rose Farm Workers

The age of the selected respondents ranged between 21 to 68 years with the mean age of **39.36**. It was found that less than half (46.67%) of the respondents belonged to the age group of 21-36 years. More than one third (36.67%) of the respondents belonged to the age group of 37-52 years and one-sixth (16.67%) of the respondents belonged to the age group of 53-68 years respectively **(Table 1).**

4.1.2. Gender of the Rose Farm Workers

Table 1, depicts the information regarding the gender of the respondents. It can be observed that majority of the respondents (76.67%) were males and slightly more than one-fifth of the respondents (23.33%) were females.

4.1.3. Type of Family

According to the data exhibited in **table 1**, it can be observed that majority (80%) of the respondents were from nuclear family and one fifth (20%) of the respondents belonged to the joint family.

4.1.4. Educational Qualification

The data about the educational qualification of the respondents as shown in **table 1**, revealed that more than half (56.67%) of the respondents had educational level up to Primary level, slightly less than one third (31.67%) of the respondents had completed Secondary level of education. Whereas, 6.67 per cent of the respondents had completed Higher Secondary level of

education, 3.33 per cent of the respondents were Illiterate and only 1.66 per cent of the respondents were Graduate.

4.1.5. Family Monthly Income:

The findings of the study revealed that majority (78.34%) of the respondents had family monthly income ranging from ₹5000-₹10000, Less than one fifth (18.33%) of the respondents had family monthly income ranging from ₹11000–₹ 16000 and few (3.33%) of the respondents had family monthly income ranging from ₹17000- ₹22000, **(table 1).**

4.1.6. Work Experience of the Respondents with Rose Crops (in years)

Table 1, reveals that work experience of the selected respondents (Rose farm worker) ranged between 2 to 17 years with the mean years **4.06**. It was found that the majority (91.67%) of the respondents had work experience from 2- 6 years with Rose crops harvesting. Whereas, few (5 %) of the respondents had work experience of 7-11 years and 3.33 per cent of respondents were engaged in Rose harvesting process in the last 12-17 years.

4.1.7 Medical Background of the Respondents

From the data gathered during the personal interview of respondents, it was found that none of the respondents had medical-related health problem like Diabetes, Hypertension, Joint Pain, Back Pain, Respiratory Problem, Arthritis, Tendencies, and women were also not in pregnancy stage. Therefore, it can be concluded that all the respondents engaged in Rose harvesting process working in selected Rose farms were physically and mentally normal (not physically or mentally challenged) and especially females were not in the pregnancy stage.

Table 1: Frequency and Percentage distribution of the respondents according to their Background Information			
Sr.no	**Background Information of the Respondents**	**Respondents(n=60)**	
		f	***%***
1.	**Age (in years)**		
	21-36	28	46.67
	37-52	22	36.67
	53-68	10	16.67
		Mean	**39.36**
		Standard Deviation	**11.74**
2.	**Gender**		
	Male	46	76.67
	Female	14	23.33
3.	**Family Type**		
	Nuclear	48	80
	Joint	12	20
4.	**Educational Qualification**		
	Illiterate	2	3.33
	Primary Level	34	56.67
	Secondary Level	19	31.67
	Higher Level	4	6.67
	Graduate	1	1.66
5.	**Family Monthly Income**		
	₹5000 – 10000	47	78.34
	₹11000 – 16000	11	18.33
	₹17000 - 22000	2	3.33
		Mean	**₹9500**
		Standard Deviation	**3191.13**
6.	**Work Experience**		
	2 – 6 years	55	91.67
	7 – 11 years	3	5
	12 – 17 years	2	3.33
		Mean	**4.06**
		Standard Deviation	**2.35**

4.1.7 Size of the Rose Farms (in Bigha)

The findings of **table 2**, highlights that the selected respondents were working in Rose farm size ranged between 3-4 Bigha (land area).

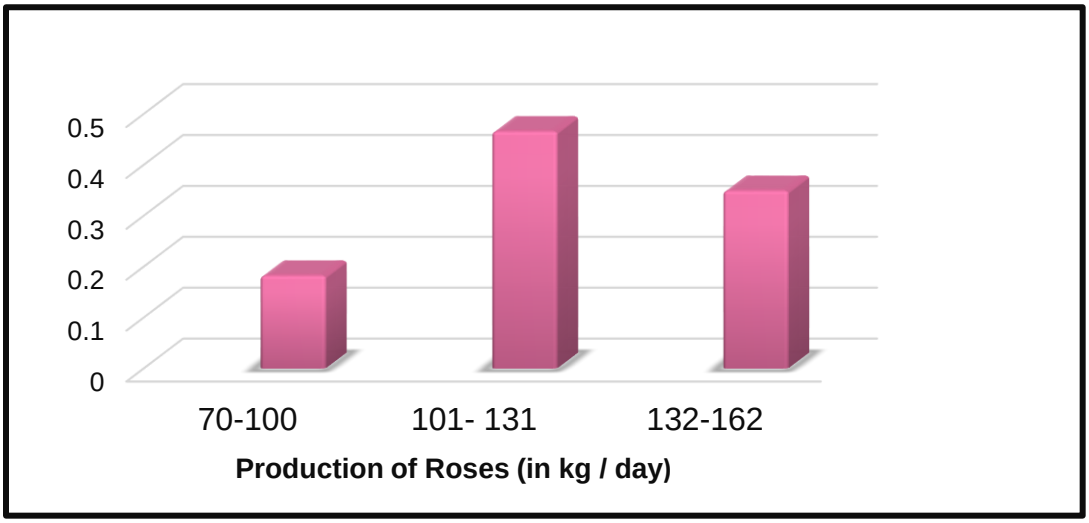
Table 2: Frequency and Percentage Distribution of the Respondents According to the Size of the Rose Farms (In Bigha) they were Engaged in Harvesting.

Size of the Rose Farms (in Bigha)	No of Farms (n=06)		Respondents (n=60)	
	f	*%*	*f*	*%*
3 – 4 Bigha	06	100	60	100

4.1.8. Production of Rose Crops (in Kgs/ day) of Selected Farms

According to the information given in **Fig 11**, less than one half (46.67%) of the respondents worked in Rose farms having production of Rose crops approximately up to 101-131 kgs. per day, more than one third (36.67%) of the respondents worked in Rose farms having production of Roses approximately up to 132-162 kgs. per day and less than one fifth (16.67%) of the respondents worked in Rose farms having production of Roses approximately up to 70-100 kgs. per day.

Figure 20: Distribution of Respondents according to Production of Rose Crops (in Kgs/ day) of selected Farms they worked in.



SECTION II

4. 2. Section II: Musculoskeletal Discomfort Experienced by the Rose Farm workers during Rose Harvesting Process (Plucking, Gathering and Heaping).

This section deals with the Musculoskeletal Discomfort experienced (measured through frequency and severity index of body pain) by the Rose farm workers during the harvesting process. **The data was collected through Psychophysical Collet and Bishop (1964), Standardized Body Discomfort Scale**. The investigator administered the scale in two parts Viz; Upper Body Parts (1-18) and Lower Body Parts (19-27). Based on the frequency and severity of body discomfort experienced by the respondents during the Rose harvesting process, the following results were obtained**.**

4.2.I. Frequency of Musculoskeletal Discomfort Experienced (Measured through Frequency Index of Body Discomfort) in Upper Body Parts (1-18) during Rose Harvesting Process (Plucking, Gathering and Heaping).

As depicted in **table 3,** it can be observed that majority of the respondents always experienced pain in the upper back (90%), mid-back (90%), lower back (90%) neck (78.33%) and right wrist (78.33%). While, more than half of the respondents always experienced pain in right palm (68.33%) and both the shoulders (66.67%) respectively. Whereas, the majority of the respondents experienced pain sometimes in clavicle left and clavicle right (78.33%), slightly more than half of the respondent reported about pain in right forearm (55%). However, majority of the responded reveled no pain in left arm (80%), left forearm (75.00%), left elbow (71.67%), left wrist (71.67%) and left palm (71.67%). Therefore, it could be concluded that out of 18 upper body parts, almost (90%) all the respondents always experienced pain in the upper back and lower back with the weighted mean **2.9** respectively. Subsequently, almost all the respondent always experienced pain in the mid-back with the

weighted mean score of **2.88** and majority of the respondents always experienced pain in the neck with **2.78** weighted mean score and right wrist with **2.76** weighted mean scores.

Table 3: Frequency of Body Discomforts Experienced by the Rose Farm workers in Upper Body Parts (1-18) during Rose Harvesting Process (Plucking, Gathering and Heaping).

Sr. No	Upper Body Parts	Frequency Index (n=60)						
		Always		Sometimes		Never		Wt. Mean Score (3-1)
		f	%	*f*	%	*f*	%	
1	**Neck**	47	78.33	13	21.67	0	0.00	**2.78**
2	Clavicle Left	13	21.67	47	78.33	0	0.00	2.21
3	Clavicle Right	13	21.67	47	78.33	0	0.00	2.21
4	Left Shoulder	40	66.67	20	33.33	0	0.00	2.66
5	Right Shoulder	40	66.67	20	33.33	0	0.00	2.66
6	Left Arm	0	0.00	12	20.00	48	80.00	1.2
7	Right Arm	36	60.00	24	40.00	0	0.00	2.6
8	Left Elbow	0	0.00	17	28.33	43	71.67	1.28
9	Right Elbow	38	63.33	21	35.00	1	1.67	2.61
10	Left Forearm	0	0.00	15	25.00	45	75.00	1.25
11	Right Forearm	26	43.33	33	55.00	1	1.67	2.41
12	Left Wrist	0	0.00	17	28.33	43	71.67	1.28
13	**Right Wrist**	47	78.33	12	20.00	1	1.67	**2.76**
14	Left Palm	0	0.00	17	28.33	43	71.67	1.28
15	Right Palm	41	68.33	18	30.00	1	1.67	2.66
16	**Upper back**	54	90.00	6	10.00	0	0.00	**2.9**
17	**Mid Back**	54	90.00	5	8.33	1	1.67	**2.88**
18	**Lower Back**	54	90.00	6	10.00	0	0.00	**2.9**
Total Weighted Mean								**2.25**

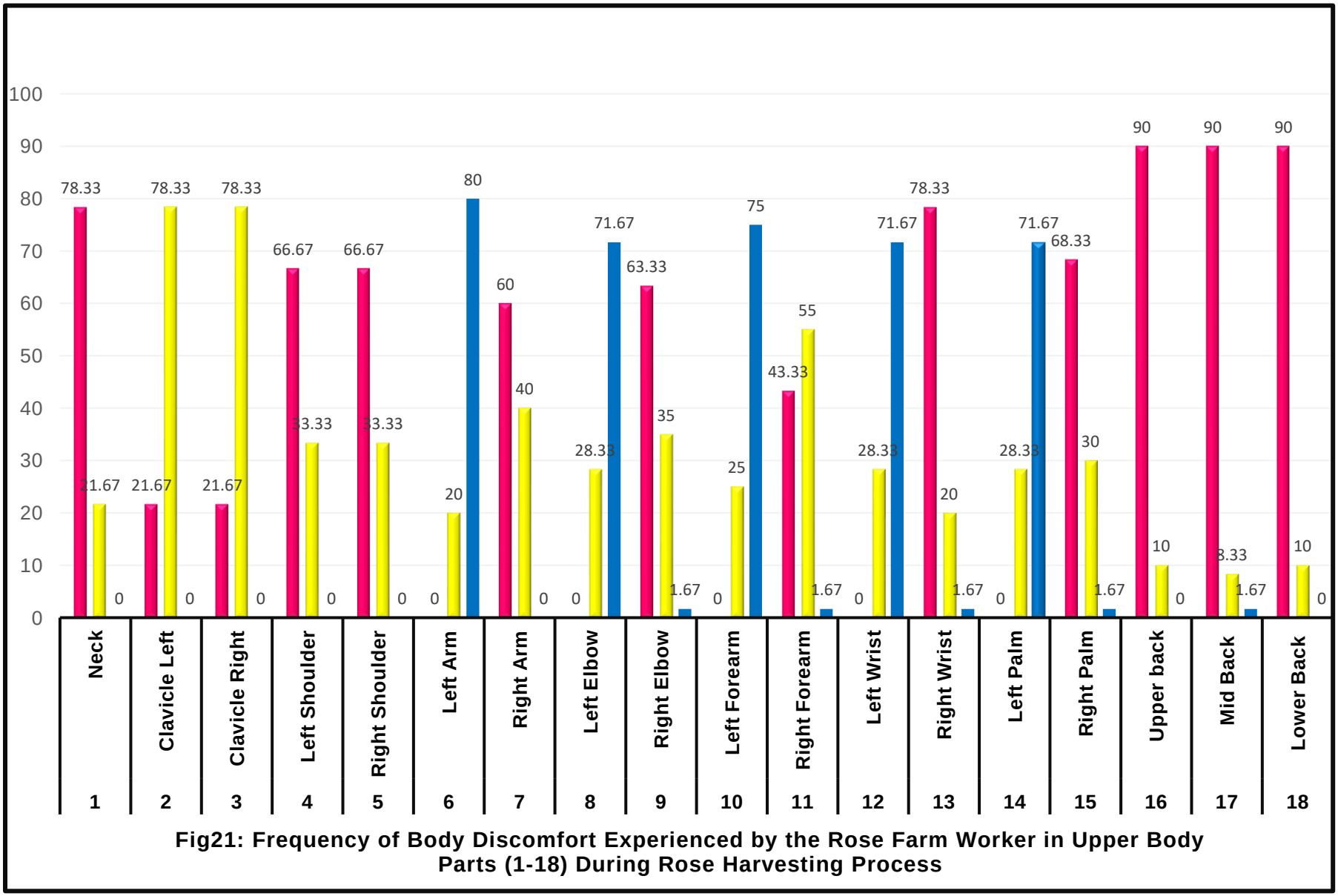
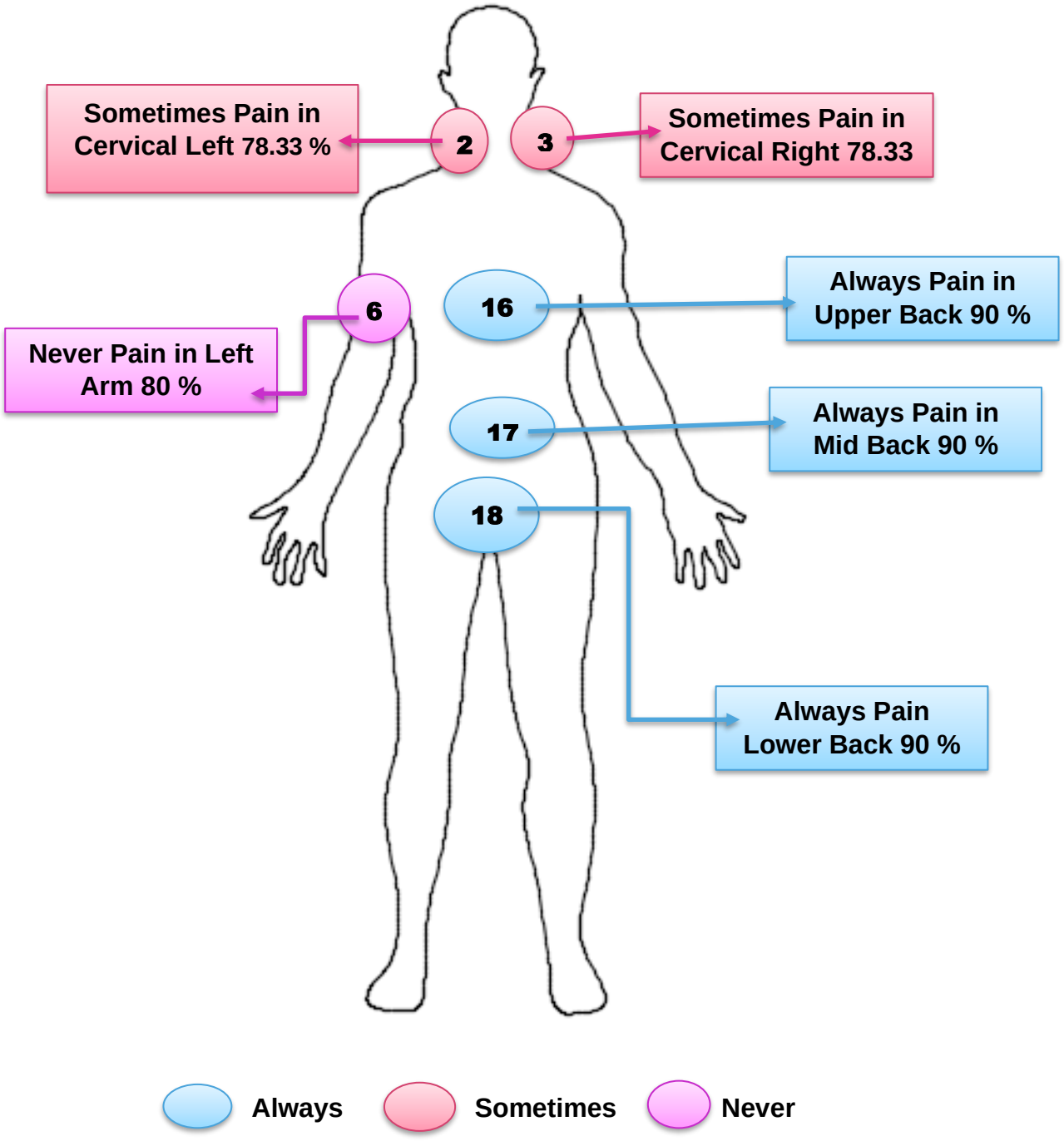


Fig21: Frequency of Body Discomfort Experienced by the Rose Farm Worker in Upper Body Parts (1-18) During Rose Harvesting Process

Fig 22: **Frequency of Body Discomforts Experienced by the Rose Farm Workers in Upper Body Parts (1-18) during Rose Harvesting Process (Plucking, Gathering and Heaping).**



Overall Distribution of the Respondents according to the Frequency of Body Discomfort Experienced in Upper Body Parts (1-18) during Rose Harvesting Process (Plucking, Gathering and Heaping).

According to **table 4**, the results revealed that more than one half (63.33%) of the respondents always experienced discomfort in the upper body parts, little less than one third (28.33%) of the respondents sometimes experienced discomfort in the upper body parts and little less than the tenth (8.33 %) of the respondents never experienced discomfort in the upper body parts.

Table 4: Overall distribution of the Respondents according to the Frequency of Body Discomfort Experienced in Upper Body Parts (1-18) during Rose Harvesting Process (Plucking, Gathering and Heaping)

Sr. No	Frequency Index of Body Discomfort	Range of Scores	Respondents(n=60)	
			f	%
1.	Always	43-54	38	63.33
2.	Sometimes	30-42	17	28.33
3.	Never	18-29	5	8.33

4.2.2. Frequency of Body Discomfort Experienced in Lower Body Parts (19-27) during Rose Harvesting Process (Plucking, Gathering and Heaping).

Table 5, depicts the information regarding the frequency of Body Discomfort Experienced by the farm worker during the Rose harvesting process. According to the data, it can be seen that majority of the respondents always experienced pain in left foot (88.67%), right foot (88.67%) and buttock (85%).

Whereas, more than half of the respondents experienced pain sometimes in left knee (68.33%), right knee (68.33%), left leg (66.67%), right leg (66.67%) and little less than two-thirds (61.67%) respondents in the left thigh and right thigh. However, 8.33 per cent of the respondents had never experienced pain in right and left thigh.

Table 5: Distribution of the Respondents according to the Frequency of Body Discomforts Experienced by Rose Farm Workers in (19-27) Lower Body Parts during Rose Harvesting Process (Plucking, Gathering, Heaping).

Sr. No	Lower Body Parts	Frequency Index (n=60)						
		Always		Sometimes		Never		Wt. Mean Score (3-1)
		f	*%*	*f*	*%*	*f*	*%*	
19	**Buttock**	51	85	9	15	0	0	**2.85**
20	Left Thigh	18	30	37	61.67	5	8.33	2.21
21	Right Thigh	18	30	37	61.67	5	8.33	2.21
22	Left knee	19	31.67	41	68.33	0	0	2.31
23	Right Knee	19	31.67	41	68.33	0	0	2.31
24	Left Leg	20	33.33	40	66.67	0	0	2.33
25	Right Leg	20	33.33	40	66.67	0	0	2.33
26	**Left Foot**	53	88.33	7	11.67	0	0	**2.88**
27	**Right Foot**	53	88.33	7	11.67	0	0	**2.88**
							Total Weighted Mean	**2.48**

Therefore, from the information depicted in **table 5**, it could be concluded that out of 9 Lower Body Parts in the first-place majority of the respondents always experienced pain in the left foot and right foot with a weighted mean score of **2.88** respectively. Subsequently, the majority of the respondents always experienced pain in Buttock with the weighted mean of **2.85**.

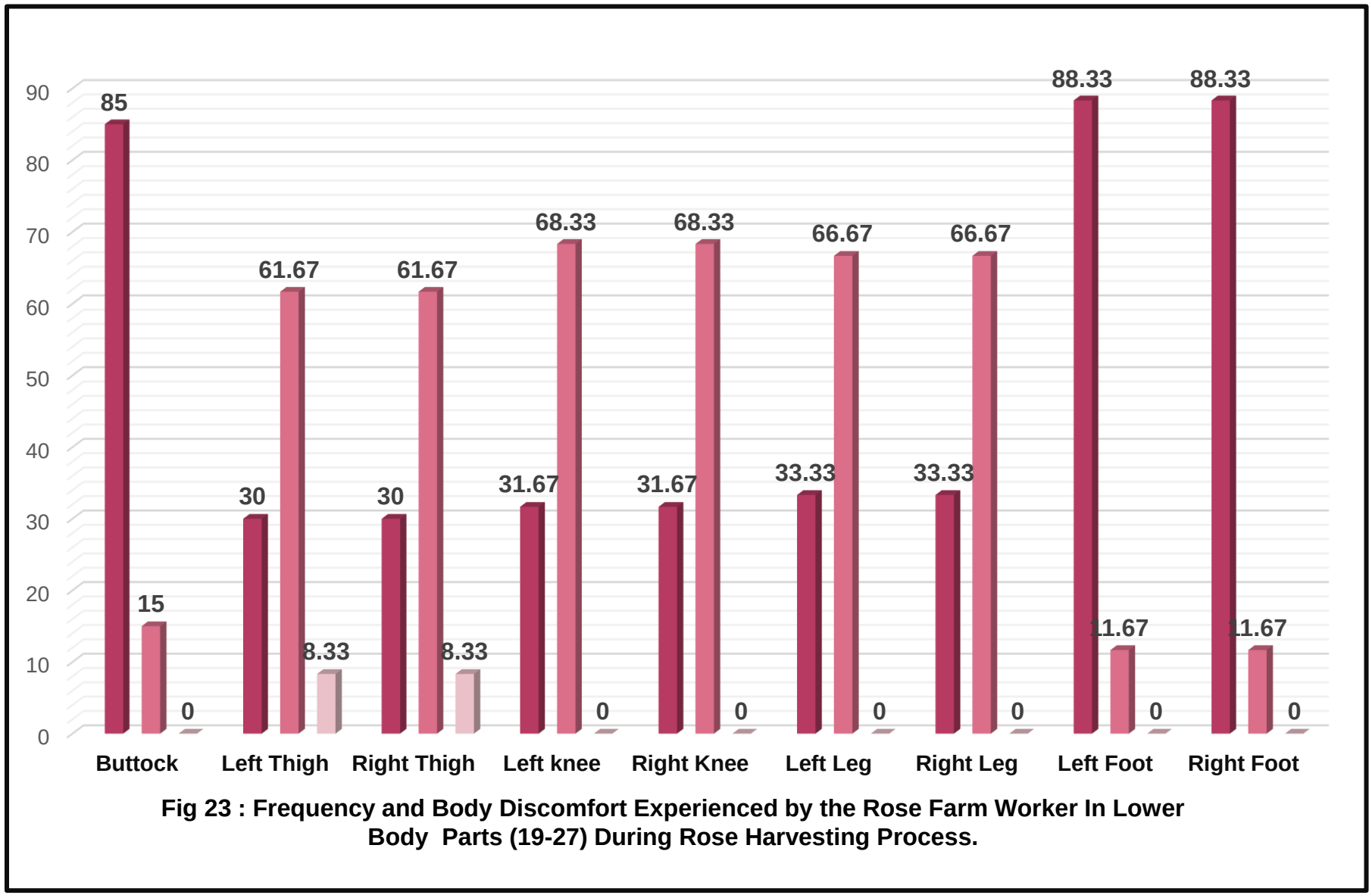
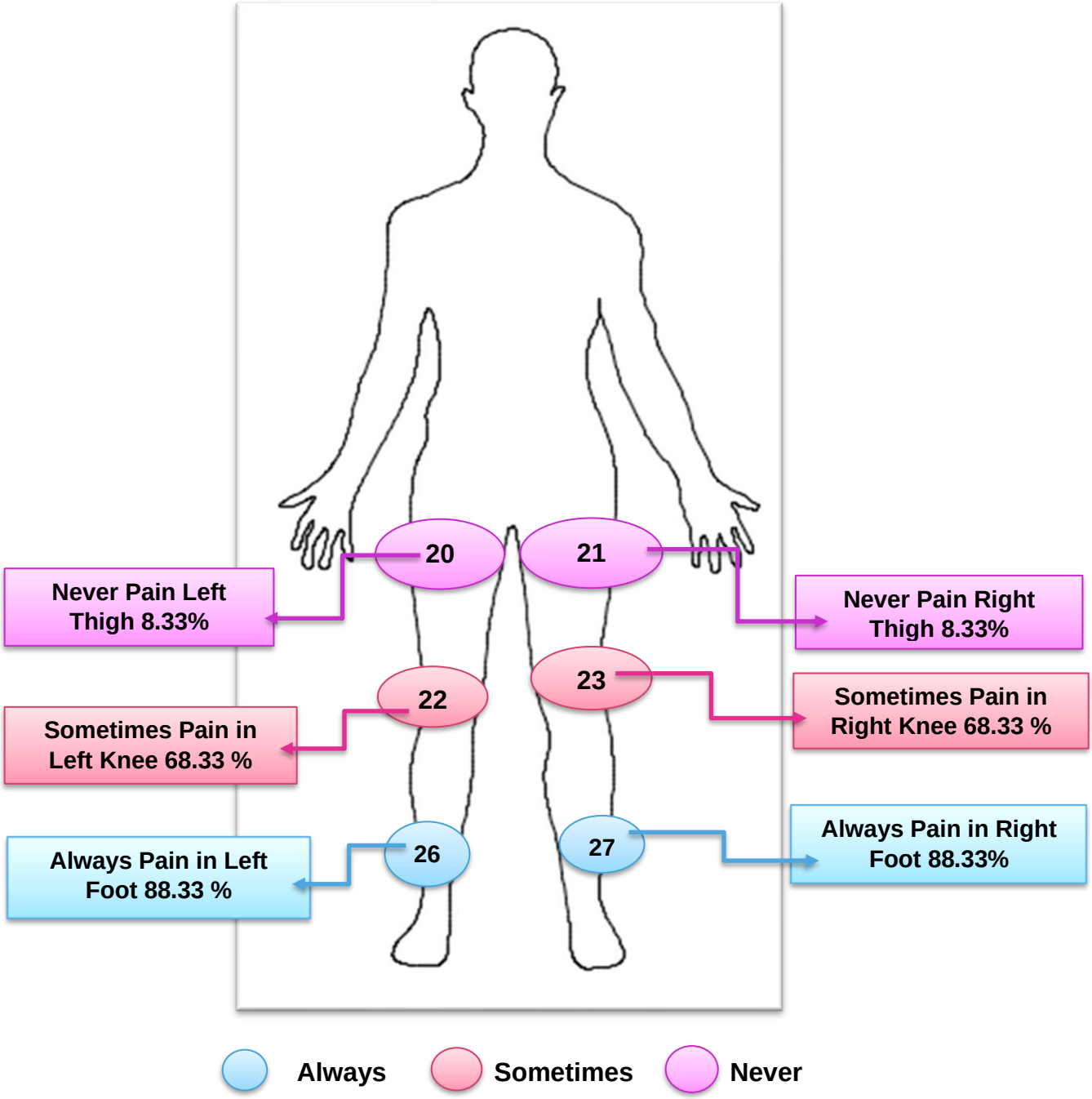


Fig 23 : Frequency and Body Discomfort Experienced by the Rose Farm Worker In Lower Body Parts (19-27) During Rose Harvesting Process.

Fig 24: **Frequency of Body Discomforts Experienced by the Rose Farm workers in Lower Body Parts (19-27) during Rose Harvesting Process (Plucking, Gathering and Heaping).**



Overall Distribution of the Respondents according to the Frequency of Body Discomfort Experienced in Lower Body Parts During Rose Harvesting Process (Plucking, Gathering and Heaping)

According to the facts depicted in **table 6**, it is revealed that half (50%) of the respondents sometimes experienced discomfort in lower body parts and slightly less than half (41.67%) of the respondents had always experienced discomfort in lower body parts. Whereas, very few (8.33%) respondents never experienced discomfort in lower body parts.

Table 6: Overall Distribution of the Respondents according to the Frequency of Body Discomfort Experienced in Lower Body Parts (19-27) During Rose Harvesting Process (Plucking, Gathering and Heaping)

Sr. No	Frequency Index of Body Discomfort in Lower Body Parts	Range of Score	Respondents (n=60)	
			f	%
1	Always	22-27	25	41.67
2	Sometimes	15-21	30	50
3	Never	9-14	5	8.33

4.2.3. The Extent of Body Discomfort Experienced (measured on the severity of pain) by the Respondents in Upper Body Parts During Rose Harvesting Process (Plucking, Gathering and Heaping)

Table 7, describes the extent of body discomfort (based on the severity of pain) experienced by the respondents in upper body parts (1-18) during Rose harvesting process (Plucking, Gathering and Heaping)**.** The data indicates that more than two-fifth of the respondents had very severe pain in the upper back (43.33 %), mid-back (43.33 %), lower back (43.33 %), neck (41.67%) and right wrist (41.67%). Whereas, more than one-half of the respondents had severe pain in the upper back (53.33%), mid-back (53.33%), lower back (53.33%) neck (53.33%) and more than two-fifth of the respondents in the right wrist (48.33%), cervical left (45 %), cervical right (45%) left shoulder (43.33%) and right shoulder(43.33%) respectively.

Table 7: Distribution of Respondents according to the Severity of Body Pain Experienced in Upper Body Parts (1-18) During Rose Harvesting Process (Plucking, Gathering and Heaping)

Sr. No	Upper Body Parts	Severity Index (n =60)										
		Very Severe Pain		Severe Pain		Moderate Pain		Mild Pain		No Pain		Wt. Mean Score (5-1)
		f	*%*	*f*	*%*	*f*	*%*	*f*	*%*	*f*	*%*	
1	**Neck**	25	41.67	32	53.33	3	5	0	0.00	0	0.00	**4.36**
2	Clavicle Left	0	0.00	27	45.00	32	53.33	1	1.67	0	0.00	3.43
3	Clavicle Right	0	0.00	27	45.00	32	53.33	1	1.67	0	0.00	3.43
4	Left Shoulder	24	40	26	43.33	10	16.67	0	0.00	0	0.00	4.23
5	Right Shoulder	24	40	26	43.33	10	16.67	0	0.00	0	0.00	4.23
6	Left Arm	0	0.00	0	0.00	2	3.33	00	0.00	58	96.67	1.06
7	Right Arm	8	13.33	24	40.00	28	46.67	0	0.00	0	0.00	3.66
8	Left Elbow	0	0.00	0	0.00	5	8.33	0	0.00	55	91.67	1.16
9	Right Elbow	10	16.67	24	40	26	43.33	0	0.00	0	0.00	3.73
10	Left Forearm	0	0.00	0	0.00	4	6.67	0	0.00	56	93.33	1.13
11	Right Forearm	5	8.33	15	25	34	56.67	6	10.00	0	0.00	3.31
12	Left Wrist	0	0.00	0	0.00	5	8.33	00	0.00	55	91.67	1.16
13	**Right Wrist**	25	41.67	29	48.33	6	10.00	0	0.00	0	0.00	**4.31**
14	Left Palm	0	0.00	0	0.00	5	8.33	00	0.00	55	91.67	1.16
15	Right Palm	23	38.33	29	48.33	7	11.67	1	1.67	0	0.00	4.23
16	**Upper back**	26	43.33	32	53.33	2	3.33	0	0.00	0	0.00	**4.4**
17	**Mid Back**	26	43.33	32	53.33	2	3.33	0	0.00	0	0.00	**4.4**
18	**Lower Back**	26	43.33	32	53.33	2	3.33	0	0.00	0	0.00	**4.4**
											Total Weighted Mean	**3.21**

Fig 25: Distribution of Respondents according to the Severity of Body Pain Experienced in Upper Body Parts (1-18) During Rose Harvesting Process (Plucking, Gathering and Heaping)

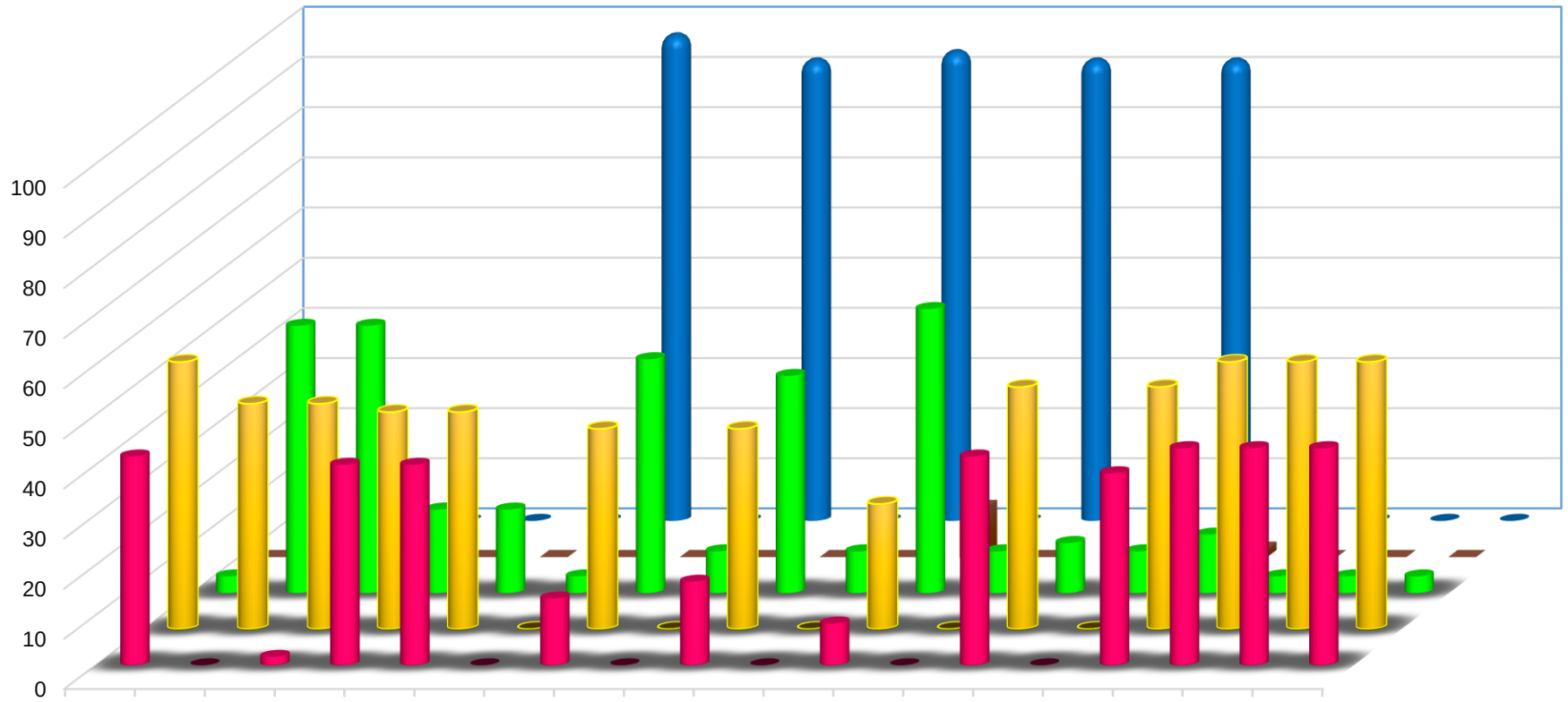
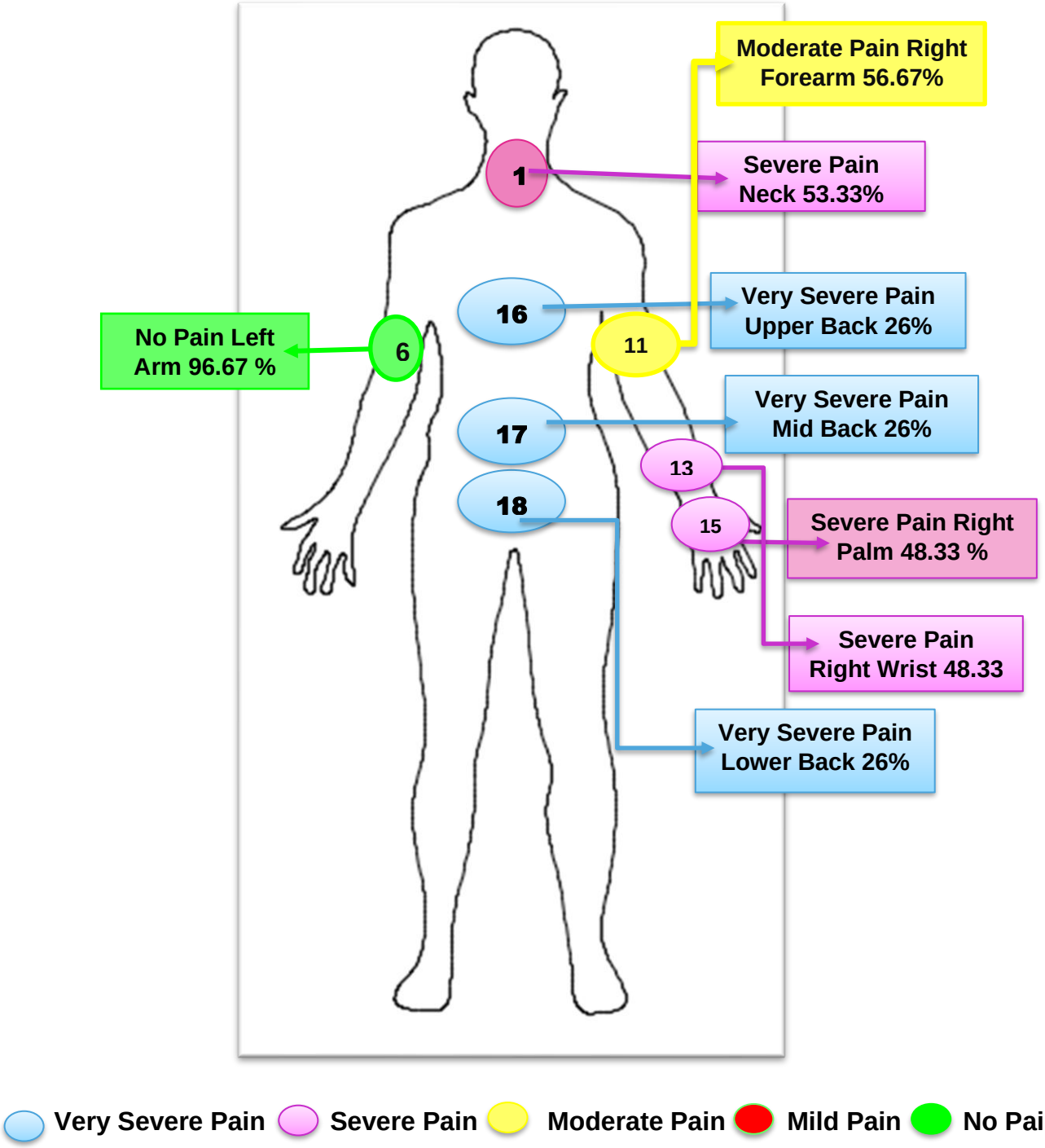


Fig 26: Extent of Body Pain (measured through the severity of pain) Experienced by the Respondents in Upper Body Parts (1-18) during Rose Harvesting Process (Plucking, Gathering and Heaping).



Equally, more than one-half of the respondents had moderate pain in the right forearm (56.67%), cervical left (53.33%), cervical right (53.33%), less than one-half of the respondents in right arm (46.67%) and right elbow (43.33%). However, ten per cent of respondents had mild pain in the right forearm, and the majority of the respondents reported that they had no pain in the left arm (96.67%), left forearm (93.33%), left elbow (91.67%), left wrist (91.67%) and left palm (91.67%).

Therefore, based on the information available from the **table 7**, it could be concluded that out of 18 upper body parts more than half of respondents experienced severe pain in the upper back, mid-back, lower back with the weighted mean **4.4** respectively and in the neck with a weighted mean score of **4.36**. Subsequently, less than half of the respondents experienced severe in the wrist with the weighted mean **4.31.**

Overall Distribution of the Respondents according to the Extent of Body Discomfort (measured through the severity of pain) Experienced in Upper Body Parts (1-18) During Rose Harvesting Process (Plucking, Gathering, Heaping).

Table 8: Overall Distribution of the Respondents according to the Extent of Body Discomfort Experienced (measured through the severity of pain) in Upper Body Parts (1-18) During Rose Harvesting Process (Plucking, Gathering, Heaping).

Sr. No	The Extent of Body Discomfort Scale	Range of Score	Respondents (n=60)	
			f	%
1	Discomfort to Great Extent	76-90	13	21.67
2	Discomfort to High Extent	61-75	24	40.00
3	Discomfort to Moderate Extent	48-60	16	26.67
4	Discomfort to Low Extent	33-47	2	3.33
5	Discomfort to No Extent	18-32	5	8.33

According to **table 8**, the results revealed that less than half (40.00%) of the respondents experienced the high extent of discomfort in upper body parts, more than one fourth (26.67%) of the respondents experienced the moderate extent of

discomfort in upper body parts, less than one third (21.67%) of the respondents experienced the great extent of discomfort in upper body parts. Whereas, 8.33 per cent of respondents experienced no discomfort in upper body parts and 3.33 per cent of respondents experienced a low extent of discomfort in upper body parts.

4.2.4. The extent of Body Discomfort (measured through the severity of pain) Experienced by Respondents in Lower Body Parts During Rose Harvesting Process (Plucking, Gathering and Heaping)

Table 9 describes the Extent of Body Discomfort Experienced (measured through the severity of pain) by the Respondents in Upper Body Parts (1-18) during Rose harvesting process**.**

Table 9: Distribution of Respondents according to the Severity of Body Discomfort Experienced (measured through the severity of pain) in lower body parts (19-27) During Rose Harvesting Process (Plucking, Gathering and Heaping)

Sr. No	Lower Body Parts	Severity Index of Body Discomfort (n=60)										
		Very Severe Pain		Severe Pain		Moderate Pain		Mild Pain		No Pain		Wt. Mean Score (5-1)
		f	*%*	*f*	*%*	*f*	*%*	*f*	*%*	*f*	*%*	
19	**Buttock**	29	48.33	31	51.67	0	0	0	0	0	0	**4.48**
20	Left Thigh	0	0	15	25	40	66.67	0	0	5	8.33	3.25
21	Right Thigh	0	0	15	25	40	66.67	0	0	5	8.33	3.26
22	Left knee	4	6.67	32	53.33	24	40	0	0	0	0	3.66
23	Right Knee	4	6.67	32	53.33	24	40	0	0	0	0	3.66
24	Left Leg	4	6.67	34	56.67	23	38.33	0	0	0	0	3.75
25	Right Leg	4	6.67	34	56.67	23	38.33	0	0	0	0	3.75
26	**Left Foot**	30	50	30	50	0	0	0	0	0	0	**4.5**
27	**Right Foot**	30	50	30	50	0	0	0	0	0	0	**4.5**
Total Weighted Mean												**3.87**

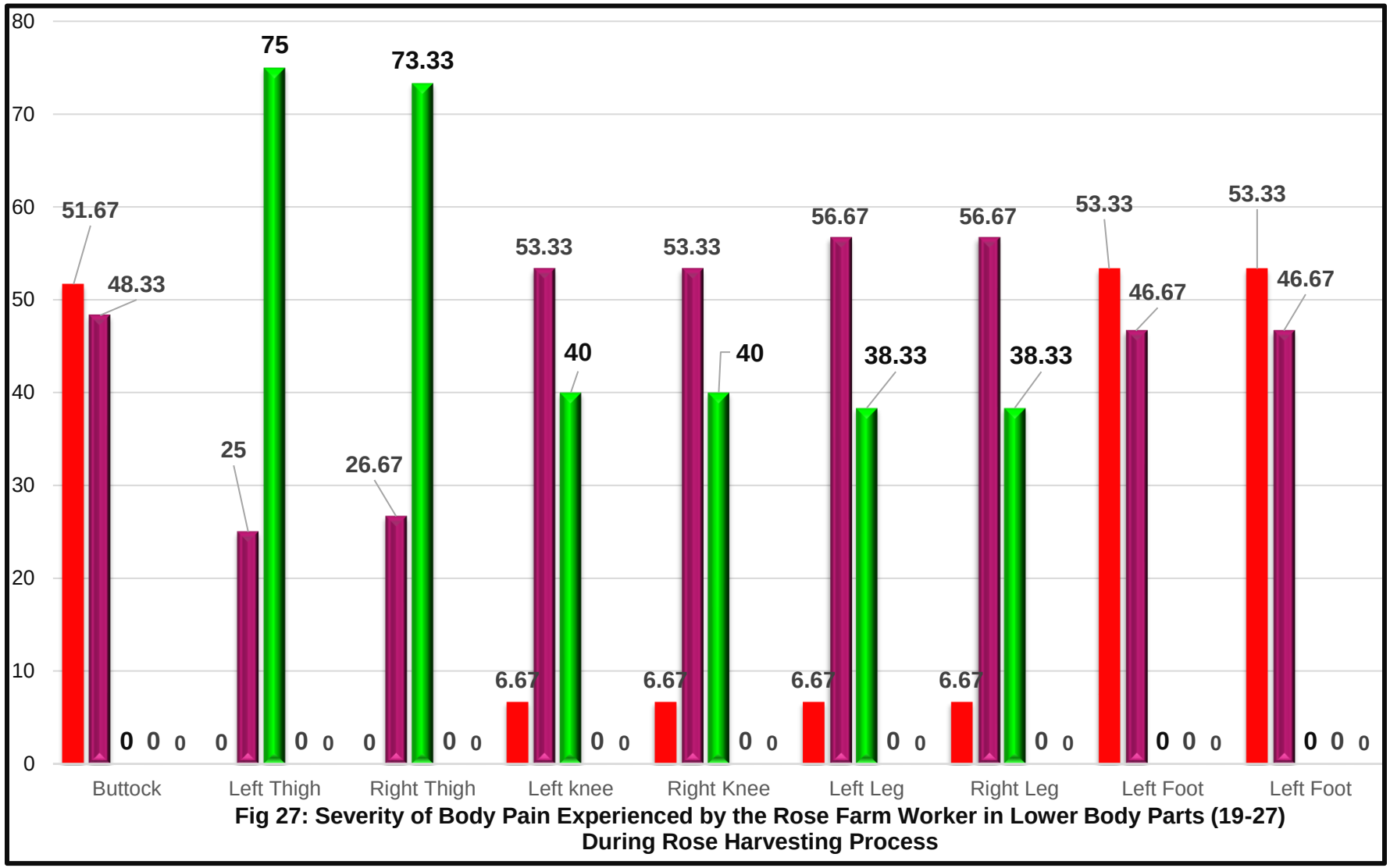
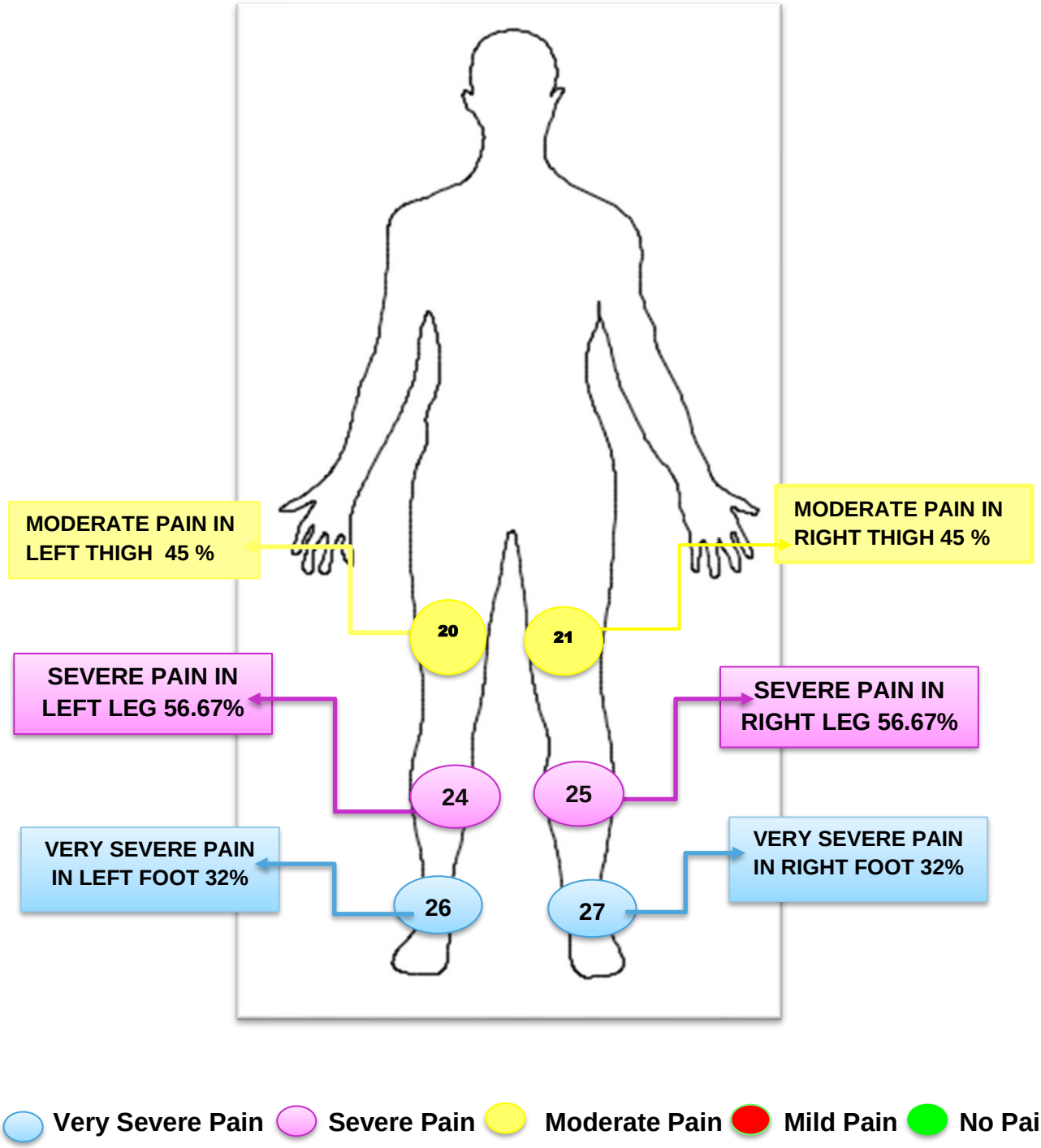


Fig 27: Severity of Body Pain Experienced by the Rose Farm Worker in Lower Body Parts (19-27) During Rose Harvesting Process

Fig 28: Extent of Body Pain Experienced (measured through the severity of pain) by the Respondents in lower Body (19-27) Parts during Rose Harvesting Process (Plucking, Gathering and Heaping)



As shown in **table 9**, the result revealed that more than half of the respondents experienced very severe pain in left foot (53.33%), right foot (53.33%), buttock (51.67%). Whereas, more than one-half of the respondents experienced severe pain in left leg (56.67%), right leg (56.67%), left knee (53.33%), right knee (53.33%) and less than one half (46.67%) of the respondents in the left foot and right foot. However, majority of the respondents experienced moderate pain in the left thigh (75. %) and right thigh (73.33%).

Therefore, based on the information available from the **table 9**, it could be concluded that out of 9 lower body parts half of the respondents experienced very severe pain in the left foot and right foot with the weighted mean score **4.5** respectively. Whereas, slightly less than half of the respondents experienced severe pain in the buttock with the weighted mean score of **4.48**.

Table 10: Overall Distribution of the Respondents according to Extent of Body Discomfort Experienced (measured through the severity of pain) by them in Lower Body Parts (9-27) During Rose Harvesting Process (Plucking Gathering, Heaping).

Sr. No	The Extent of Body Discomfort Scale	Range Score	Respondents (n=60)	
			f	*%*
1	Discomfort to Great Extent	34 - 45	19	31.67
2	Discomfort to High Extent	30 - 37	25	41.67
3	Discomfort to Moderate Extent	25 - 29	16	26.67
4	Discomfort to Low Extent	17 - 24	2	3.33
5	Discomfort to No Extent	9 - 16	5	8.33

According to the facts depicted in **table 10**, it is revealed that less than half (41.67%) of the respondents experienced the high extent of discomfort in lower body parts and less than one third (31.67%) of the respondents experienced the great extent of discomfort in lower body parts. Whereas, less than one third (26.67%) of the respondents experienced a moderate extent of discomfort in lower body parts.

Table 11: Overall Extent of Frequency and Severity of Body Discomfort Experienced by the Rose Farm workers During Rose Harvesting Process according to the Weighted Mean Score

Body Parts	Frequency Index Weighted Mean Score (3-1)	Severity Index Weighted Mean Score (5-1)
Upper Body Parts		
1. Upper Back	2.9	4.4
2. Lower Back	2.9	4.4
3. Mid Back	2.88	4.4
4. Neck	2.78	4.36
5. Right Wrist	2.76	4.31
6. Right Palm	2.66	4.23
7. Left Shoulder	2.66	4.23
8. Right Shoulder	2.66	4.23
9. Right Arm	2.6	3.73
10. Right Elbow	2.61	3.73
11. Right Forearm	2.41	3.66
12. Clavicle Left	2.21	3.43
13. Clavicle Right	2.21	3.43
14. Left Palm	1.28	1.16
15. Left Wrist	1.28	1.16
16. Left Elbow	1.28	1.16
17. Left Forearm	1.25	1.13
18. Left Arm	1.2	1.06
Lower Body Parts		
19. Left Foot	2.88	4.5
20. Right Foot	2.88	4.5
21. Buttock	2.85	4.48
22. Left leg	2.33	3.75
23. Right Leg	2.33	3.75
24. Left knee	2.31	3.66
25. Right Knee	2.31	3.66
26. Left Thigh	2.21	3.25
27. Right Thigh	2.21	3.25

The **table 11**, represent the frequency and severity of body discomfort experienced by the respondents in their upper (1-18) and lower (19-27) body parts during Rose harvesting process. It can be observed that amongst the upper body parts (1-18) the frequency of body discomfort was highest in the upper and mid-back with weighted mean **score 2.9** respectively and in the lower back with weighted mean **2.88**. the second-highest frequency of pain was experienced in the neck with weighted mean **2.78** and in right wrist with weighted mean **2.76** followed with right palm, left and right shoulder with weighted mean **2.66.** Similarly, amongst the lower body parts (19-27) the frequency of body discomfort was high in Right and left foot with weighted mean **2.88** respectively and in the buttock with weighted mean **2.85**.

Subsequently, about the severity of pain experienced by the respondents in their upper (1-18) and lower (19-27) body parts during Rose harvesting process. It can be observed that amongst the upper body parts (1-18) the severity of body discomfort was highest in the upper back, mid-back and lower back with weighted mean **4.4**. The second highest was the severity of body pain is observed in the neck with weighted mean **4.36** and right wrist with the weighted mean **4.31** followed with severe pain in the right palm, left and right shoulder with weighted mean **4.23** respectively. Similarly, amongst the lower body parts (19-27) the frequency of body discomfort was seen high in right and left foot with weighted mean **4.5** respectively and in the buttock with weighted mean **4.48 (table 11)**.

Thus, it can be concluded that the frequency and severity of body discomfort are experienced in upper body parts like the upper back, lower back, mid-back, neck, right wrist, right palm, left shoulder and right shoulder in comparison to lower body parts viz; Right foot, left foot and Buttock. This could be due to the adopted standing and forward bending posture for plucking, gathering and heaping of the Rose crops which might have resulted in frequency and severity of body discomfort in the upper back, lower back, mid-back. Whereas, the frequency and severity of body discomfort in the right wrist and right palm might be due to plucking of the Rose with the right hand and the frequency and severity of body discomfort in the neck and left and right shoulder might be due to carrying the Rose collecting bag on their neck **(Table 11)**.

SECTION III

4.3 Section- III: BMI of the Farmers, Timings of Rose Harvesting, Postures Adopted, Frequency of Task Performed and Actual Time Spent on Task, Duration of Maintaining Adopted Posture, Time Taken for Harvesting Process, Spontaneous and Recommended Rest Pauses taken by Rose Farm workers During the Rose Harvesting Process (Plucking, Gathering and Heaping) by the Rose Farm Worker.

This section covers information regarding the BMI of the farmers, timings of Rose harvesting, postures adopted, frequency of task performed and overall time spent on the task, duration of maintaining adopted posture, time taken for harvesting process, spontaneous and recommended rest pauses taken during the Rose harvesting process by Rose farm workers of the selected Rose farms.

4.3.1: BMI of the Farmers

Table 12: Distribution of the Respondents according to their Height, Weight, and BMI.

Height (in m)	**Respondents (n=60)**	
	f	***%***
1.49 – 1.60	19	31.67
1.61 – 1.72	8	13.33
1.73 – 1.84	23	**38.33**
1.85 – 1.96	10	16.67
Mean	**5.59**	
Standard Deviation	**0.415**	
Weight (in Kgs)		
45 – 55	18	30
56 – 66	23	**38.33**
67 – 77	16	26.67
78-88	3	5
Mean	**61**	
Standard Deviation	**9.79**	
BMI (Kg/M^2)		
Underweight = 16.0-18.5	7	11.67
Normal Weight =18.5 – 24.9	44	**73.33**
Overweight = 25 – 29.9	9	15
Mean	**21.08**	
Standard deviation	**3.05**	

Plate : 3 Investigator taking Height and Weight of Rose Farm Workers

The findings of **table 12,** reflects that the height of the respondents varied between 1.49–1.96 m and the mean height of the respondents was found to be 5.59 m and the standard deviation was 0.415. Whereas, the weight of the respondents varied between 45- 88 kg and the mean weights of the respondents 61 kg and the standard deviation was 9.79. Therefore, the BMI of the respondents varied between 16.0 to 29.0. and the mean BMI of the respondents was 21.08 and the standard deviation was 3.05.

4.3.2: Postures Adopted, Frequency of Rose Harvesting Task (Plucking, Gathering and Heaping) and Overall Time (in hrs.) spent on Rose Harvesting Process by the Rose Farm Workers.

From the showed in t**able 13** showcased that, all the (100%) of the respondents performed the task (Plucking, Gathering and Heaping) by adopting standing and forward bending posture as the main posture during Rose harvesting process. Further, it can be observed that cent per cent (100%) of the respondents performed the Rose harvesting task (Plucking, Gathering and Heaping) daily and a majority (83.33%) of the respondents spent 3-4 hrs. for Rose harvesting.

Table 13: Distribution of the Respondents according to the Postures Adopted, Frequency of Performing the task and Actual Time (in hrs.) Spend on Rose Harvesting Process (Plucking, Gathering and Heaping) of selected Rose Farms.

Main Postures Adopted for Rose Harvesting	Respondents (n=60)	
	f	%
Standing and Forward bending	60	**100**
Only Standing	0	0
Frequency of Rose Harvesting		
Daily	60	**100**
Alternate Days	0	0
Actual time spent (in hrs.) for Rose Harvesting		
1-2	10	16.67
3-4	50	**83.33**

4.3.3: Duration of Maintaining Adopted Postures (in seconds per plant) by the Rose Farm Workers During Rose Harvesting Process (Plucking, Gathering and heaping).

Analysis of results given in t**able 14,** reveals that during task "**Picking"** of the Rose cent per cent of the respondents adopted standing and forward bending posture. Wherein more than half (66.67%) of the respondents maintained the adopted posture for 10-12 second (sec/plant), one fourth (25%) of the respondents maintained the adopted posture for 7-9 second (sec/per plant) and less than the tenth (8.33%) of the respondents maintained the adopted posture for 4-6 second (sec/plant) during the picking of Rose crops.

Similarly, regarding task "**Gathering"** of Rose crops into the Rose collecting bag cent per cent of the respondents adopted standing posture. Wherein, more than half (65%) of the respondents maintained adopted posture for 4-6 second (sec/plant), less than one third (26.67%) of the respondents maintained adopted posture for 10-12 (sec/plant) and less than the tenth (8.33%) of the respondents maintained adopted posture for 7-9 seconds (sec/plant) during the Rose crops Gathering process **(table 14)**.

Whereas, for moving from one plant to another plant for picking and gathering Rose it was found that, less than three fourth (73.33%) of the respondents took 4-6 second time for moving, one fifth (20%) of the respondents took 10-12 second time for moving and less than the tenth (6.67%) of the respondents took 7-9 second time for moving from one plant to another plant **(table 14)**.

Table 14: Distribution of Respondents according to the duration of maintaining the Adopted Postures (in seconds per plant) by the Rose Farm Workers during Rose Harvesting Process (Plucking, Gathering and Heaping).

Time Duration of Maintaining the Adopted Posture (in sec / plant)	Standing and Forward Bending		Only Standing		Moving	
	f	*%*	*f*	*%*	*f*	*%*
4-6	5	8.33	39	65	44	**73.33**
7-9	15	25	5	8.33	4	6.67
10-12	40	**66.67**	16	**26.67**	12	20

4.3.4: Time Duration Taken (in min) Per Trip and Extent of Body Discomfort Experienced (Measured on Extent of Exhaustion) by the Rose Farm Workers During Rose Harvesting

The information given in **table 15,** describes the time duration taken for harvesting Rose crops per trip and Extent of Body Discomfort experienced by the Rose Farm workers during each trip.

Regarding time duration taken for the harvesting of Rose crops cent per cent of the respondents could make only four trips (1 bag = 4kg Roses/trip) for Rose crops harvesting. Wherein, it was observed that more than half (63.33%) of the respondents took 30-40 min time duration (in Min) for the first trip, less than half (46.67%) of the respondents took 41-50 min time (in Min) in the second trip, more than half (68.33%) of the respondents took 41-50 min (in Min) time for the third trip and less than half (45%) of the respondents took 51-60 min time duration (in Min) for the fourth trip of harvested Rose crops during Rose harvesting process **(table 15).**

Table 15: Distribution of Respondents according to the time duration taken (in min) per trip and Extent of Body Discomfort (Measured on Extent of Exhaustion) Experienced during Rose Harvesting Process (Plucking, Gathering and Heaping).

Time Duration (in min)			The extent of Body Discomfort (Extent of Exhaustion) (n=60)									
			Not Exhausted		Little Exhausted		Moderately Exhausted		Extremely Exhausted		Completely Exhausted	
	f	*%*	*f*	*%*	*f*	*%*	*f*	*%*	*f*	*%*	*f*	*%*
Bag 1 = 1 Trip (n=60)												
30-40	38	**63.33**	28	**46.67**	22	36.67	4	6.67	6	10	0	0.00
41-50	14	23.33										
51-60	8	13.33										
Bag 2 = 2 Trip (n=60)												
30-40	22	36.67	0	0.00	18	30	22	**36.67**	13	21.67	7	11.67
41-50	28	**46.67**										
51-60	10	16.67										
Bag 3 = 3 Trip (n=50)												
30-40	0	0.00	0	0.00	0	0.00	11	22	24	**48**	15	30
41-50	41	**68.33**										
51-60	9	15										
Bag 4 = 4 trip (n=30)												
30-40	0	0.00	0	0.00	0	0.00	0.	00	4	13.33	26	**86.67**
41-50	3	5										
51-60	27	**45**										

Consequently, For the Extent of Body Discomfort experienced (Measured on Extent of Exhaustion) by the Rose farm workers, it was observed that amongst the 60 selected respondents ten per cent of the respondents were extremely exhausted and less than ten per cent of the respondents (6.67%) were moderately exhausted after doing first trip (1bag=4kg Roses/trip) of Rose harvesting. Whereas, more than one third (36.67%) of the respondent were little exhausted after doing one trip of Rose harvesting and less than half (46.67%) of the respondent were not all exhausted after completion of the first trip of Rose harvesting **(table 15).**

During the second trip (1 bag = 4kg Roses/trip) of Rose harvesting, it was observed that amongst the 60 selected respondent more than one third (36.67%) of the respondent were moderately exhausted and less than one third (30%) of the respondent were little exhausted. Whereas, less than one fifth (11.67%) of the respondents were completely exhausted and more than one fifth (21.67 %) of the respondents were extremely exhausted after completion of the second trip of Rose harvesting and 10 respondents could not continue with Rose harvesting process after the second trip **(table 15).**

During the third trip (1 bag=4kg Roses/trip) of Rose harvesting, amongst the 50 respondents, it was observed that less than one third (30%) of the respondents were completely exhausted after completion third trip of Rose harvesting. Whereas, less than half (48%) of the respondents were extremely exhausted and more than one fifth (22%) of the respondent were moderately exhausted, amongst which 20 respondents could not continue with Rose harvesting process after completion of the third trip **(table 15).**

During the fourth trip (1bag=4kg Roses/trip) of Rose harvesting, it was observed that amongst the 30 respondents, the majority (86.67%) of them were completely exhausted and less than one fifth (13.33%) of them were extremely exhausted and could not continue with the Rose harvesting process **(table 15).**

Distribution of the Respondents (Rose Farm Workers) according to the Time Duration Taken for overall (4 trips) Rose Harvesting Process (Plucking, Gathering and Heaping).

According to **table 16**, the results revealed that less than one third (30%) of the respondents took short duration (90-133 minutes) time, less than half of the respondents took moderate duration (134-177 minutes) time and more than one-fourth of the respondents took long duration (178-221 minutes) time for overall (4 trips) process of Rose harvesting.

Table 16: Time Duration taken (in min) for Overall Rose Harvesting Process by the Rose Farm Workers During Rose Harvesting Process (Plucking, Gathering and Heaping).

Time Duration	Range Score (in minutes)	*f*	*%*
Short Duration	90-133	10	16.67
Moderate Duration	134-177	20	33.33
Long Duration	178-221	30	**50**

4.3.5: Spontaneous Rest Pauses and Recommended Rest Pauses taken by Rose Farm Workers during the Rose Harvesting Process (Plucking, Gathering and Heaping).

Regarding the spontaneous rest pauses and the recommended rest pauses during rose harvesting process, it was observed that none of the selected farm workers took spontaneous rest pauses and nor was prescribed recommended rest pauses during the Rose harvesting process (Plucking, Gathering and Heaping)

SECTION – IV

Section IV: Distance Covered and Extent of Body Discomfort (Measured on Extent of Exhaustion) Experienced, Quantity of Rose Harvested and Extent of Body Discomfort Experienced (Measured on Extent of Pain), Frequency of Repetitive Task (Plucking, Gathering and Heaping) with Adopted Posture by the Rose Farm Worker During Rose Harvesting Process

4. 4. 1: Distance Covered and Extent of Body Discomfort Experienced (Measured on Extent of Exhaustion) by the Rose Farm workers during Rose Harvesting Process (Plucking, Gathering and Heaping).

The information given in **table 17,** describes the distance covered (meter) for the harvesting of Rose crops per trip and extent of Body Discomfort experienced (Measured on Extent of Exhaustion) by the Rose farm workers during each trip**.**

Regarding distance covered by the Rose farm workers during the Rose harvesting process, a range score for each trip was obtained based on the shortest and longest distance covered by the Rose farm workers. Amongst the 60 respondents, it was observed that less than half (46.67%) of the respondents covered distance up to 316 -330 meter (moderate) for the first trip (1 bag = 4kg Roses/trip). For the second trip (1 bag = 4kg Roses/trip) more than half (53.33%) of the respondents covered distance up to 626–641 meter (moderate). For the third trip (1 bag = 4kg Roses/trip) it was observed that majority (82%) of the respondents covered distance up to 952–969 meter (moderate). Whereas, less than half (45%) of the respondents covered distance up to 1310-1327 meter (long) for the fourth trip (1bag=4kg Roses/trip) of Rose harvesting **(table 17)**.

Consequently, for the extent of body discomfort experienced (measured on extent of exhaustion) by the Rose Farm workers, it was observed that amongst the 60 selected respondents ten per cent of the respondents were extremely exhausted and less than ten per cent of the respondents (6.67%) were moderately exhausted

Table 17: Distribution of respondents according to the Distance Covered (in meter) and Extent of Body Discomfort experienced (Measured on Extent of Exhaustion) by the Rose Farm Workers during Rose Harvesting Process (Plucking, Gathering and Heaping).

Distance Covered (in meter)			The extent of Body Discomfort (Measured on Extent of Exhaustion) n=60									
			Not Exhausted		Little Exhausted		Moderately Exhausted		Extremely Exhausted		Completely Exhausted	
	f	*%*	*f*	*%*	*f*	*%*	*f*	*%*	*f*	*%*	*f*	*%*
Bag 1 = 1 Trip` (n=60)												
Short Distance -**01 – 315**	12	20	27	**45**	23	38.33	4	6.67	6	10	0	0.00
Moderate Distance **316- 330**	28	**46.67**										
Long Distance **331 – 345**	20	33.33										
Bag 2 = 2 Trip (n=60)												
Short Distance **609** – **625**	10	16.67	0	0.00	18	30	22	**36.67**	13	21.67	7	11.67
Moderate Distance **626 - 641**	32	**53.33**										
Long Distance **642 - 625**	18	30										
Bag 3 = 3 Trip (n=50)												
Short Distance 933 – **951**	0	0.00	0	0.00	0	0.00	11	22	24	**48**	15	30
Moderate Distance **952 - 969**	41	**82**										
Long Distance **970 – 987**	9	18										
Bag 4 = 4 Trip (n=30)												
Short Distance **1273 – 1291**	0	0.00	0	0.00	0	0.00	0.	00	4	13.33	26	**86.67**
Moderate Distance **1273 - 1291**	3	10										
Long Distance **1310 - 1327**	27	**45**										

after distance covered for the first trip (1bag = 4kg Roses/ trip) of Rose harvesting. Whereas, more than one third (38.33%) of the respondents were little exhausted after the distance covered for the first trip of Rose harvesting and less than half (45%) of the respondent were not all exhausted after completion of the first bag of Rose harvesting **(table 17)**.

During the second trip (1 bag=4kg Roses/ trip) of Rose harvesting, it was observed that amongst the 60 selected respondent more than one third (36.67%) of the respondent were moderately exhausted and less than one third (30%) of the respondent were little exhausted. Whereas, less than one fifth (11.67%) of the respondents were completely exhausted and more than one fifth (21.67%) of the respondents were extremely exhausted after completion of the second bag of Rose harvesting and 10 respondents could not continue with Rose harvesting process after the second bag of Rose harvesting **(Table 17)**.

During the third trip (1bag = 4kg Roses/ trip) of Rose harvesting, amongst the 50 respondents, it was observed that less than one third (30%) of the respondents were completely exhausted after completion third bag of Rose harvesting. Whereas, less than half (48%) of the respondents were extremely exhausted and more than one fifth (22%) of the respondent were moderately exhausted, amongst which 20 respondents could not continue with Rose harvesting process after completion of the third trip **(table 17)**.

During the fourth trip (1 bag = 4kg Roses/ trip) of Rose harvesting, it was observed that amongst the 30 respondents, the majority (86.67%) of them were completely exhausted and less than one fifth (13.33%) of them were extremely exhausted and could not continue with the Rose harvesting process **(table 17)**.

Distribution of the Respondents (Rose Farm Workers) according to the Distance Covered for overall (4 trips) Rose Harvesting Process (Plucking, Gathering and Heaping)

According to **table 18**, the results revealed that less than one fifth (16.67%) of the respondents covered short distance (643-87 meter), one third (33.33%) of the

respondents covered moderate distance (872-1100 meter) and a half (50%) of the respondents covered long distance (1101-1329 meter) for overall (4 trips) Rose harvesting process (Plucking, Gathering and Heaping) with the Mean of **1088.35** in meters.

Table 18: Distribution of the Respondents according to the Distance Covered for overall (4 trips) Rose Harvesting Process (Plucking, Gathering and Heaping)

Distance Covered	Range Score (in meter)	*f*	*%*
Short Distance	643-871	10	16.67
Moderate Distance	872-1100	20	33.33
Long Distance	1101-1329	30	**50**
Mean	**1088.35**		

Plate 4 : Farm Workers Making Trips (Distance Covered) During Rose Harvesting Process with Rose Collecting Bag Hanged on their Neck.

4.4.2: Quantity of Rose Harvested and Extent of Body Discomfort Experienced by the Rose Farm Workers (Measured on Extent of Pain) during Rose Harvesting Process

Table 19, gives clear representation about the quantity of Rose harvested and the Extent of Body Discomfort (Measured on Extent of Pain) experienced by the Rose Farm workers during Rose harvesting process. Concerning quantity of Rose harvested, it can be observed that amongst the selected 60 Rose farm workers engaged in Rose harvesting process, 10 farm workers could harvest 8 kgs of Rose crops (two trips), 20 farm workers could harvest 12 kgs (three trips) of Rose crops and 30 Rose farm workers could harvest 16 kgs (four trips) of Rose crops.

Regarding the extent of pain experienced by the Rose farm workers during Rose harvesting process, it can be observed that, amongst 60 respondents, after harvesting 8 kgs of Rose crops (two trips) more than one fifth (23.33 %) of the respondents experienced less extent of pain, half (50%) of the respondents experienced the moderate extent of pain. Whereas, more than the tenth (16.67%) of the respondents experienced a high extent of pain and tenth (10%) of the respondents experienced the very high extent of pain. It was also observed that three respondents amongst those respondents experienced a high extent of pain and all the respondents experienced the very high extent of pain could not continue further with Rose harvesting process **(table 19)**.

Subsequently, it was observed that after harvesting 12 kgs of Rose crops (three trips) amongst the 50 respondents, less than the tenth (8%) of the respondents experienced the moderate extent of pain, more than half (58%) of the respondents experienced the high extent of pain and more than one third (34%) of the respondents experienced the very high extent of pain. Further, it was observed that three respondents experienced a high extent of pain and all the respondents experienced the very high extent of pain could not continue further with the Rose harvesting. Consequently, 30 respondents continued with Rose harvesting **(Table 19)**.

After harvesting 16 kgs of Rose crops (four trips) less than the tenth (8%) of the respondents experienced the high extent of pain and majority (86.67%) of the respondents experienced the very high extent of pain and none of them could continue Rose harvesting process **(table 19)**.

Figure 29 : Frequency and Percentage Distribution of Respondents according to the Quantity of Rose Harvested and Extent of Body Discomfort (Measured on Extent of Pain) Experienced During the Rose Harvesting Process.

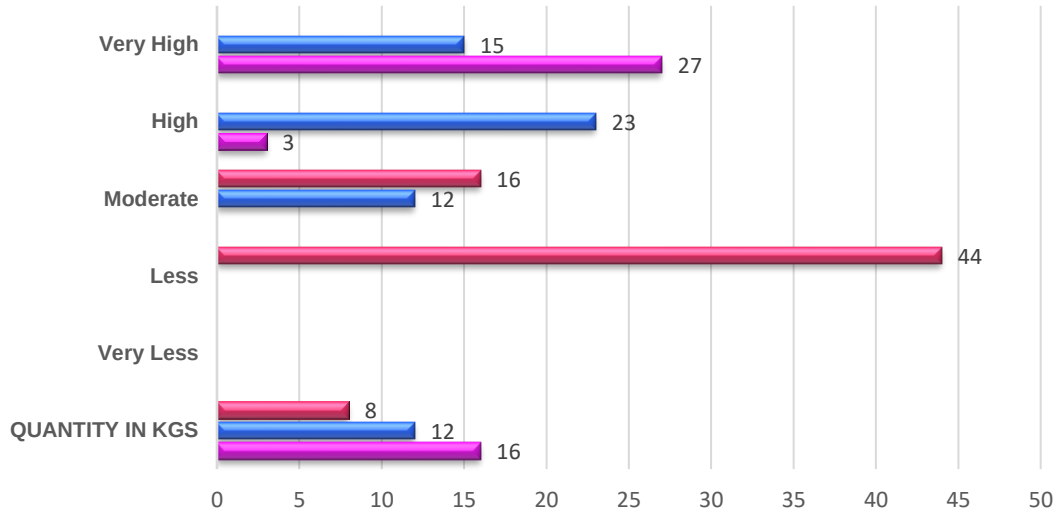


Table 19: Frequency and Percentage Distribution of Respondents according to the Quantity of Rose Harvested and Extent of Body Discomfort (Measured on Extent of Pain) Experienced During the Rose Harvesting Process (N=60)

		Quantity of Rose Harvested (1 trip = Bag 1 =4 kg)		
Extent of Pain Experienced		8 kgs **(n=60)**	12 kgs (**n=50)**	**16 kgs (n=30)**
Very Less	*f*	0	0	0
	%	0.00	0.00	0.00
Less	*f*	14	0	0
	%	23.33	0.00	0.00
Moderate	*f*	30	4	0
	%	50	8	0.00
High	*f*	10	29	4
	%	16.67	58	8
Very High	*f*	6	17	26
	%	10	34	86.67

4.4.3: Repetition of the task (Plucking, Gathering and Heaping with Standing and Forward Bending Posture) done by the Rose Farm Workers during Rose Harvesting Process.

Table 20, represents the data regarding the frequency of repetition of the task (plucking, Gathering and Heaping with standing and forward bending posture) performed during Rose harvesting process. Amongst the 60 respondents, regarding the frequency of repetitive task Viz; **Plucking,** it can be observed that, during rose harvesting of the first bag of Rose crops, less than half (41.67%) of the respondents belonged to the frequency range group of 1041 – 1221. During the second bag of harvesting Rose crops, it was found that more than half (58.33%) respondents belonged to the range group between 1181–1371. While harvesting the third bag amongst the 50 respondents, less than half (46.67%) belonged to the frequency range group between 1035–1169 and for the fourth bag amongst the 30 respondents, more than one fifth (23.33%) belonged to the frequency range group between 1035 – 1169 during Rose Harvesting Process **(table 20)**.

Regarding the frequency of repetitive task Viz; **Gathering**, it can be observed that half of the (50 %) of the respondents belonged to the frequency range group of 249-379 for filling first bag (4kg Roses), less than half (45%) of the respondents belonged to the frequency range group of 264 – 407 for filling second bag (1 trip = 4kg Roses), half of the (50 %) of the respondents belonged to the frequency range group of 274 – 387 for filling third bag (4kg Roses). Whereas, less than one third (33%) of the respondents belonged to the frequency range group of 274 – 387 for filling fourth bag (4kg Roses) during the Rose harvesting process **(table 20)**.

Regarding the frequency of repetitive task Viz**; Heaping**, the data clearly depicts that amongst 60 respondents, 10 (16.67%) respondents repeated Heaping task only 2 times (2 trips). Similarly, it can have observed that, 20 (33.33%) respondents repeated the heaping task 3 times as they quit Rose harvesting process after gathering 12 kgs of Rose crops (3 trips) and subsequently, 30 (50%) respondents repeated Heaping task four times (4 trips) during the Rose harvesting process **(table 20)**.

Table 20: Distribution of respondents according to the Repetition task (plucking, Gathering and Heaping with standing and forward bending posture) done by the Rose Farm Workers during Rose Harvesting Process								
Frequency of Repetition of Task						**N=60**		
Posture Adopted Standing and Forward Bending for Rose Harvesting Process								
Plucking of Rose			**Gathering of Rose**			**Heaping of Rose**		
Range Score (Frequency)	***f***	***%***	**Range Score (Frequency)**	***f***	***%***	**Frequency**	***f***	***%***
Bag 1 = 4 kg (n=60)								
860 – 1040	15	25	118-248	9	15	**1**	**60**	**100**
1041 – 1221	25	**41.67**	249-379	**30**	50			
1222 - 1402	20	33.33	**380-510**	21	**35**			
Bag 2 = 4 kg (n=60)								
800 – 990	5	8.33	120-263	14	23.33	**1**	**60**	**100**
991 – 1180	20	33.33	264 – 407	**27**	**45**			
1181 – 1371	35	**58.33**	**408 – 551**	19	31.67			
Bag 3 = 4kg (n = 50)								
850 – 1004	14	23.33	160 -273	9	15	**1**	**50**	**83.33**
1005 – 1159	8	13.33	274 – 387	**30**	**50**			
1160 – 1314	28	**46.67**	**388 – 501**	11	18.33			
Bag 4 = 4 kg (n=30)								
900 – 1034	6	10	200 – 276	5	8.33	**1**	**30**	**50**
1035 – 1169	14	**23.33**	277 – 353	**15**	**25**			
1170 - 1304	**10**	16.67	**354 – 430**	12	20			

Distribution of the Respondents (Rose Farm workers) according to the Repetition of the task (Plucking, Gathering and Heaping) Performed during overall (16 kgs = 4 trips) Rose Harvesting Process

According to **table 21**, the results revealed that regarding repetition of task "**Plucking",** less than one fifth (18.33%) of the respondents belonged to frequency range group of 1660-2814, one third (33.33%) of the respondents belonged to frequency range group of 2815-3969 and less than half (48.33%) of the respondents belonged to frequency range group of 3970 – 5124 with the Mean of 3773.53 during Rose crops harvesting.

Similarly, regarding repetition of task "**Gathering",** it was observed that less than one fifth (16.67%) of the respondents belonged to frequency range group of 391-840, one third (33.33%) of the respondents belonged to frequency range group of841-1290. Whereas, less than half of the respondents belonged to frequency range group 1291-1740 during Rose harvesting process (**table 21).**

Regarding repetition of task "**Heaping",** it was observed that 10 respondents repeated Heaping task two times, 20 respondents repeated Heaping task three times and 30 respondents repeated Heaping task four times during Rose harvesting process (**table 21)**.

Table 21: Repetition of the task (Plucking, Gathering and Heaping) Performed by the Respondents during the Overall Rose Harvesting Process

Plucking of Rose Crops			**Gathering of Rose Crops**			**Heaping of Rose Crops**		
Range Score (Frequency)	***f***	***%***	**Range Score (Frequency)**	***f***	***%***	**Frequency**	***f***	***%***
1660-2814	11	18.33	391-840	10	16.67	2	10	16.67
2815-3969	20	33.33	841-1290	23	**38.33**	3	20	33.33
3970-5124	29	48.33	**1291-1740**	27	45	4	30	**50**
Mean 3773.53			**Mean 1127.98**			**Mean 3.33**		

Plate 5: Farm Workers Engaged in Rose Plucking Task During Rose Harvesting Process

Plate 6: Farm Workers Gathering Roses in Collecting Bag During Rose Harvesting Process

Plate 7: Farm Workers Unloading (Heaping) Collected Rose from Collecting Bag in to Main Rose Collecting Bag after Completion of Each Trip During Rose Harvesting Process

SECTION VI

4.5. Section VI: Testing of the Hypotheses

The present section covers in detail the statistical analysis of the hypotheses of the present study. The relational statistic applied to test the hypotheses were ANOVA, “t” test and Coefficient of Correlation was computed to analyze the findings statistically. The details of the rational statistics computed are described follows.

Analysis of Variance was computed to show the difference between the personal variable namely Age, BMI, and Work Experience and the situational variable namely time spent on harvesting, distance covered during harvesting, the quantity of Rose harvested and frequency of repetitive task performed while harvesting process.

't' test was applied to find out the mean difference between personal variable namely Gender of the respondents and situational variables namely time spent on harvesting, distance covered during harvesting, the quantity of Rose harvested and frequency of repetitive task performed while harvesting process.

Pearson’s Product Moment Correlation Coefficient was computed to find out the interrelationship between the situational variable namely time spent on Rose harvesting, distance covered during Rose harvesting, the quantity of Rose harvested and frequency of repetitive task performed during Rose harvesting process with the frequency and severity of Musculoskeletal Discomfort experienced by the Rose Farm workers during Rose harvesting process.

For the purpose of statistical analysis following hypotheses were formulated

HO_1: The situational variables (viz. time duration spent, distance covered, the quantity of Rose harvested, Repetition of the task during Rose harvesting process) do not vary with the personal variables (viz. gender, age, BMI and work experience) of the Rose Farm Workers.

For the purpose of statistical analysis following sub hypotheses were formulated

$HO_{1.1}$: There exists no significant difference in situational variables (viz. time duration spent, distance covered, the quantity of Rose harvested, Repetition of the task) due to a personal variable (Gender) of the Rose Farm workers.

The 't' test was computed to find out the significant difference in the mean score of situational variables (time duration spent, distance covered, the quantity of Rose harvested, repetition of the task) with the personal variable (Gender) of the Rose farm workers.

Table 22: 't' test showing the mean difference in the situational variable (viz. time duration spent, distance covered, the quantity of Rose harvested, repetition of the task) due to their personal variable (Gender) of the Rose Farm workers.

Personal Variable (Gender)	Situational Variables			
	Time duration spent on Rose harvesting process			
	Mean Score	**df**	**'t' (Cal.)**	**Level of Significance**
Female	183.9286	59	2.247	***0.05**
Male	164.4043			
	Distance covered during Rose harvesting process			
Female	2799.93	59	2.103	***0.05**
Male	2288.51			
	The quantity of Rose harvested			
Female	14.57	59	2.022	***0.05**
Male	12.94			
	Repetition of the task performed during Rose harvesting process			
	Plucking			
Female	3949.57	59	.956	N. S
Male	3676.60			
	Gathering			
Female	1007.64	59	-.281	N. S
Male	1031.66			
	Heaping			
Female	3.64	59	.308	N. S
Male	3.23			
*Level of Significance = 0.05 level N.S. = Not significant				

The **table 22**, clearly depicts that a significant difference was found in the mean score of situational variables (viz. time duration spent on Rose harvesting process, distance covered and the quantity of Rose harvested) due to their personal variable (Gender) at **0.05 level**. However, there was no significant difference found in the repetition of the task performed during Rose harvesting process due to their personal variable (Gender). Thus, the null hypotheses $\mathbf{HO_{1.1}}$ was partially accepted. Hence, it can be concluded that the Gender of the respondents significantly affects the time duration spent on Rose harvesting process, the distance covered during Rose harvesting process and the quantity of Rose harvested by the respondents. Whereas, repetition of the task performed by Rose farm workers during Rose harvesting process is not affected by the Gender of the Respondents.

$HO_{1.2}$: The situational variables (viz. time duration spent on Rose harvesting process, distance covered during Rose harvesting process, the quantity of Rose harvested, repetition of the task) do not vary with the personal variables (viz. age, BMI and work experience) of the Rose Farm workers.

ANOVA was computed to find out the variation between the situational variables (viz. time duration spent on Rose harvesting process, distance covered during Rose harvesting process, the quantity of Rose harvested, repetition of the task) with the personal variables (viz. age, BMI and work experience) of the Rose farm workers **(table 23)**.

The findings of **table 23 (A)**, clearly highlight that the computed F-value for selected personal variables (age) was found to be significant at **0.01 level**. This indicates that the situational variables namely time duration spent on Rose harvesting process, vary with the personal variable (age) of the Rose farm workers. However, regarding the personal variables viz. BMI and Work Experience of the respondents, the data depicts that the computed F- value for selected personal variables were found not to be significant, which indicates that situational variable namely time duration spent on Rose harvesting process, do not vary with the BMI and Work Experience of the Rose Farm

workers. Hence, it can be concluded that the null hypotheses **$HO_{1.2}$** was partially accepted.

Table 23 (A): Analysis of variance for selected situational variables namely time duration spent on Rose harvesting process with personal variables (viz. age, BMI and work experience) of the Rose Farm workers.

Personal Variables	Time duration spent on Rose harvesting process				
	Sum of Scores	Mean Scores	*df*	F (Cal.)	Level of Significance
Age					
Between Group	35973451.954	22171.822	2	59.216	***0.01**
Within Group	21716.552	374.423	58		
BMI					
Between Group	734.935	367.467	2	.326	N. S
Within Group	65325.262	1126.298	58		
Work experience					
Between Group	2092.560	1046.280	2	.949	N. S
Within Group	63967.636	1102.890	58		
N.S. = Not significant *Level of Significance = 0.01 level					

The findings of **table 23 (B)**, clearly highlight that the computed F-value for selected personal variables (age) was found to be significant at **0.01 level**. This indicates that the situational variable namely time duration spent on Rose harvesting process, vary with the personal variable (age) of the Rose farm workers. However, regarding the personal variables viz. BMI and Work Experience of the respondents, the data depicts that the computed F-value for selected personal variables were found to be not significant, which indicates that situational variable namely Distance Covered during Rose harvesting process, do not vary with the BMI and Work Experience of the Rose farm workers. Hence, it can be concluded that the null hypotheses **$HO_{1.2}$** was partially accepted.

Table 23 (B): Analysis of variance for selected situational variables namely Distance covered during Rose harvesting process with personal variables (viz. age, BMI and Work Experience) of the Rose Farm workers.

Personal Variables	Distance Covered during Rose Harvesting Process				
	Sum of Scores	Mean Scores	*df*	F (Cal.)	Level of Significance
Age					
Between Group	35973451.954	17986725.977	2	95.120	***0.01**
Within Group	10967512.243	189095.039	58		
BMI					
Between Group	346753.122	173376.561	2	.216	N. S
Within Group	46594211.074	803348.467	58		
Work Experience					
Between Group	1721080.247	860540.123	2	1.104	N. S
Within Group	45219883.950	779653.172	58		

The findings of **table 23 (C)**, clearly highlight that the computed F-value for selected personal variables (age) was found to be significant at **0.01 level**. This indicates that the situational variable namely Quantity of rose harvested during Rose harvesting process, vary with the personal variable (age) of the Rose farm workers. However, regarding the personal variables viz. BMI and Work Experience of the respondents, the data depicts that the computed F-value for selected personal variables were found to be not significant, which indicates that situational variable namely Quantity of rose harvested during Rose harvesting process, do not vary with the BMI and Work Experience of the Rose farm workers. Hence, it can be concluded that the null hypotheses $\mathbf{HO_{1.2}}$ was partially accepted.

Table 23 (C): Analysis of variance for selected situational variables namely Quantity of Rose harvested with personal variables (viz. age, BMI and work experience) of the Rose Farm Workers.

Personal Variables	The Quantity of Rose Harvested				
	Sum of Scores	Mean Scores	*df*	F (Cal.)	Level of Significance
Age					
Between Group	434.282	217.141	2	124.942	***0.01**
Within Group	100.800	1.738	58		
BMI					
Between Group	3.225	1.612	2	176	N. S
Within Group	531.857	9.170	58		
Work experience					
Between Group	21.337	10.668	2	1.204	N. S
Within Group	513.745	8.858	58		

The findings of **table 23 (D)**, clearly highlight that the computed F-value for selected personal variables (age) was found to be significant at **0.01 level**. This indicates that the situational variable namely Repetition of the task performed during the Rose harvesting process, vary with the personal variable (age) of the Rose Farm workers. However, regarding the personal variables viz. BMI and Work Experience of the respondents, the data depicts that the computed F-value for selected personal variables were found to be not significant, which indicates that situational variable namely Repetition of the task performed during the Rose harvesting process, do not vary with the BMI and Work Experience of the Rose Farm workers. Hence, it can be concluded that the null hypotheses $\mathbf{HO_{1.2}}$ was partially accepted.

Table 23 (D): Analysis of variance for selected situational variables namely Repetition of the task performed during rose harvesting process with personal variables (viz. age, BMI and work experience) of the Rose Farm workers.

Personal Variables	Repetition of the task performed during Rose harvesting process				
	Sum of Scores	Mean Scores	*df*	F (Cal.)	Level of Significance
Age					
Plucking					
Between Group	35273698.607	17636849.303	2	49.755	***0.01**
Within Group	20559326.705	354471.150	58		
Gathering					
Between Group	1955674.967	977837.484	2	13.348	***0.01**
Within Group	4248774.705	73254.736	58		
Heaping					
Between Group	27.143	13.571	2	124.942	***0.01**
Within Group	6.300	.109	58		
Within Group	6.300	.109	58		
BMI					
Plucking					
Between Group	218404.808	109202.404	2	.114	N. S
Within Group	55614620.503	958872.767	58		
Gathering					
Between Group	36053.244	18026.622	2	.170	N. S
Within Group	6168396.429	106351.663	58		
Heaping					
Between Group	.202	.101	2	.176	N. S
Within Group	33.241	.573	58		
Within Group	33.241	.573	58		
Work experience					
Plucking					
Between Group	2262098.966	1131049.483	2	1.225	N. S
Within Group	53570926.345	923636.661	58		
Gathering					
Between Group	471715.327	235857.663	2	2.386	N. S
Within Group	5732734.345	98840.247	58		
Heaping					
Between Group	1.334	.667	2	1.204	N. S
Within Group	32.109	.554	58		
N.S. = Not significant *Level of Significance = 0.01 level					

The overall conclusion of **$HO_{1.2}$** as depicted in **table 23**, clearly highlight that the computed F- value for selected personal variables (age) was found to be significant at 0.01 level. This indicates that the situational variables (viz. time duration spent on Rose harvesting process, distance covered during Rose harvesting process, the quantity of Rose harvested, repetition of the task performed during Rose harvesting process) vary with the personal variable (age) of the Rose Farm workers.

Whereas, regarding the personal variables (viz. BMI and Work Experience of the respondents, the data depicts that the computed F- value for selected personal variables (viz. BMI and Work Experience) were found not to be significant, which indicates that situational variables (viz. time duration spent on Rose harvesting process, distance covered during Rose harvesting process, the quantity of Rose harvested, repetition of the task performed during Rose harvesting process) do not vary with the personal variable viz. BMI and Work Experience of the Rose farm workers. Hence, it can be concluded that the null hypotheses **$HO_{1.2}$** was partially accepted **(Table 23)**.

HO_2: There exists no significant difference in the intervening variable (duration of maintaining adopted posture during Rose harvesting) due to personal variables (viz. gender, age, BMI and work experience) of the Rose Farm Workers.

For the purpose of statistical analysis following sub hypotheses were formulated

$HO_{2.1}$: There exists no significant difference in the intervening variable (duration of maintaining adopted posture during Rose harvesting process) due to personal variable (Gender) of the Rose Farm Workers

The 't' test was computed to find out the significant difference in the mean score of the intervening variable (duration of maintaining adopted posture during Rose harvesting process) with the personal variable (Gender) of the Rose Farm Workers.

Table 24: 't' test showing the mean difference in the intervening variable (duration of maintaining adopted posture) due to personal variables (Gender) of the Rose Farm Workers

Personal Variables	Duration of Maintaining adopted Posture during Rose harvesting process			
	Mean Square	df	't' (Cal)	Level of Significance
Gender				
Female	22.4286	59	-.287	N. S
Male	22.8723		22.8723	
*Level of Significance = 0.05 level N.S. = Not significant				

The **table 24**, clearly depicts that, the intervening variable (duration of maintaining adopted posture by the Rose farm workers during Rose harvesting process) do not differ due to the (Gender) of the Rose farm workers. Thus, the null hypothesis **$HO_{2.1}$** was accepted.

$HO_{2.2}$: There exists no significant difference in the intervening variable (duration of maintaining adopted posture during Rose harvesting) due to personal variables (viz. age, BMI and work experience) of the Rose Farm workers

ANOVA was computed to find out the variation in the duration of maintaining adopted posture with their personal variables (age, BMI and work experience) of the Rose farm workers (**table 25**).

The findings in **table 25,** clearly highlight that the computed F- value for the selected intervening variables viz. duration of maintaining adopted posture by the Rose farm worker during Rose harvesting process was found to be significant at **0.01 level** with the age of the respondents. This indicates that the duration of maintaining adopted posture by the Rose farm worker during Rose harvesting process significantly vary with their age.

Table 25: Analysis of variance for selected intervening variables (duration of maintaining adopted posture during Rose harvesting) with personal variables (viz. age, BMI and work experience) of the Rose Farm Workers.

Personal Variables	Sum of Square	Mean Square	df	$F_{(Cal)}$	Level of Significance
Age					
Between Group	726.654	363.327	2	27.578	***0.01**
Within Group	764.133	13.175	58		
BMI					
Between Group	63.046	31.523	2	1.281	N. S
Within Group	1427.741	24.616	58		
Work Experience					
Between Group	80.655	40.328	2	1.659	N. S
Within Group	1410.132	24.313	58		
N.S. = Not significant *Level of Significance = 0.01 level					

Regarding the personal variables viz. BMI and Work Experience, the computed F-ratio was found not to be significant. This indicates that the duration of maintaining adopted posture by the Rose farm worker during Rose harvesting process do not vary with the BMI and work experience of the Rose farm workers. Therefore, it can be concluded that the null hypotheses **$HO_{2.2}$** was partially accepted.

HO_3: There exists no significant relationship between the intervening variable (duration of maintaining adopted posture during Rose harvesting process) and the situational variables (viz. time duration spent, distance covered, the quantity of Rose harvested and frequency of repetitive task performed while harvesting process).

Co-efficient correlation was computed between the intervening variable (duration of maintaining adopted posture by the Rose farm workers during Rose harvesting process) and the situational variables (viz. time spent on Rose harvesting process, distance covered during Rose harvesting process, the quantity of Rose harvested and frequency of repetitive task performed

during Rose harvesting process) of the respondents to see whether the duration of maintaining adopted posture by the Rose farm workers during Rose harvesting process was significantly affected by the selected situational variables or not.

Table 26: Coefficient of correlation between the intervening variable (duration of maintaining adopted posture) with the situational variables (viz. time duration spent, distance covered, the quantity of Rose harvested and frequency of repetitive task performed while harvesting process)

Situational Variables	Duration of maintaining adopted posture		
	N	'r' values	Level of Significance
Time duration spent on the Rose harvesting process	60	.579	***0.01**
Distance covered during the Rose harvesting process	60	.649	***0.01**
The quantity of rose harvested	60	.674	***0.01**
Frequency of repetitive task performed during the Rose harvesting process			
• Plucking	60	.709	***0.01**
• Gathering	60	.584	***0.01**
• Heaping	60	.584	***0.01**
*Level of Significance = 0.01 level			

The data revealed in **table 26** depicts that, there exists a **positive relationship** between the selected intervening variables (duration of maintaining adopted posture) and the situational variables (viz. time duration spent on Rose harvesting process, distance covered during Rose harvesting process, the quantity of Rose harvested and frequency of repetitive task performed while harvesting process). Therefore, the null hypotheses **HO_3** was rejected at the 0.01 level **(table 26)**.

Hence, it can be concluded that the time duration spent on Rose harvesting, distance covered during Rose harvesting, the quantity of Rose harvested and the frequency of repetitive tasks performed while rose harvesting process by Rose Farm workers was significantly affected by the intervening variables (duration of maintaining adopted posture) of Rose farm workers.

HO_4: There exists no significant difference in the Musculoskeletal Discomfort (measured on frequency and severity of pain) experienced by the Rose Farm workers during Rose harvesting process due to their personal variable (Gender)

The 't' test was computed to find out the significant difference in the mean score of frequency and severity of musculoskeletal discomfort experienced by the Rose farm workers during Rose harvesting process and their personal variable (Gender).

Table27: 't' test showing the mean difference between the Musculoskeletal Discomfort (measured on frequency and severity of pain) experienced by the Rose Farm Workers during Rose harvesting process due to their personal variables (Gender).

Personal Variables	**Frequency of Musculoskeletal Discomfort**			
Gender	Mean Square	df	**'t' (Cal)**	**Level of Significance**
Female	45.29	59	.308	N. S
Male	44.94			
	The Severity of Musculoskeletal Discomfort			
Female	94.18	59	-1.639	N. S
Male	99.38			
N.S. = Not significant				

The **table 27,** clearly depicts that, Gender does not have a significant effect on the frequency and severity of musculoskeletal discomfort experienced by the Rose farm worker during Rose harvesting process.

$H0_5$: There exists a relationship between the extent of musculoskeletal discomfort (measured on frequency and severity of pain) experienced by the Rose Farm workers during Rose harvesting process with their personal variables (viz. age, BMI and work experience)and situational variables (viz. time spent, distance covered, the quantity of Rose harvested and frequency of repetitive task performed during harvesting process).

For the purpose of statistical analysis following sub hypotheses were formulated

$HO_{5.1}$: There exists no significant relationship between the musculoskeletal discomfort (measured on frequency and severity of pain) experienced by the Rose Farm workers during Rose harvesting process with their personal variables (viz. age, BMI and work experience).

ANOVA was computed to find out the variation between the frequency and severity of musculoskeletal discomfort experienced by the Rose farm workers during Rose harvesting process with their personal variables viz. age, BMI and Work Experience **(table 28).**

Table 28: Analysis of variance between the frequency and severity of musculoskeletal discomfort experienced by the Rose Farm workers during Rose harvesting process with their personal variables (viz. age, BMI and Work Experience).

Personal Variables	Frequency of Musculoskeletal Discomfort				
	Sum of Square	Mean Square	df	$F_{(Cal)}$	Level of Significance
Age					
Between Group	229.046	114.523	2	10.646	***0.01**
Within Group	623.938	10.758 58	58		
BMI					
Between Group	23.984	11.992	2	.839	N. S
Within Group	829.000	14.293	58		
Work experience					
Between Group	78.888	39.444	2	2.955	N. S
Within Group	774.095	13.346	58		
	The severity of Musculoskeletal Discomfort				
Age					
Between Group	2354.173	1177.087	2	47.979	***0.01**
Within Group	907.727	24.533	58		
BMI					
Between Group	27.745	13.873	2	.159	N. S
Within Group	3234.155	87.410	58		
Work experience					
Between Group	288.429	144.215	2	1.795	N. S
Within Group	2973.471	80.364	58		
*Level of Significance = 0.01 level N.S. = Not significant					

The findings of **table 28**, clearly highlight that the computed F- value for frequency and severity of musculoskeletal discomfort experienced by the Rose farm worker during Rose harvesting process with their personal variables (viz. age) was found to be significant at **0.01 level**. This indicates that the frequency and severity musculoskeletal discomfort experienced by the Rose farm worker during Rose harvesting process vary with their personal variable viz. age.

Regarding the personal variables BMI and Work Experience, the computed F-value was found not significant, which indicates that the frequency and severity of musculoskeletal discomfort experienced by the Rose farm worker during Rose harvesting process do not vary with BMI and Work Experience of the respondents **(Table 28)**. Hence, it can be concluded that the null hypotheses **HO $_{5.1}$** was partially accepted.

$HO_{5.2}$: There exists no significant relationship between Musculoskeletal Discomfort experienced (measured on the frequency and severity of pain) by the Rose Farm Workers during Rose harvesting process and their situational variables (viz. time spent, distance covered, the quantity of Rose harvested and frequency of repetitive task performed during harvesting process).

The coefficient of correlation was computed between the frequency and severity of musculoskeletal discomfort experienced by the Rose farm workers during Rose harvesting process and their situational variables (viz. time spent on Rose harvesting process, distance covered during Rose harvesting process, the quantity of Rose harvested and frequency of repetitive task performed during harvesting process) to see whether the frequency and severity of musculoskeletal discomfort experienced by the Rose farm workers during Rose harvesting process was significantly affected by the selected situational variables or not.

The data represented in **table 29**, clearly depicts that, there exists a **positive relationship** between the frequency and severity of musculoskeletal discomfort experienced by the Rose Farm workers during Rose harvesting process and

their situational variables (viz. time spent, distance covered, the quantity of Rose harvested and frequency of repetitive task performed during harvesting process). Therefore, the null hypotheses **HO $_{5.2}$** was rejected **(Table 29).**

Table 29: The coefficient of correlation between Musculoskeletal Discomfort (measured on the frequency and severity of pain) experienced by the Rose Farm workers during Rose harvesting process and their situational variables (viz. time spent, distance covered, the quantity of Rose harvested and frequency of repetitive task performed during harvesting process).

Situations Variables	Frequency of Musculoskeletal Discomfort		
	N	'r' - values	Level of Significant
Time spent on Rose harvesting process	60	.416	***0.01**
Distance covered during Rose harvesting process	60	.480	***0.01**
The quantity of Rose harvested	60	.495	***0.01**
Frequency of Repetitive Task Performed During Rose Harvesting Process			
• Plucking	60	.448	***0.01**
• Gathering	60	.495	***0.01**
• Heaping	60	.494	***0.01**
	Severity of Musculoskeletal Discomfort		
Time spent on Rose harvesting process	60	.764	***0.01**
Distance covered during Rose harvesting process	60	.823	***0.01**
The quantity of Rose harvested	60	.822	***0.01**
Frequency of repetitive task performed during the Rose harvesting process			
• Plucking	60	.787	***0.01**
• Gathering	60	.363	***0.01**
• Heaping	60	.495	***0.01**
*Level of Significance = 0.01 level			

Hence, it can be concluded that the frequency and severity of musculoskeletal discomfort experienced by the Rose Farm workers during Rose harvesting process are significantly affected by the situational variables(viz. time spent, distance covered, the quantity of Rose harvested and frequency of repetitive task performed during harvesting process) of the Rose farm workers.

Conclusion:

Since ancient times, flowers and ornamental plants have always remained a fundamental part of the social fabric of human life. Man has traditionally used flowers for revealing his innermost feelings to God and deities or presenting to the beloved ones or complimenting anyone or versifying any conceivable emotion. Whereas, gardens with ornamental and flowering plants are being noted in most of our historical references

Among flowers, Rose (Rosa indicia) is one of nature's beautiful creations and is universally commended as the "Queen of Flower", commonly belongs to family Rosacea. Undoubtedly, Rose is the most beautiful and complement flower, which talks about love and happiness. It signifies love beauty and selflessness and is a perfect gift to show gratitude and care. Rose is a woody and thorny shrub plant and has more than hundreds of species and over 2000 cultivars**.**

Rose is one of the top-selling flowers in the global flower trade and stands first among the commercial cut flowers. As far as in Gujarat state, the majority of the land area is under traditional flower cultivation like Desi Rose, Kashmiri Rose, Marigold, Lily and Jasmine. The major Rose growing districts of Gujarat are Bharuch, Vadodara, Ahmedabad, Kheda, and Chota Udaipur, where Roses are Cultivated in 4178 hectares and production is 38865 MT (Director of Horticulture, Government of Gujarat, year-wise estimated Area, Production and Productivity annual report 2018-19).

Vadodara being the second-highest district known for Rose production mainly cultivate two types of Roses such as Kashmiri Rose and Desi Rose which are very much in demand.

Rose Farm workers of Floriculture Industry performs numerous labour-intensive jobs such as land preparation, removing of stalks and stubbles, extending, making of field compartment, preparation of channels for irrigation, digging of Rose crop into land, manuring, weeding (plant to plant), pruning and budding, spraying of pesticides on Rose crop and lastly, harvesting of Rose crops in which Rose farm workers are involved in the task like of Plucking, gathering,

heaping of the Rose crop. Therefore, Rose cultivation is considered to be a drudgery prone activity. Rose farm workers experience types of musculoskeletal discomforts due to repetitive task and physical load, which affect their health and productivity. In Rose cultivation plucking, heaping and gathering of the Rose flower is considered as the severe most drudgery prone activity, where workers have to keep their posture in bending position from the back facing towards the ground for plucking the Rose. It leads them to severe pain in their backbone, leg, thighs and feet**.**

Vadodara being the second major district engaged in Rose Cultivation, the present study aimed to assess the Musculoskeletal Discomforts experienced by the Rose farm workers of Vadodara district. The Extent of Musculoskeletal Discomfort (Body Discomfort) was measured through various parameters viz. the Extent of Exhaustion experienced by the respondents due to Time Duration Spent on Rose harvesting ,the Extent of Exhaustion experienced by the respondents due to Distanced Covered during Rose harvesting , the Extent of Body Pain experienced by the respondents due to Quantity of Rose harvested and the Extent of Frequency and Severity of Body Pain measured through Psychophysical Corlett and Bishop's Body Part Discomfort Standardized Scale (1976).

From the findings of the study, the results revealed that less than one-third of the respondents took short duration (90-133 minutes) time, less than half of the respondents took moderate duration (134-177 minutes) time and more than one-fourth of the respondents took long duration (178-221 minutes) time for overall (4 trips Rose harvesting process.

Regarding Distanced covered by the rose farm workers, the results showed that less than one fifth (16.67%) of the respondents covered short distance (643-87 meter), one third (33.33%) of the respondents covered moderate distance (872-1100 meter) and a half (50%) of the respondents covered long distance (1101-1329 meter) for overall (4 trips) Rose harvesting process (Plucking, Gathering and Heaping) with the Mean of 1088.35 in meters.

Concerning to Repetitive task performed, it was found that for frequency repetition of task “**Plucking”,** less than one fifth (18.33%) of the respondents belonged to frequency range group of 1660-2814, one third (33.33%) of the respondents belonged to frequency range group of 2815-3969 and less than half (48.33%) of the respondents belonged to frequency range group of 3970 – 5124 with the Mean of 3773.53 during Rose crops harvesting.

Similarly, regarding repetition of task “**Gathering”,** it was observed that less than one fifth (16.67%) of the respondents belonged to frequency range group of 391-840, one third (33.33%) of the respondents belonged to frequency range group of841-1290. Whereas, less than half of the respondents belonged to frequency range group 1291-1740 during Rose harvesting process**.**

Whereas, regarding the repetition of task "**Heaping”,** it was observed that, 10 respondents repeated heaping task two times, 20 respondents repeated heaping task three times and 30 respondents repeated heaping task four times during Rose harvesting process.

Regarding the overall extent of frequency and severity of musculoskeletal discomfort (body discomfort) experienced by the respondents in their upper (1-18) and lower (19-27) body parts during Rose harvesting process. It was observed that the extent of frequency and severity of body discomfort was experienced in upper body parts viz. upper back, lower back, mid-back, neck, right wrist, right palm, left shoulder and right shoulder by the respondents in comparison to lower body parts viz; Right foot, left foot and Buttock.

This could be because during the Rose harvesting process (Plucking, Gathering and Heaping) the farmers adopted standing and forward bending posture for plucking, gathering and heaping of the Rose crops which might have resulted in frequency and severity of body discomfort in the upper back, lower back, mid-back. Whereas, the frequency and severity of body discomfort in the right wrist and right palm might be due to plucking of the Rose with the right hand and the frequency and severity of body discomfort in the neck and left and right shoulder might be due to carrying the Rose collecting bag on their neck.

The relational statistics were applied to test the hypotheses. Wherein, ANOVA, “t” test and Coefficient of Correlation were computed to analyze the findings statistically.

The 't' test was computed to find out the significant difference in the mean score of situational variables (time duration spent on Rose harvesting process, distance covered during Rose harvesting process, the quantity of Rose harvested, repetition of the task) with the personal variable (Gender) of the Rose Farm workers. The results revealed that the Gender of the respondents significantly affects the time duration spent on Rose harvesting process, the distance covered during the Rose harvesting process and the quantity of Rose harvested by the respondents. Whereas, repetition of the task performed by Rose Farm workers during Rose harvesting process is not affected by the Gender of the Respondents.

ANOVA was computed to find out the variation between the situational variables (viz. time duration spent on Rose harvesting process, distance covered during Rose harvesting process, the quantity of Rose harvested, repetition of the task) with the personal variables (viz. age, BMI and work experience) of the Rose Farm workers.

The results, clearly highlight that the time duration spent on Rose harvesting process, distance covered during Rose harvesting process, the quantity of Rose harvested, repetition of the task performed during Rose harvesting process varies with the age of the Rose Farm workers but do not vary with the BMI and Work Experience of the Rose Farm workers.

The 't' test was computed to find out the significant difference in the mean score of the intervening variable (duration of maintaining adopted posture during Rose harvesting process) with the personal variable (Gender) of the Rose Farm workers. The results, clearly depicted that the duration of maintaining adopted posture by the Rose farm workers during Rose harvesting process do not differ due to the Gender of the Rose Farm workers.

ANOVA was computed to find out the variation in the duration of maintaining adopted posture with their personal variables (viz. age, BMI and Work Experience) of the Rose Farm workers. The findings, clearly highlighted that the duration of

maintaining adopted posture by the Rose farm worker during Rose harvesting process was significantly affected only due to age of the respondents but not due to BMI and Work Experience of the respondents

Co-efficient correlation was computed between the intervening variable (duration of maintaining adopted posture by the Rose farm workers during Rose harvesting process) and the situational variables (viz. time spent on Rose harvesting process, distance covered during Rose harvesting process, the quantity of Rose harvested and frequency of repetitive task performed during Rose harvesting process) of the respondents to see whether the duration of maintaining adopted posture by the Rose farm workers during Rose harvesting process was significantly affected by the selected situational variables or not.

The results, clearly stipulate that the time duration spent on Rose harvesting, distance covered during Rose harvesting, the quantity of Rose harvested and the frequency of repetitive task performed by Rose Farm workers were significantly affected due to the duration of maintaining adopted posture by Rose Farm workers.

The ‘t’ test was computed to find out the significant difference in the mean score of frequency and severity of musculoskeletal discomfort experienced by the Rose Farm workers during Rose harvesting process and their personal variable (Gender). The results**,** clearly depicted that, gender does not have a significant effect on the frequency and severity of musculoskeletal discomfort experienced by the Rose farm worker during Rose harvesting process.

ANOVA was computed to find out the variation between the frequency and severity of musculoskeletal discomfort experienced by the Rose Farm workers during Rose harvesting process with their personal variables viz. age, BMI and work experience.

The findings, clearly highlight that there is a significant effect of age on frequency and severity of musculoskeletal discomfort experienced by the Rose farm worker during Rose harvesting process. However, BMI and Work Experience of the respondents do not have a significant effect on the frequency and severity of

musculoskeletal discomfort experienced by the Rose farm worker during Rose harvesting process.

The coefficient of correlation was computed between the frequency and severity of musculoskeletal discomfort experienced by the Rose farm workers during Rose harvesting process and their situational variables (viz. time spent on Rose harvesting process, distance covered during Rose harvesting process, the quantity of Rose harvested and frequency of repetitive task performed during harvesting process) to see whether the frequency and severity of musculoskeletal discomfort experienced by the Rose farm workers during Rose harvesting process was significantly affected by the selected situational variables or not.

The results, clearly reveled that the situational variables (viz. time spent on Rose harvesting process, distance covered during Rose harvesting process, the quantity of Rose harvested and frequency of repetitive task performed during harvesting process) have a significant effect on the frequency and severity of musculoskeletal discomfort experienced by the Rose Farm workers during Rose harvesting process.

4.6 Section VI: Suggested Coping Strategies

Need-based coping strategies were suggested based on frequency and severity of musculoskeletal discomfort experienced by the Rose farm workers during Rose harvesting process in various upper and lower body parts due to time spent on the Rose harvesting process, distance travelled during the Rose harvesting process, the quantity of rose harvested, frequency of repetitive task (Plucking, Gathering and Heaping).

1. It was observed that majority of the respondents experienced high frequency and severity of musculoskeletal discomfort in the right wrist, and right palm which may due to the continuous repetition of plucking, gathering and heaping of the Rose crops by adopting standing and forward bending posture with no rest-pause. Therefore, it is suggested that farmers should adopt the 2 feet long Rose pruner available in the market to reduce pain in Right Wrist and Right palm while Rose harvesting. Additionally, the Rose pruner will help the farmers to reduces the upper back pain, mid-back pain and lower back pain because the farmer will not have to bend forward for plucking rose while using Rose pruner during Rose harvesting process.

Plate 8 : Rose Pruner to Reduce Pain in Right Wrist and Right Palm While Rose Harvesting

2. It was observed that during rose harvesting process farmers do not take rest due to which they use to exhausted. Therefore, it is suggested that farmers should take rest-pause after every short interval during rose harvesting process because rest periods are the perfect time to improve mobility and flexibility.

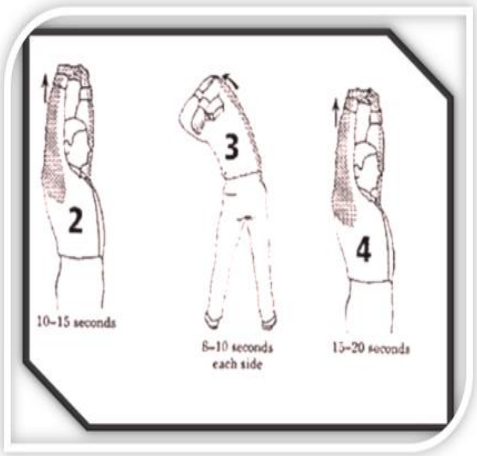


Plate 9 : Suggested Rest Pause after Every Short Interval During Rose Harvesting Process to Improve Flexibility

3. Regarding frequency and severity of musculoskeletal discomfort in neck, right and left shoulder, right wrist and palm. It was observed that during rose harvesting process the farmers hang rose gathering bag on their neck for long duration and also bend forward for plucking the rose. Therefore, it is suggested that Farmers should adopt Rose collecting trolley instead of rose collecting to reduce the neck and shoulder pain during Rose harvesting. The Rose collecting trolley would also help the farmers to reduce their walking distance as more quantity of roses can be harvested in a trip as compared to rose collecting bag which as a result will prevent the farmers to walk for heaping of roses. Consequently, it will benefit the farmers in increasing

productivity as they will be able to collect more roses at the same working hours.

Plate 10 : Use of Flowers Collecting Trolley

4. It was observed that majority of the respondents had on musculoskeletal discomfort in lower body parts Viz; Foot and legs due to the time duration taken, and distance covered during each trip. Therefore, it is suggested that farmers should adopt farming boots to reduce Foot and leg pain during the Rose harvesting process.

Plate 11 : Use of Farming Boots to Reduce Foot and Leg Pain During Rose Harvesting Process

SUMMARY,CONCLUSION AND RECOMMENDATIONS

CHAPTER V

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary:

Floriculture is the part of the horticulture industry, concerned with commercial production, marketing, and sale of bedding plants, cut flowers, potted flowering plants, foliage plants, flower arrangement, and noncommercial home gardening·

Since ancient times, flowers and ornamental plants have always remained a fundamental part of the social fabric of human life. Man has traditionally used flowers for revealing his innermost feelings to God and deities or presenting to the beloved ones or complimenting anyone or verifying any conceivable emotion. Whereas, gardens with ornamental and flowering plants are being noted in most of our historical references. Garlands of olive leaves were worn by the roman soldiers and Lotus blossoms decorated the Egyptian royalty. Backyards growing of flower dates back to ancient times like the Ramayana and Mahabharata. Flowers and plants are cultivated for aesthetic purposes for their fragrance, perfumes and medicines. Therefore, it can be said that floriculture is a primitive farm activity with immense potential for generating remunerative self–employment among small and marginal farmers

Among flowers, Rose (Rosa indicia) is one of nature's beautiful creations and is universally commended as the "Queen of Flower", commonly belongs to family Rosacea. Roses have the everlasting beauty and true essence of nature, always inspire to be glorious, and charming. William Shakespeare (20^{th} century), the famous poet, praise Rose as a sweet-smelling flower which takes us to an altogether different world. Undoubtedly, Rose is the most beautiful and complement flower, which talks about love and happiness. It signifies love beauty and selflessness and is a perfect gift to show gratitude and care. Rose is a woody and thorny shrub plant and has more than hundreds of species and over 2000

cultivars**.** They form a group of plants that can be erect shrubs, climbing, or trailing with stems that are often armed with sharp spikes. Rose plants range in size from compact, miniature Roses, to climbers that can reach seven meters in height. Different species hybridize easily and are used in the development of the wide range of garden Roses.

Rose is one of the top-selling flowers in the global flower trade and stands first among the commercial cut flowers. As far as in Gujarat state, the majority of the land area is under traditional flower cultivation like Desi Rose, Kashmiri Rose, Marigold, Lily and Jasmine. The major Rose growing districts of Gujarat are Bharuch, Vadodara, Ahmedabad, Kheda, and Chota Udaipur, where Roses are Cultivated in 4178 hectares and production is 38865 MT.

Vadodara being the second-highest district known for Rose production mainly cultivate two types of Roses such as Kashmiri Rose and Desi Rose which are very much in demand. In Kashmiri Rose plants numerous buds and flowers are grown in one branch of the flowering plant and spikes. Due to which in the least investment the production of Kashmiri Roses is done in huge amount and it is also beneficial for the cultivators. Kashmiri Rose is cultivated in every season and it requires very less maintenance for growing Rose plants. The height of the Kashmiri Rose plants is minimum 2 ft. and have fewer thrones compared to other Rose crops. Whereas, the Desi Gulab is about 2-3 inches wide, very delicate and sturdier-looking and requires lots of maintenance. Therefore, the farmers in Vadodara district are more engrossed in the production of Kashmiri Roses.

In most of the countries, farming is recognized as one of the most hazardous industries because farming activities have the highest risks of work-related musculoskeletal discomforts than other occupational activities. The nature of farming activities is leading to awkward body posture including leaning, Kneeling, crawling, bending, twisting to one side, lifting and carrying heavy loads and repeated motions that can result in physical stress and traumatic injuries.

Musculoskeletal discomforts are one of the most common types of injuries developed due to damage of tissue, muscles, nerves, tendons, ligaments, joints, cartilage or spinal discs.

Rose farm workers of Floriculture Industry performs numerous labour-intensive jobs such as land preparation, removing of stalks and stubbles, levelling, making of field compartment, preparation of channels for irrigation, digging of Rose crop into land, manuring, weeding (plant to plant), pruning and budding, spraying of pesticides on Rose crop and lastly, harvesting of Rose crops in which Rose farm workers are involved in the task like of plucking, gathering, heaping of the Rose crop. Therefore, Rose cultivation and harvesting is considered to be a drudgery prone activity.

Rose farm workers experience types of musculoskeletal discomforts due to repetitive task and physical load, which affect their health and productivity. In Rose cultivation plucking, heaping and gathering of the Rose flower is considered as the severe most drudgery prone activity, where workers have to keep their posture in bending position from the back facing towards the ground for plucking the Rose which leads them to severe pain in their backbone, leg, thighs and feet**.**

During Rose harvesting activity from morning till evening, workers usually adapt squatting posture and they continue to work in this posture for a long duration without adapting any other posture due to which they face severe pain in lower back and knees. Whereas articulates that lower back pain is the most common MSD among the farmers and at the same time, some physical injuries have also occurred while working in a Rose farm because of plenty of thorns on Rose plants and its stem causing physical injuries.

Since primaeval periods flowers and ornamental plants have always remained an essential part of the social fabric of human life. Among the flowers Roses are propagated as ornamental as well as commercial plants. The cultivation of Roses has grossed its due importance throughout the present era as compared to other flowering plants. Therefore, the farm workers are very much interested to invest in Rose cultivation due to its high demand to gain a good amount of profit.

Vadodara being the second major district indulged in Rose cultivation, the present study focused on the assessment of the musculoskeletal discomforts experienced by the Rose farm workers of Vadodara district.

Therefore, it was thought that the present study will be distinctive and will benefit to the farm workers those who are continuously engaged in cultivation and harvesting of flowers to increase their productivity and at the same time it will help in reducing their Physical workload and Musculoskeletal discomforts. It will also be valuable to the Krishi Vigyan Kendras who are involved in imparting knowledge and awareness to the Rose farm workers.

It will also contribute to the field of Ergonomics as it dealt with ergonomic problems and postural difficulties of Rose farm workers. Lastly, the present study will be beneficial to the Family and Community Resource Management Department as, Ergonomics, Human Resource Management, Extension in Resource Management taught at Post Graduate level.

Objectives of the Study:

1. To collect the background information (Age, Height and Weight) of the Rose farm workers engaged in Rose harvesting process (Plucking, Gathering and Heaping) of selected Rose farms and categorized them according to Body Mass Index (BMI).
2. To analyze the duration of maintaining the adopted postures by the Rose farm workers during Rose harvesting process (Plucking, Gathering and Heaping) of selected Rose farms of Vadodara District.
3. To analyze the frequency and duration of rest pauses taken; distance covered; time spent; the quantity of Rose harvested and frequency of repetition of the task done by the Rose farm workers during Rose harvesting process (Plucking, Gathering and Heaping) of selected Rose farms.
4. To assess the Extent of Musculoskeletal Discomfort experienced by the Rose farm workers due to the distance covered; time spent; the quantity

of Rose harvested and frequency of repetition of the task done by the Rose farm workers during Rose harvesting process (Plucking, Gathering and Heaping) of selected Rose farms.

5. To suggest the coping strategies to overcome Musculoskeletal Discomfort experienced by the Rose farm workers of selected Rose farm of Vadodara District.

Delimitations of the Study:

For Rose Farms:

1. The present study was limited to the selected Rose farms of Vadodara districts indulged in Kashmiri Rose Cultivation.
2. The present study was limited to those Rose farms having minimum production of Rose crops above 70 kg/day.
3. The present study was limited to the selected Rose farms of Vadodara districts having a minimum of ten farm workers.

For Rose Farms Workers:

1. The present study was limited to those Rose farm workers who were above 18 years.
2. The present study was limited to those Rose farm workers who were engaged in Rose harvesting process (Plucking, Gathering and Heaping) and had a minimum of two years of work experience with the same crop.
3. The present study was limited to those Rose farm workers who were physically and mentally normal (not physically or mentally challenged) and especially females, not in the pregnancy stage.
4. The present study was limited to those Rose farm workers who were willing to participate in the research study.

Hypotheses of the Study

1. The situational variables (viz. time duration spent, distance covered, the quantity of Rose harvested, Repetition of the task performed while Rose harvesting process) vary with the personal variables (viz. gender, age, BMI and work experience) of the Rose farm workers.
2. There exists a difference in the intervening variable (duration of maintaining adopted posture during Rose harvesting) due to personal variables (viz. gender, age, BMI and work experience) of the Rose farm workers.
3. There exists a relationship between the intervening variable (duration of maintaining adopted posture during Rose harvesting process) and the situational variables (viz. time duration spent, distance covered, the quantity of Rose harvested and frequency of repetitive task performed while Rose harvesting process).
4. There exists a difference in the musculoskeletal discomfort experienced by the Rose farm workers during Rose harvesting process due to their personal variable (Gender).
5. There exists a relationship between the extent of musculoskeletal discomfort experienced by the Rose farm workers during Rose harvesting process with their personal variables (viz. age, BMI and work experience) and the situational variables (viz. time spent, distance covered, the quantity of Rose harvested and frequency of repetitive task performed during harvesting process).

Methodology

The present study was undertaken to assess the Musculoskeletal Discomforts experienced by the Rose farm workers during the Rose harvesting process in selected Rose farm of Vadodara District, Gujarat.

Purposive sampling technique was used for the selection of Rose farms and Rose farm workers. Under this procedure in the first stage amongst the five major Rose growing Districts of Gujarat, Vadodara District was selected as it had maximum Kashmiri Rose farms. In the second stage, those villages of Vadodara District were

selected purposively which had Kashmiri Rose farms having minimum 70 kg /per day Rose crop production and had minimum ten farm workers engaged in Rose harvesting process. For the selection of Rose farm workers , only those workers were selected who were above 18 years, having minimum two years of work experience with the same Crop, who were physically and mentally normal (not physically or mentally challenged) and especially females not in the pregnancy stage and were willing to participate in the research study.

The data for the present study were gathered by the researcher from October to January 2019 - 2020. The data collection was done in three steps described as follows:

Interview Schedule was developed for data collection, the researcher visited the Rose farms which were selected through purposive sampling technique. The researcher stayed at the selected villages during the time of data collection because the Rose harvesting task was done in the early morning i.e. 3.00 am to 7.00 am, every day. The respondents (Rose farm workers) were interviewed personally by the investigator with the help of an interpreter (a fellow student who knew the Gujarati language) and the responses were recorded on the pre-validated interview schedule. It took almost 30 - 45 min to take an interview with a respondent. Along with other the interview schedule was divided in two sections viz. **Section I** sought information regarding the personal data of the rose farm workers like Name, Age (in years), Gender, Type of Family, Educational Qualification, Monthly Income, Work Experience in the Rose Farm, Medical Background of Rose Farm Workers, Size of the Rose Farm, Production of Roses in kgs/per day, Crop calendar of Rose cultivation. **Section II,** sought information regarding the frequency and severity of body discomfort experienced by the Rose farm workers during Rose harvesting process (Plucking, Gathering and Heaping) for which **Corlett and Bishop's Body Part Discomfort Standardized Scale (1976) was utilized.**

Observation Sheet was prepared to observe the duration of maintaining the posture adopted by the farm worker during Rose harvesting task and to record the frequency and actual time spent on the task performed, video recording of the

selected respondents was done. The recording was done each time the respondent was engaged in a task (Plucking, Heaping and Gathering) and the observations were then recorded in the pre-validated observation sheet. The observation sheet was divided in two parts **Section I,** congregated information regarding, BMI of the Rose farm workers, timings of Rose harvesting, posture adopted by the Rose farm workers during Rose harvesting and actual time spent (in hrs.) on Rose harvesting process (Plucking, Gathering and Heaping) by the Rose farm workers. **Section II:** congregated information regarding extent of body discomfort experienced by the Rose farm worker caused due Distance covered (in meters) during rose harvesting, Frequency of Repetitive task (Plucking, Gathering and Heaping), Quantity of Rose harvested (in kg). For this purpose, three scales were developed described as follows:

The collected data were analyzed using descriptive statistics in terms of Frequency and percentage, Weighted Mean, Analysis of Variance, 't' test and Co-efficient of Correlation.

Major Findings of the Study

Section I: Background Information of the Respondents

- The age of the selected respondents (Rose farm worker) ranged between 21 to 68 years with the mean age of 39.36 years. It was found that less than half of the respondents belonged to the age group of 21-36 years.
- The data depicted that majority of the respondents were males and slightly more than one-fifth of the respondents were females.
- The data exhibited that, majority of the respondents were from nuclear family and one-fifth of the respondents belonged to a joint family.
- The data about the educational qualification revealed that more than half of the respondents had an educational level up to primary school.
- The findings regarding the family monthly income of the data shown that majority of the respondents had family monthly income ranging from ₹5000-₹10000.

- The data regarding work experience revealed that majority of the respondents had work experience from 2- 6 years with Rose crops harvesting with the mean years 4.06.
- Regarding medical background, the data revealed that all the respondents engaged in Rose harvesting process working in selected Rose farms were physically and mentally normal (not physically or mentally challenged) and especially females were not in the pregnancy stage.
- Regarding the size of the rose farms, it was observed that the selected respondents were working in Rose farm size ranged between 3-4 Bigha (land area).
- For the production of Roses, the information depicts that less than one-half of the respondents worked in Rose farms having production of Rose crops approximately up to 101-131 kgs. per day, more than one-third of the respondents worked in Rose farms having production of Roses approximately up to 132-162 kgs. per day and less than one-fifth of the respondent worked in Rose farms having production of Roses approximately up to 70-100 kgs. per day.

Section II: Frequency and Severity Index of Body Discomforts Experienced by the Rose farm workers during Rose harvesting

- For frequency of Body Discomforts in upper body parts (1-18), It was found that out of 18 upper body parts, almost cent per cent the respondents always experienced pain in the upper back and lower back with the weighted mean 2.9 respectively. Subsequently, almost all the respondent always experienced pain in the mid-back with the weighted mean of 2.88 and majority of the respondents always experienced pain in the neck with 2.78 weighted mean and right wrist with 2.76 weighted means.
- Regarding the frequency of Body Discomforts in lower body parts (19-27), the data revealed that out of 9 Lower Body Parts in the first-place

majority of the respondents always experienced pain in the left foot and right foot with a weighted mean of 2.88 respectively. Subsequently, the majority of the respondents always experienced pain in Buttock with the weighted mean of 2.85.

- Regarding the severity of Body Discomforts in upper body parts (1-18), the information depicts that out of 18 upper body parts more than half of respondents experienced severe pain in the upper back, mid-back, lower back with the weighted mean 4.4 respectively and in the neck with a weighted mean of 4.36. Subsequently, less than half of the respondents experienced severe in the wrist with the weighted mean 4.31.
- Regarding the severity of Body Discomforts in lower body parts (19-27), It was found that out of 9 lower body parts half of the respondents experienced very severe pain in the left foot and right foot with the weighted mean score 4.5 respectively. Whereas, slightly less than half of the respondents experienced severe pain in the buttock with the weighted mean score of 4.48.

Section III: BMI of the Farmers, Postures Adopted, Frequency of Task Performed and Actual Time Spent on Task, Duration of Maintaining Adopted Posture, Time Taken for Harvesting Process, Spontaneous and Recommended Rest Pauses taken by Rose farm workers during the Rose Harvesting Process (Plucking, Gathering and Heaping) of the selected Rose farms.

- The findings reflect that the height of the respondents varied between 1.49 – 1.96 m and the mean height of the respondents was found to be 5.59 m and the standard deviation was 0.415. Whereas, the weight of the respondents varied between 45- 88 kg and the mean weights of the respondents 61 kg and the standard deviation was 9.79. Therefore, the BMI of the respondents varied between 16.0 to 29.0. and the mean BMI of the respondents was 21.08 and the standard deviation was 3.05.

- The information showcased that, cent per cent of the respondents performed the rose harvesting task (Plucking, Gathering and Heaping) daily by adopting standing and forward bending posture as the main posture and spent 3-4 hrs. for Rose harvesting process.
- Analysis of results reveals that during task picking of the Rose cent per cent of the respondents adopted standing and forward bending posture. Wherein more than half (66.67%) of the respondents maintained the adopted posture for 10-12 second (sec/plant), during the picking of Rose crops. Similarly, regarding task Gathering of Rose crops into the Rose collecting bag cent per cent of the respondents adopted standing posture. Wherein, more than half (65%) of the respondents maintained adopted posture for 4-6 second (sec/plant), during the Rose crops Gathering process. Whereas, for moving from one plant to other plants for picking and gathering Rose it was found that less than three fourth (73.33%) of the respondents took 4-6 second time for moving, moving from one plant to another plant.
- Regarding time duration taken for the harvesting of Rose crops, it was found that more than half (63.33%) of the respondents took 30-40 min time duration for the first trip, less than half (46.67%) of the respondents took 41-50 min time in the second trip, more than half (68.33%) of the respondents took 41-50 min time for the third trip and less than half (45%) of the respondents took 51-60 min time duration for the fourth trip for harvested Rose crops during Rose harvesting process.
- Accordingly, for the Extent of Body Discomfort (measured though the extent of exhaustion) experienced by the Rose farm workers , it was found that amongst the 60 selected respondents less than half (46.67%) of the respondent were not all exhausted after completion of the first trip of Rose harvesting, during the second trip (1 bag = 4kg Roses/trip) of Rose harvesting it was found that amongst the 60 selected respondent more than one third (36.67%) of the respondent were moderately exhausted after completion of the second trip of Rose harvesting and 10 respondents could not continue with Rose harvesting process. During the third trip (1 bag =

4kg Roses/trip) of Rose harvesting, amongst the 50 respondents Whereas, less than half 48% of the respondents were extremely exhausted During the third trip (1 bag = 4kg Roses/trip) of Rose harvesting amongst which 20 respondents could not continue with Rose harvesting process after completion of the third trip. During the fourth trip (1 bag = 4kg Roses/trip) of Rose harvesting, it was found that amongst the 30 respondents, the majority (86.67%) of them were completely exhausted could not continue with the Rose harvesting process.

- Regarding rest-pause, the result revealed that none of the Rose farm workers took Spontaneous Rest Pauses and nor was prescribed Rest Pauses during the Rose Harvesting Process (Plucking, Gathering and Heaping) by the farm owners.

Section IV: Distance Covered and Extent of Body Discomfort (measured though the extent of exhaustion) Experienced, Quantity of Rose Harvested and Extent of Body Discomfort (measured though the extent of Pain) Experienced, Frequency of Repetitive Task (Plucking, Gathering, Heaping) with Adopted Posture by the Rose Farm Worker During Rose Harvesting Process. Distance Covered and Extent of Body Discomfort (measured though the extent of exhaustion) Experienced

- Regarding distances covered by the Rose farm workers during the Rose harvesting process, a range score for each trip was obtained based on the shortest and longest distance covered by the Rose Farm Workers. Amongst the 60 respondents, it was found that less than half (46.67%) of the respondents covered distance up to 316 -330 meter (moderate) for the first trip (1 bag = 4kg Roses/trip). For the second trip (1 bag = 4kg Roses/trip) more than half (53.33%) of the respondents covered distance up to 626 – 641 meter (moderate), for the third trip (1 bag = 4kg Roses/trip) it was observed that majority (82%) of the respondents covered distance up to 952 – 969 meter (moderate) and less than half (45%) of the respondents

covered distance 1310 - 1327 meter (long) for the fourth trip (1 bag = 4kg Roses/trip) of Rose harvesting.

- Consequently, for the Extent of Body Discomfort (measured though the extent of exhaustion) experienced by the Rose Farm Workers, it was observed that amongst the 60 selected respondents less than half (45%) of the respondent were not all exhausted after completion of the first bag of Rose harvesting. During the second trip (1 bag = 4kg Roses/ trip) of Rose harvesting, it was observed that more than one third (36.67%) of the respondent were moderately exhausted and more than one fifth 21.67 % of the respondents were extremely exhausted after completion of the second bag of Rose harvesting and 10 respondents could not continue with Rose harvesting process after the second bag of Rose harvesting. During the third trip (1 bag = 4kg Roses/ trip) of Rose harvesting, amongst the 50 respondents, it was observed that less than one third 30% of the respondents were completely exhausted after completion third bag of Rose harvesting Whereas, less than half 48% of the respondents were extremely exhausted amongst which 20 respondents could not continue with Rose harvesting process after completion of the third trip. During the fourth trip (1 bag = 4kg Roses/ trip) of Rose harvesting it was observed that amongst the 30 respondents, the majority (86.67%) of them were completely exhausted and could not continue with the Rose harvesting process.

Quantity of Rose Harvested and Extent of Body Discomfort (measured though the extent of pain) **Experienced**

- The clear representation of data depicts that the quantity of Rose harvested and the Extent of Body Discomfort (measured though the extent of Pain) experienced by the Rose farm workers during Rose harvesting process. About the quantity of Rose harvested, it can be observed that amongst the selected 60 Rose farm workers engaged in Rose harvesting process, 10 farmers could harvest 8 kgs of Rose crops (two trips), 20 farmers could

harvest 12 kgs (three trips) of Rose crops and 30 respondents could harvest 16 kgs (four trips) of Rose crops.

- Regarding the Extent of Body Discomfort (measured though the extent of pain) experienced by the Rose farm workers during Rose harvesting process, it can be observed that, amongst 60 respondents, after harvesting 8 kgs of Rose crops (two trips) half (50%) of the respondents experienced a moderate Extent of Body Discomfort (measured though the extent of pain). Subsequently, it was observed that after harvesting 12 kgs of Rose crops (three trips) amongst the 50 respondents, more than half (58%) of the respondents experienced a high Extent of Body Discomfort (measured though the extent of pain). After harvesting 16 kgs of Rose crops (four trips) majority (86.67%) of the respondents experienced a very high Extent of Body Discomfort (measured though the extent of pain) and none of them could continue Rose harvesting process

Frequency of Repetitive Task (Plucking, Gathering, Heaping) with Adopted Posture by the Rose Farm Worker During Rose Harvesting Process

- The results depict regarding the frequency of repetition of the task (plucking, Gathering and Heaping with standing and forward bending posture) performed while Rose harvesting process. Amongst the 60 respondents, regarding the frequency of repetitive task Viz; Plucking, it can be observed that, during harvesting first bag of Rose crops, less than half (41.67%) of the respondents belonged to the frequency range group of 1041 – 1221. During the harvesting of the second bag of Rose crops, it was found that more than half (58.33%) respondents belonged to the range group between 1181 – 1371. While harvesting the third bag amongst the 50 respondents, less than half (46.67%) belonged to the frequency range group between 1035 – 1169 and for the fourth bag amongst the 30 respondents, more than one fifth (23.33%) belonged to the frequency range group between 1035 – 1169 during Rose harvesting process.

- Regarding the frequency of repetitive task Viz; Gathering, it can be observed that half of them (50 %) of the respondents belonged to the frequency range group of 249-379 for filling first bag (4kg Roses), less than half (45 %) of the respondents belonged to the frequency range group of 264 – 407 for filling second bag (1 trip = 4kg Roses), half of them (50 %) of the respondents belonged to the frequency range group of 274 – 387 for filling third bag (4kg Roses). Whereas, less than one third (33%) of the respondents belonged to the frequency range group of 274 – 387 for filling fourth bag (4kg Roses) during the Rose harvesting process.
- Regarding the frequency of repetitive task Viz**;** Heaping, the data depicts that amongst 60 respondents, 10 (16.67%) respondents repeated Heaping task only 2 times (2 trips). Similarly, it can have observed that 20 (33.33%) respondents repeated the heaping task 3 times as they quit Rose harvesting process after gathering 12 kgs of Rose crops (3 trips) and subsequently, 30 (50%) respondents repeated Heaping task four times (4 trips) during the Rose harvesting process.

Section V: Testing of Hypotheses

Analysis of Variance was computed to show the difference between the personal variable namely Age, BMI, and Work Experience and the situational variable namely time spent on harvesting, distance covered during harvesting, the quantity of Rose harvested and frequency of repetitive task performed while harvesting process.

't' test was applied to find out the mean difference between personal variable namely Gender of the respondents and situational variables namely time spent on harvesting, distance covered during harvesting, the quantity of Rose harvested and frequency of repetitive task performed while harvesting process.

Pearson’s Product Moment Correlation Coefficient was computed to find out the interrelationship between the situational variable namely time spent on Rose harvesting, distance covered during Rose harvesting, the quantity of Rose harvested and frequency of repetitive task performed during Rose harvesting

process with the frequency and severity of Musculoskeletal Discomfort experienced by the Rose farm workers during Rose harvesting process.

- The results clearly depict that a significant difference was found in the mean score of situational variables (viz. time duration spent on Rose harvesting process, distance covered and the quantity of Rose harvested) due to their personal variable (Gender) at **0.05 level**. However, there was no significant difference found in the repetition of the task performed during Rose harvesting process due to their personal variable (Gender). Thus, the null hypotheses **HO1.1** was partially accepted. Hence, it can be concluded that the Gender of the respondents significantly affects the time duration spent on Rose harvesting process, the distance covered during Rose harvesting process and the quantity of Rose harvested by the respondents. Whereas, repetition of the task performed by Rose farm workers during Rose harvesting process is not affected by the Gender of the Respondents.
- The results clearly highlight that the computed F- value for selected personal variables (age) was found to be significant at 0.01 level. This indicated that the situational variables (viz. time duration spent on Rose harvesting process, distance covered during Rose harvesting process, the quantity of Rose harvested, repetition of the task performed during Rose harvesting process) vary with the personal variable (age) of the Rose farm workers. Whereas, regarding the personal variables (viz. BMI and Work Experience of the respondents, the data depicts that the computed F- value for selected personal variables (viz. BMI and Work Experience) were found not to be significant, which indicated that situational variables (viz. time duration spent on Rose harvesting process, distance covered during Rose harvesting process, the quantity of Rose harvested, repetition of the task performed during Rose harvesting process) do not vary with the personal variable viz. BMI and Work Experience of the Rose farm workers. Hence, it can be concluded that the null hypotheses **HO1.2** was partially accepted.

- The data depicts that, the intervening variable (duration of maintaining adopted posture by the Rose farm workers during Rose harvesting process) do not differ due to the (Gender) of the Rose farm workers. Thus, the null hypothesis **HO2.1** was accepted.
- The findings clearly highlight that the computed F- value for the selected intervening variables viz. duration of maintaining adopted posture by the Rose farm worker during Rose harvesting process was found to be significant at **0.01 level** with the age of the respondents. This indicated that the duration of maintaining adopted posture by the Rose farm worker during Rose harvesting process significantly vary with their age. Regarding the personal variables viz. BMI and Work Experience, the computed F- ratio was found not to be significant. This indicated that the duration of maintaining adopted posture by the Rose farm worker during Rose harvesting process do not vary with the BMI and work experience of the Rose farm workers. Therefore, it can be concluded that the null hypotheses **HO2.2** was partially accepted.
- The data revealed that, there exists a **positive relationship** between the selected intervening variables (duration of maintaining adopted posture) and the situational variables (viz. time duration spent on Rose harvesting process, distance covered during Rose harvesting process, the quantity of Rose harvested and frequency of repetitive task performed while harvesting process). Therefore, the null hypotheses **HO3** was rejected at the 0.01 level.
- The data clearly depicts that, Gender does not have a significant effect on the frequency and severity of musculoskeletal discomfort experienced by the Rose farm worker during Rose harvesting process **HO4**.
- The findings clearly highlight that the computed F- value for frequency and severity of musculoskeletal discomfort experienced by the Rose farm worker during Rose harvesting process with their personal variables (viz. age) was found to be significant at **0.01 level**. This indicated that the frequency and severity musculoskeletal discomfort experienced by the Rose farm worker during Rose harvesting process vary with their personal

variable viz. age. Regarding the personal variables BMI and Work Experience, the computed F- value was found not significant, which indicated that the frequency and severity of musculoskeletal discomfort experienced by the Rose farm worker during Rose harvesting process do not vary with BMI and Work Experience of the respondents. Hence, it can be concluded that the null hypotheses **HO 5.1** was partially accepted.

- The data clearly depicts that, there exists a **positive relationship** between the frequency and severity of musculoskeletal discomfort experienced by the Rose Farm workers during Rose harvesting process and their situational variables (viz. time spent, distance covered, the quantity of Rose harvested and frequency of repetitive task performed during harvesting process). Therefore, the null hypotheses **HO 5.2** was rejected.

Conclusion

A study was conducted to assess the Musculoskeletal Discomforts experienced by the Rose farm workers, to analyze the duration of maintaining the adopted postures, to assess the frequency and duration of rest pauses taken, to assess the distance covered, time spent during Rose harvesting process (Plucking, Gathering and Heaping) and the Extent of Body Discomfort (measured though the extent of exhaustion) experienced by the Rose farm workers . Further, it was also aiming to assess the Quantity of Rose harvested (Kg) and the Extent of Body Discomfort (measured though the extent of pain) experienced and to assess the frequency of repetition of the task and extend of body discomfort experienced, by the Rose farm workers during Rose harvesting process (Plucking, Gathering and Heaping) of selected Rose farms of Vadodara District.

The salient findings of the study revealed that the mean age of the respondents was 39.36 years. Less than half (46.67%) of the respondents belonged to the age group of 21-36 years. Majority of the respondents (76.67%) were males. A majority (80%) of the respondents were from a nuclear family. More than half (56.67%) of the respondents had educational level up to primary School. The mean total monthly income of the family was ₹9500. A majority (78.34%) of the respondents

had family monthly income ranging from ₹5000-₹10000. A majority (91.67%) of the respondents had work experience from 2- 6 years with Rose crops harvesting. None of the respondents had medical problem and women were not pregnancy stage. Rose farm size ranged between 3-4 Bigha (land area) and Less than one half (46.67%) of the respondents worked in Rose farms having production of Rose crops approximately up to 101-131 kgs. per day.

Regarding the frequency of body discomfort experienced by the Rose farm workers during Rose harvesting process, it could be concluded that out of 18 upper body parts, almost (90%) all the respondents always experienced pain in the upper back and lower back with the weighted mean 2.9 respectively. Subsequently, almost all the respondent always experienced pain in the mid-back with the weighted mean of 2.88 and majority of the respondents always experienced pain in the neck with 2.78 weighted mean and right wrist with 2.76 weighted means. Consequently, out of 9 Lower Body Parts in the first-place majority of the respondents always experienced pain in the left foot and right foot with a weighted mean of 2.88 respectively. Subsequently, the majority of the respondents always experienced pain in Buttock with the weighted mean of 2.85.

Regarding the extent of body discomfort (based on the severity of pain) experienced by the respondents in upper body parts during Rose harvesting process (plucking, gathering and heaping it could be concluded that out of 18 upper body parts more than half of respondents experienced severe pain in the upper back, mid-back, lower back with the weighted mean 4.4 respectively and in the neck with a weighted mean of 4.36. Subsequently, less than half of the respondents experienced severe in the wrist with the weighted mean 4.31. Similarly, out of 9 lower body parts half of the respondents experienced very severe pain in the left foot and right foot with the weighted mean score 4.5 respectively. Whereas, slightly less than half of the respondents experienced severe pain in the buttock with the weighted mean score of 4.48.

The height of the respondents varied between1.49–1.96 m and mean height of the respondents was found to be 5.59 m whereas, the weight of the respondents

varied between 45- 88 kg and the mean weights of the respondents 61 kg. Therefore, the BMI of the respondents varied between 16.0 to 29.0. and the mean BMI of the respondents was 21.08.

It was observed that cent per cent (100%) of the respondents performed the task (Plucking, Gathering and Heaping) daily by adopting standing and forward bending posture during Rose harvesting process and the majority (83.33%) of the respondents spent 3-4 hrs. for harvesting.

Regarding maintaining the adopted posture, it was observed that more than half (66.67%) of the respondents maintained the adopted posture for 10-12 second (sec/plant), during the picking of Rose crops. Similarly, more than half (65%) of the respondents maintained adopted posture for 4-6 second (sec/plant during Gathering of Rose crops into the Rose collecting bag. Whereas, for moving from one plant to another plant for picking and gathering Rose it was found that less than three fourth (73.33%) of the respondents took 4-6 second time for moving.

Regarding time spent on rose harvesting, it was observed that more than half (63.33%) of the respondents took 30-40 min time duration (in Min) for the first trip, less than half (46.67%) of the respondents took 41-50 min time (in Min) in the second trip, more than half (68.33%) of the respondents took 41-50 min (in Min) time for the third trip and less than half (45%) of the respondents took 51-60 min time duration (in Min) for the fourth trip.

Whereas, less than half (46.67%) of the respondent were not all exhausted after completion of the first trip of Rose harvesting. More than one third (36.67%) of the respondent were moderately exhausted after completion of the second trip of Rose harvesting. Less than half 48% of the respondents were extremely exhausted after completion of the third trip. The majority (86.67%) of them were completely exhausted after completing the fourth trip (1 bag = 4kg Roses/trip) of Rose harvesting and could not continue with the Rose harvesting process. None of the Rose farm Workers was taken Spontaneous Rest Pauses and Recommended Rest Pauses during the Rose Harvesting Process (Plucking, Gathering and Heaping) of the selected Rose farms.

Amongst the 60 respondents, it was observed that less than half (46.67%) of the respondents covered distance up to 316 -330 meter (moderate) for the first trip (1 bag = 4kg Roses/trip). For the second trip (1 bag = 4kg Roses/trip) more than half (53.33%) of the respondents covered distance up to 626 – 641 meter (moderate), for the third trip (1 bag = 4kg Roses/trip) it was observed that majority (82%) of the respondents covered distance up to 952 – 969 meter (moderate) and less than half (45%) of the respondents covered distance 1310 - 1327 meter (long) for the fourth trip (1 bag = 4kg Roses/trip) of Rose harvesting.

Consequently, For the Extent of Body Discomfort (measured though Extent of exhaustion) experienced by the Rose farm Workers, it was observed that less than half (45%) of the respondent were not all exhausted after completion of the first bag of Rose harvesting. More than one third (36.67%) of the respondent were moderately exhausted after completion of the second bag of Rose harvesting. less than half 48% of the respondents were extremely exhausted amongst which 20 respondents could not continue with Rose harvesting process after completion of the third trip. the majority (86.67%) of them were completely exhausted could not continue with the Rose harvesting process. About the quantity of Rose harvested, it can be observed that amongst the selected 60 Rose farm workers engaged in Rose harvesting process, 10 farmers could harvest 8 kgs of Rose crops (two trips), 20 farmers could harvest 12 kgs (three trips) of Rose crops and 30 respondents could harvest 16 kgs (four trips) of Rose crops. Half (50%) of the respondents experienced a moderate Extent of Body Discomfort (measured though the extent of pain) after harvesting 8 kgs of Rose crops (two trips). More than half (58%) of the respondents experienced a high Extent of Body Discomfort (measured though the extent of pain) after harvesting 12 kgs of Rose crops (three trips) and the majority (86.67%) of the respondents experienced a very high Extent of Body Discomfort (measured though the extent of pain) after harvesting 16 kgs of Rose crops (four trips).

Amongst the 60 respondents, concerning the frequency of repetitive task Viz; Plucking, it can be observed that, during harvesting first bag of Rose crops, less

than half (41.67%) of the respondents belonged to the frequency range group of 1041 – 1221. During the harvesting of the second bag of Rose crops, it was found that more than half (58.33%) respondents belonged to the range group between 1181 – 1371. While harvesting the third bag amongst the 50 respondents, less than half (46.67%) belonged to the frequency range group between 1035 – 1169 and for the fourth bag amongst the 30 respondents, more than one fifth (23.33%) belonged to the frequency range group between 1035 – 1169 during Rose harvesting process.

Regarding the frequency of repetitive task Viz; Gathering, it can be observed that half of them (50 %) of the respondents belonged to the frequency range group of 249-379 for filling first bag (4kg Roses), less than half (45 %) of the respondents belonged to the frequency range group of 264 – 407 for filling second bag (1 trip = 4kg Roses), half of them (50 %) of the respondents belonged to the frequency range group of 274 – 387 for filling third bag (4kg Roses).

Whereas, less than one third (33%) of the respondents belonged to the frequency range group of 274 – 387 for filling fourth bag (4kg Roses) during the Rose harvesting process. Regarding the frequency of repetitive task Viz; Heaping, the data depicts that amongst 60 respondents, 10 (16.67%) respondents repeated Heaping task only 2 times (2 trips). Similarly, it can have observed that 20 (33.33%) respondents repeated the heaping task 3 times as they quit Rose harvesting process after gathering 12 kgs of Rose crops (3 trips) and subsequently, 30 (50%) respondents repeated Heaping task four times (4 trips) during the Rose harvesting process.

Testing of Hypotheses

The results of the computed ‘t’ test revealed that, that there was a significant difference found in the situational variable (viz. time duration spent on Rose harvesting process, distance covered during Rose harvesting process, the quantity of Rose harvested) due to their variable (Gender) at **0.05** level. However, there was no significant difference found in the repetition of the task performed during Rose harvesting process due to their variable (Gender).

ANOVA was computed to find out the variation between the situational variables (viz. time duration spent on Rose harvesting process, distance covered during Rose harvesting process, the quantity of Rose harvested, repetition of the task) with the personal variables (viz. age, BMI and work experience) of the Rose farm workers. The result revealed that the computed F- value for selected personal variables (age) was found to be significant at the 0.01 level.

The 't' test was computed to find out the significant difference in the mean score of the intervening variable (duration of maintaining adopted posture during Rose harvesting process) with the personal variable (Gender) of the

ANOVA was computed to find out the variation in the duration of maintaining adopted posture with their personal variables (age, BMI and work experience) of the Rose farm workers. The result revealed that the computed F- value for the selected intervening variables viz. duration of maintaining adopted posture by the Rose farm worker during Rose harvesting process was found to be significant at 0.01 level with the age of the Rose farm workers.

Co-efficient of correlation was computed between the intervening variable (duration of maintaining adopted posture by the Rose farm workers during Rose harvesting process) and their situational variables (viz. time spent on Rose harvesting process, distance covered during Rose harvesting process, the quantity of Rose harvested and frequency of repetitive task performed during Rose harvesting process). The data revealed that there exists a **positive relationship** between the selected intervening variables (duration of maintaining adopted posture) and the situational variables (viz. time duration spent on Rose harvesting process, distance covered during Rose harvesting process, the quantity of Rose harvested and frequency of repetitive task performed while harvesting process).

ANOVA was computed to find out the variation between the frequency and severity of musculoskeletal discomfort experienced by the Rose farm workers during Rose harvesting process with their personal variables viz. age, BMI and work experience. The result revealed that the computed F- value for frequency and severity of musculoskeletal discomfort experienced by the Rose farm worker

during Rose harvesting process with their personal variables (viz. age, BMI and work experience) was found to be significant at 0.01 level.

The coefficient of correlation was computed between the frequency and severity of musculoskeletal discomfort experienced by the Rose farm workers during Rose harvesting process and their situational variables (viz. time spent on Rose harvesting process, distance covered during Rose harvesting process, the quantity of Rose harvested and frequency of repetitive task performed during harvesting process). The data revealed that there exists a positive relationship between the selected frequency and severity of musculoskeletal discomfort experienced by the Rose farm workers during Rose harvesting process and their situational variables (viz. time spent on Rose harvesting process, distance covered during Rose harvesting process, the quantity of Rose harvested and frequency of repetitive task performed during harvesting process).

Section VI: Suggested Coping Strategies

Need-based coping strategies were suggested based on frequency and severity of musculoskeletal discomfort experienced by the Rose farm workers during Rose harvesting process in various upper and lower body parts due to time spent off the rose harvesting process, distance travelled during the rose harvesting process, the quantity of rose harvested, frequency of repetitive task (Plucking, Gathering and Heaping). Wherein, Use of Rose Pruner for plucking roses, Rose Collecting Trolly for gathering roses, farmers boot for walking and rest-pause were suggested as coping strategies.

Implications of the Study

The findings of the investigation brought out several implications for the field of Family and Community Resource Management, Floriculture Industry, Krishi Vigyan Kendra, Ergonomic tool and Equipment designers which are described as follow.

For the Floriculture Industry

The findings of the present investigation regarding frequency and severity of musculoskeletal discomfort experienced in upper and lower body parts by the Rose farm workers during rose harvesting process will be helpful to the Rose farm owners in increasing the productivity of the farm workers of floriculture industry also suggested coping strategies mention in the study can also be adopted for the same.

For the Field of Family and Community Resource Management

The field of Family and Community Resource Management has a core subject like Ergonomics, Consumer ergonomics, Human Resource Management, Extension in Resource Management in their curriculum. Therefore, the present research will be adding in the literature of studies done in the field of Family and Community Resource Management.

The finding of the present study will also be helpful to develop a need-based extension education program on farm ergonomics for farmers of the floriculture industry to enhance their productivity with workplace safety.

The review of literature, method and procedure adopted for the present study will help to undertake major or minor research projects on ergonomic problems and postural difficulties experienced by the floriculture farm workers dealing with various flower crops.

For the Krishi Vigyan Kendra

Krishi Vigyan Kendra is considered as a knowledge centre for imparting need-based skill-oriented training programmes to the farmers. The findings of the present study can be helpful to Krishi Vigyan Kendras in developing educational programs on farm ergonomics and postural difficulties for the floriculture industry workers.

Ergonomic Tool and Equipment Designers

The findings of the study related to frequency and severity of musculoskeletal discomfort experienced by the Rose farm workers can be helpful to the Ergonomic

Tool and Equipment Designers in designing tools and equipment that can be used for a various repetitive task carried during Rose harvesting as well as other flowering crops.

Limitations of the study

1. Out of the entire process of rose cultivation, the study was confined to only the process of rose harvesting (plucking, gathering and heaping) as at the time of data collection only that was being conducted by the rose farm workers in the Rose farms.

Recommendations for Future Researches

1. A Comparative study on musculoskeletal discomfort experienced by the farm workers dealing with different flower crops can be undertaken.
2. A research study can be carried out to know the farming activities performed by women farm workers during the harvesting of flowering crops.
3. A research study can be carried out to know the health consequence of pesticide used in different flowering crops
4. A research study on mechanical injuries experienced by the farm workers dealing with different flowering crops can be undertaken.
5. A study can be carried out to access the health problems experienced by the farm workers dealing with different flowering crops.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APPENDICES

APPENDIX I

INTERVIEW SCHEDULE

ASSESSMENT OF MUSCULOSKELETAL DISCOMFORTS EXPERIENCED BY THE ROSE FARM WORKERS OF VADODARA DISTRICT

Form no: ----------

SECTION-I: BACKGROUND INFORMATION OF THE RESPONDENTS

---

1. **Name of the Respondent:** ----------
2. **Village:** ----------
3. **Age (in Years)** ----------
4. **Gender:**
   - □ Male
   - □ Female
5. **Type of Family:**
   - □ Joint
   - □ Nuclear
6. **Educational Qualification (Completed):**
   - □ Illiterate
   - □ Up to Primary School
   - □ Up to Secondary School
   - □ Up to Higher secondary
   - □ Graduate
   - □ Any other ----------
7. **Family Monthly Income (in INR)**
   - □ ₹5000- 10000
   - □ ₹11,000 – 20,000
   - □ ₹21000 – 30,000
   - □ ₹1,000 – 40,000
   - □ ₹41,000 – 50,000
   - □ ₹51,000 and above

8. Work experience in Rose Farm

- Months: _____
- Years**:** _____

9. Medical Background of the Respondents

Medical Problems	**Yes**	**No**
1. Diabetes		
2. Hypertension		
3. Joint Pain		
4. Back Pain		
5. Respiratory Problem		
6. Arthritis		
7. Tendencies		
8. Any Other		

10. Size of the Rose Farm (in Bigha) and production of Rose crops where the Respondents were engaged

Size of the farm	Small (1-5 bigha)	Marginal (5-10 bigha)	Large (10 -15 bigha)	Very Large More than 15 bigha
Production in (KG)				
10-20				
21-30				
31-40				
41-50				
51-60				
61-70				
71-80				
81-90				
91-100				
100 and above				

11. Crop Calendar of Rose Cultivation Process followed by the Respondents.

Sr. No	Cultivation Process	January	February	March	April	May	June	July	August	September	October	November	December
Task 1: Land Preparation													
Sub Task A	Removing of stalks and stubbles												
Sub Task B	Preparation of channel for irrigation												
Sub Task C	Compartment bundling												
Sub Task D	Leveling												
TASK 2: Manuring													
Sub Task A	Transportation of Manure												
Sub Task B	Spreading of Manure												
Task: 3	Digging the Rose Crop into land												
Task: 4	Weeding (Plant to plant)												
Task: 5	Budding and Pruning (Selective removal of certain parts of plants such as branches, buds, or roots)												
Task: 6	Spraying Pesticides on rose crops												
Task 7: Harvesting													
Sub Task A	Plucking and Gathering of Rose Crops												

SECTION II:

FREQUENCY AND SEVERITY INDEX OF BODY DISCOMFORT EXPERIENCED BY THE ROSE FARM WORKERS DURING ROSE HARVESTING PROCESS

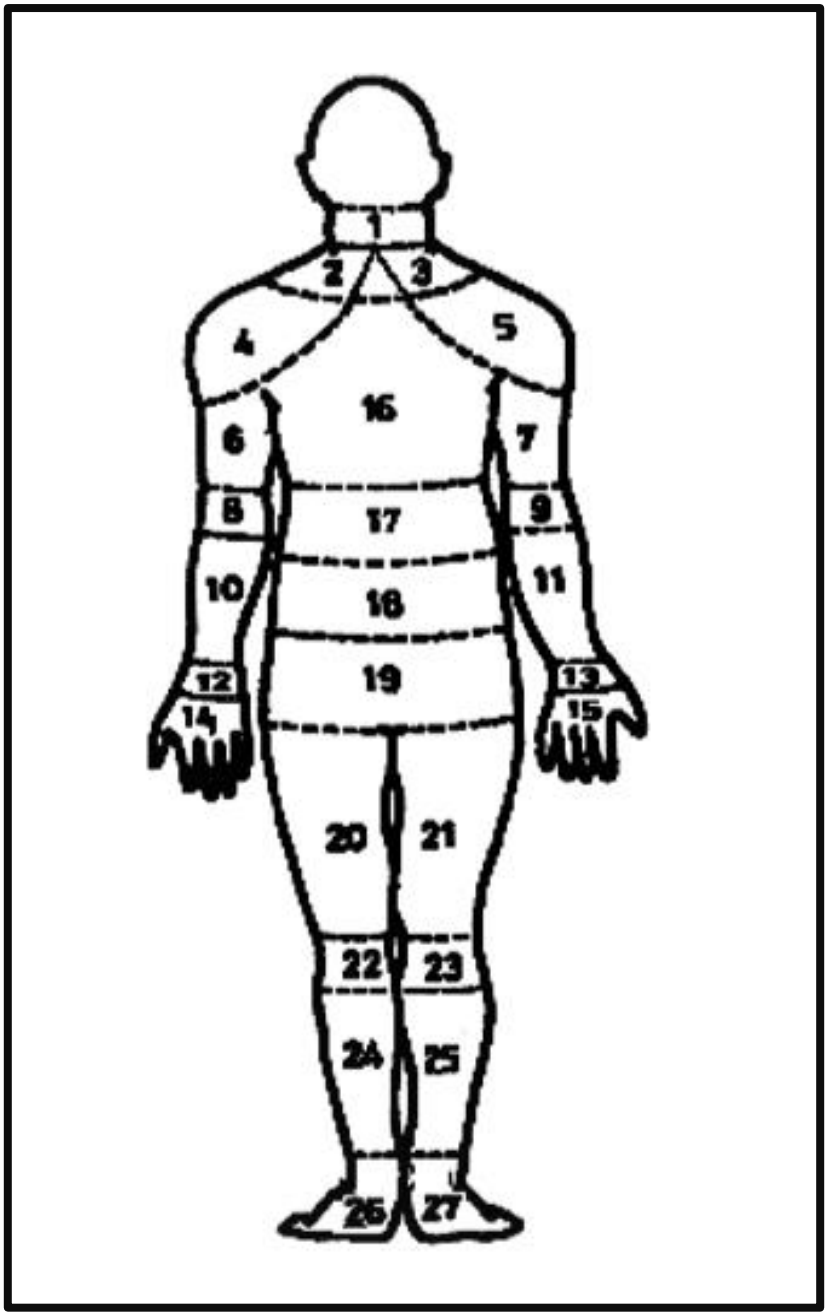
1: Frequency Index of Body Discomforts Experienced by the Rose Farm Workers During Rose Harvesting Process (Plucking, Gathering and Heaping).

Sr. no	Body Parts	Frequency Index of Body Discomfort		
		Plucking, Gathering and Heaping of Rose Cops		
		Always	Sometimes	Never
1	Neck			
2.	Clavicle Left			
3	Clavicle Right			
4.	Left Shoulder			
5.	Right shoulder			
6.	Left arm			
7.	Right Arm			
8.	Left elbow			
9	Right elbow			
10	Left forearm			
11	Right forearm			
12	Left Wrist			
13	Right Wrist			
14.	Right Palm			
15	Left Palm			
16	Upper back			
17	Mid back			
18	Lower back			
19	Buttocks			
20	Left thigh			
21	Right thigh			
22	Left knee			
23	Right knee			
24	Left leg			
25	Right leg			
26	Left foot			
27	Right foot			

2: Severity Index of Body Discomforts Experienced by the Rose Farm Workers During Rose Harvesting Process (Plucking, Gathering and Heaping)

Sr.no	Body Parts	Severity Index of Body Discomfort				
		Plucking, Gathering and Heaping of Rose Crops				
		Very Severe Pain	Severe Pain	Moderate Pain	Mild Pain	No Pain
1.	Neck					
2.	Clavicle Left					
3	Clavicle Right					
4.	Left Shoulder					
5.	Right shoulder					
6.	Left Arm					
7.	Right Arm					
8.	Left elbow					
9	Right elbow					
10	Left forearm					
11	Right forearm					
12	Left Wrist					
13	Right Wrist					
14	Left Palm					
15.	Right Palm					
16	Upper back					
17	Mid back					
18	Lower back					
19	Buttocks					
20	Left thigh					
21	Right thigh					
22	Left knee					
23	Right knee					
24	Left leg					
25	Right leg					
26	Left foot					
27	Right foot					

CORLETT AND BISHOP'S BODY PARTS DISCOMFORT STANDARDIZED SCALE (1976)



1. Neck
2. Clavicle Left
3. Clavicle Right
4. Left Shoulder
5. Right Shoulder
6. Left Arm
7. Right Arm
8. Left Elbow
9. Right Elbow
10. Left Forearm
11. Right Forearm
12. Left Wrist
13. Right Wrist
14. Left Palm
15. Right Palm
16. Upper Back
17. Mid Back
18. Lower Back
19. Buttocks
20. Left Thigh
21. Right Thigh
22. Left Knee
23. Right Knee
24. Left Leg
25. Right Leg
26. Left Foot
27. Right Foot

SEVERITY SCALE				
5. Very Severe Pain	**4. Severe Pain**	**3. Moderate Pain**	**2. Mild Pain**	**1.No Pain**

APPENDIX II

OBSERVATION SHEET

SECTION I:

BMI of The Farmers, Timings of Rose Harvesting, Postures Adopted, Frequency of Task Performed and Actual Time Spent On Task, Duration of Maintaining Adopted Posture, Time Taken for Harvesting Process, Spontaneous and Recommended Rest Pauses taken by Rose Farm Workers during the Rose Harvesting Process (Plucking, Gathering and Heaping) of the selected Rose farms.

1: Height of Respondents (in CM): ----------

2: Weight of Respondents (in Kgs): ----------

3: BMI of the Respondents

4: Time of Rose Harvesting: _____to _____ am /pm

5: Postures Adopted, Frequency and Actual Time Spend on Rose Harvesting Process (Plucking, Gathering and Heaping) of selected Rose Farms.

Sr. No	Rose Harvesting Task	Postures Adopted for Performing Task		Frequency of Task Performed		Actual Time Spent on task	
		Standing and forward Bending	Only Standing	Daily (in hrs.)	Alternate Days (in hrs.)	Total Hours	Total Minutes
1.	Plucking, Gathering and Heaping						

6: Duration of Maintaining the Adopted Postures while Performing the Rose Harvesting Task (Plucking, Gathering and Heaping) by the Rose Farm Workers.

Sr.no	Adopted Posture	Time duration of maintaining the adopted postures (in seconds per plant)					
		0-10	11-20	21-30	31-40	41-50	51-60
1.	Standing and Forward Bending						
2.	Only Standing						
3.	Moving						

7: Time Taken for Rose Harvesting Process (Plucking, Gathering and Heaping) and Extent of Body Discomfort (Measured through Extent of Exhaustion) Experienced by the Rose farms workers

Bags (1Bag=4kg)	Time taken (in minutes)							Extent of Exhaustion				
	Below 30	30	60	90	120	150	180	NT	LT	MT	EXT	CEX
Bag 1												
Bag 2												
Bag 3												
Bag 4												
Bag 5												
Bag 6												
Bag 7												

***KEYS: Not Exhausted – 5, Little Exhausted -4, Moderately Exhausted – 3, Extremely Exhausted – 2, Completely Exhausted – 1**

8: Spontaneous and Recommended Rest Pauses taken by Rose Farm Workers during the Rose Harvesting Process (Plucking, Gathering and Heaping) of the selected Rose Farms.

A. The obvious Rest Pauses taken by the Rose Farm Workers Spontaneously during Rose Harvesting Process (Plucking, Gathering and Heaping)

No of Bags	Number of Spontaneous Rest Pauses								Duration of Spontaneous Rest Pauses (Min)					
	1	2	3	4	5	6	7	8	5-10	11-15	16-20	21-25	26-30	31-35
1st Bag – 2nd Bag														
2nd Bag – 3rd Bag														
3rd Bag – 4th Bag														
4th Bag – 5th Bag														
Not Taken														

B. The Pauses for Rest that are Given by the Farm Owners during Rose Harvesting Process (Plucking, Gathering and Heaping)

No of Bags	Number of Recommended Rest Pauses given by the Rose Farm Owners								Duration of Recommended Rest Pauses (min)					
	1	2	3	4	5	6	7	8	5-10	11-15	16-20	21-25	26-30	31-35
1st Bag – 2nd Bag														
2nd Bag – 3rd Bag														
3rd Bag – 4th Bag														
4th Bag – 5th Bag														
Not Given														

SECTION -II

Distance Covered and Extent of Exhaustion Experienced, Quantity of Rose Harvested and Extent of Pain Experienced, Frequency of Repetitive Task (Plucking, Gathering, Heaping) with Adopted Posture by the Rose Farm Worker During Rose Harvesting Process

---

1: Distance Covered and Extent of Body Discomfort (Measured through Extent of Exhaustion) Experienced by the Rose Farm Worker During Rose Harvesting Process (Plucking, Gathering and Heaping).

No of Bags (1bag = 4 kg)						Extent of Exhaustion				
Distance Covered (in meter)	Bag-1	Bag-2	Bag-3	Bag-4	Bag-5	NT	LT	MT	EXT	CEX
1.										
2.										
3.										
4.										

***KEYS: Not Exhausted – 5, Little Exhausted -4, Moderately Exhausted – 3, Extremely Exhausted – 2, Completely Exhausted – 1**

2: Quantity of Rose Harvested and Extent of Body Discomfort (Measured through Extent of Pain) Experienced by the Rose Farm Workers During Rose Harvesting Process (Plucking, Gathering and Heaping).

Sr.no	Quantity of Rose Harvested		Extent of Pain				
			Very Severe Pain	Severe Pain	Moderate pain	Mild Pain	No Pain
1.	Below kg						
2.	4 kgs						
3.	8 kgs						
4.	12 kgs						
5.	16 kgs						

(3): Frequency of Repetitive Task (Plucking, Gathering and Heaping) with Adopted Posture During Ros e Harvesting Posture During Rose Harvesting Process by the Rose Farm Workers.

FREQUENCY OF REPETITION OF TASK														
PLUCKING						GATHERING					HEAPING			
Sr.no	No of bags	Posture Adopted Standing and Forward Bending												
		1000-1500	1500-2000	2000-2500	2500-3000	More than 3000	100-200	200-300	300-400	400-500	500 More	1 times	2 times	3 times	4 times
1.	Bag 1														
2.	Bag 2														
3.	Bag 3														
4.	Bag 4														
5.	Bag 5														
Grand Total															

ABSTRACT

ABSTRACT

India as a long tradition of floriculture. However, the social and economic aspect of flower growing was recognized much later. Among the flowers Roses are propagated as ornamental as well as commercial plants. The cultivation of Roses has grossed its due importance throughout the present era as compared to other flowering plants. Therefore, the farm workers are very much interested to invest in Rose cultivation due to its high demand to gain a good amount of profit.

The Rose farm workers of floriculture Industry performs abundant labour intensive jobs such as land preparation, removing of stalks and stubbles, levelling, compartment, preparation of channels for irrigation, digging of Rose crop into land, manuring, weeding of Rose crop (plant to plant), pruning and budding, pesticides spraying on Rose crop and lastly, harvesting the Rose in which Rose farm workers are involving in the task of Plucking, gathering, heaping of the Rose crop. Therefore, Rose cultivation and harvesting is considered to be a drudgery prone activity.

Rose farm workers experience types of musculoskeletal discomforts due to the repetitive nature of task performed. which affect their health and productivity. In Rose farm, plucking, heaping and gathering of the Rose flower is considered to be the severe most drudgery prone activity, where workers have to keep their posture in bending position from the back facing towards the ground for plucking the Rose. Due to which can lead to severe pain in their upper and lower body parts Viz. Upper back, mid-back and lower back, neck shoulder, wrist, foot, leg, knee and thigh.

The objectives of the study were **1.** To collect the background information (Age, Height and Weight) of the Rose farm workers engaged in Rose harvesting process (Plucking, Gathering and Heaping) of selected Rose farms and categorized them according to Body Mass Index (BMI). **2**. To analyze the duration of maintaining the adopted postures by the Rose farm workers during Rose harvesting process (Plucking, Gathering and Heaping) of selected Rose farms of Vadodara District. **3.** To analyze the frequency and duration of rest pauses taken; distance covered; time spent; the quantity of Rose harvested and frequency of repetition of the task done by the Rose farm workers during Rose harvesting

process (Plucking, Gathering and Heaping) of selected Rose farms **4.** To assess the Extent of Musculoskeletal Discomfort experienced by the Rose farm workers due to the distance covered; time spent; the quantity of Rose harvested and frequency of repetition of the task done by the Rose farm workers during Rose harvesting process (Plucking, Gathering and Heaping) of selected Rose farms. **5.** To suggest the coping strategies to overcome Musculoskeletal Discomfort experienced by the Rose farm workers of selected Rose farm of Vadodara District. .

The research design was descriptive in nature. The sample size for the present study comprised of 60 Rose farm workers (male and female) engaged in Rose harvesting process (Plucking, Gathering and Heaping) and had minimum two years of experience with the same crop. For the present study, purposive sampling technique was used for the selection of Rose Farms and Rose Farm workers. The data were collected by pre-tested and pre-validated structure Interview Schedule and observation sheet. The data were analysed by applying descriptive (frequency, percentage, mean and standard deviation) as well as relational statistical (Analysis of Variances, 't' test and Correlation of co-efficient).

The major findings of the present study the mean age of the respondents were 39.36 years. More than three-forth of the respondents (76.67%) were males. A majority (80%) of the respondents were from a nuclear family. More than one-half (56.67%) of the respondents had educational level up to primary School. The mean total monthly income of the family was ₹9500. A majority (91.67%) of the respondents had work experience from 2- 6 years with Rose crops harvesting. None of the respondents had medical-related health problem like Diabetes, Hypertension, Joint Pain, Back Pain, Respiratory Problem, Arthritis, Tendencies, and women are also not pregnant. Rose farm size ranged between 3-4 Bigha (land area). Less than one- half (46.67%) of the respondents worked in Rose farms having production of Rose crops approximately up to 101-131 kgs. per day.

Regarding frequency of body discomfort experienced in upper body Parts (1-18) and lower body Parts (19-27) during Rose harvesting process (Plucking, Gathering and Heaping). It was found that majority (90%) of the respondents always experienced pain in the upper back and lower back with the weighted mean 2.9 respectively. Subsequently, almost all the respondent always experienced pain in the mid-back with the weighted mean of 2.88 and majority of the respondents always experienced pain in the neck with 2.78 weighted mean and right wrist with 2.76 weighted means. Subsequently, out of 9 lower body parts in the first-place majority of the respondents always experienced pain in the left foot and right foot with a weighted mean of 2.88 respectively. Subsequently, the majority of the respondents always experienced pain in buttock with the weighted mean of 2.85.

The extent of body discomfort (based on the severity of pain) experienced by the respondents in upper body parts (1-18) and lower body parts during Rose harvesting process (Plucking, Gathering and Heaping). It was found that out of 18 upper body parts more than half of respondents experienced severe pain in the upper back, mid-back, lower back with the weighted mean 4.4 respectively and in the neck with a weighted mean of 4.36. Subsequently, less than one-half of the respondents experienced severe pain in the wrist with the weighted mean 4.31. Subsequently, out of 9 lower body parts half of the respondents experienced very severe pain in the left foot and right foot with the weighted mean score 4.5 respectively. Whereas, slightly less than one- half of the respondents experienced severe pain in the buttock with the weighted mean score of 4.48.

The mean height of the respondents was found to be 5.59 m whereas, the mean weights of the respondents 61 kg. Therefore, the mean BMI of the respondents was 21.08. cent per cent (100%) of the respondents performed the task (Plucking, Gathering and Heaping) by adopting standing and forward bending posture as the main posture during Rose harvesting process. Further, it can be observed that cent per cent (100%) of the respondents performed the Rose harvesting task (Plucking, Gathering and Heaping) daily and a majority (83.33%) of the respondents spent 3-4 hrs. for Rose harvesting. Wherein more than one- half (66.67%) of the respondents maintained the adopted posture for 10-12 second (sec/plant), during the picking of Rose crops. Similarly, regarding task

Gathering of Rose crops into the Rose collecting bag wherein, more than one-half (65%) of the respondents maintained adopted posture for 4-6 second (sec/plant during the Rose crops Gathering process. Whereas, for moving from one plant to other plants for picking and gathering Rose it was found that less than three- fourth (73.33%) of the respondents took 4-6 second time for moving.

Regarding time duration taken for the harvesting of Rose crops cent per cent of the respondents could make only four trips (1 bag = 4kg Roses/trip) for Rose crops harvesting. Wherein, it was found that more than one- half (63.33%) of the respondents took 30-40 min time duration (in min) for the first trip, less than one- half (46.67%) of the respondent were not all exhausted after completion of the first trip of Rose harvesting, less than one- half (46.67%) of the respondents took 41-50 min time (in Min) in the second trip, and more than one- third (36.67%) of the respondent were moderately exhausted after completion of the second trip of Rose harvesting, besides 10 respondents could not continue with Rose harvesting process after the second trip of Rose harvesting, more than one-half (68.33%) of the respondents took 41-50 min (in Min) time for the third trip and less than one-third 30% of the respondents were completely exhausted after completion third trip of Rose harvesting. amongst which 20 respondents could not continue with Rose harvesting process after completion of the third trip. And less than one- half (45%) of the respondents took 51-60 min time duration (in min) for the fourth trip and majority (86.67%) of them were completely exhausted and could not continue with the Rose harvesting process.

None of the Rose farm workers was taken Spontaneous rest pauses and recommended rest pauses during the Rose harvesting process (Plucking, Gathering and Heaping) of the selected Rose farms.

About distances covered by the Rose farm workers during the Rose harvesting process, a range score for each trip was obtained based on the shortest and longest distance covered by the Rose farm workers. Amongst the 60 respondents, it was found that less than one-half (46.67%) of the respondents covered distance up to 316 -330 meter (moderate) for the first trip (1 bag = 4kg Roses/trip) and less than one- half (45%) of the respondent were not all exhausted after completion of the first bag of Rose harvesting,

For the second trip (1 bag = 4kg Roses/trip) more than one-half (53.33%) of the respondents covered distance up to 626 – 641 meter (moderate), more than one-third (36.67%) of the respondent were moderately exhausted and 10 respondents could not continue with Rose harvesting process after the second bag of Rose harvesting. For the third trip (1 bag = 4kg Roses/trip) it was found that majority (82%) of the respondents covered distance up to 952 – 969 meter (moderate) Whereas, less than one- half (48%)of the respondents were extremely exhausted amongst which 20 respondents could not continue with Rose harvesting process after completion of the third trip. And less than one-half (45%) of the respondents covered distance 1310 - 1327 meter (long) for the fourth trip (1 bag = 4kg Roses/trip) of Rose harvesting and majority (86.67%) of them were completely exhausted and could not continue with the Rose harvesting process.

In relation to the quantity of Rose harvested, it can be observed that amongst the selected 60 Rose farm workers engaged in Rose harvesting process, 10 farmers could harvest 8 kgs of Rose crops (two trips) and a one-half (50%) of the respondents experienced a moderate level of pain, 20 farmers could harvest 12 kgs (three trips) of Rose crops and more than one-half (58%) of the respondents experienced a high level of pain and After harvesting 16 kgs of Rose crops (four trips) majority (86.67%) of the respondents experienced a very high level of pain and none of them could continue Rose harvesting process.

Frequency of repetition of the task (plucking, Gathering and Heaping with standing and forward bending posture) performed during Rose harvesting process. Amongst the 60 respondents, regarding the frequency of repetitive task Viz; **Plucking,** it was found that more than one - half (58.33%) respondents belonged to the range group between 1181 – 1371. during the second bag of Rose harvesting. Regarding the frequency of repetitive task Viz; **Gathering**,one- half of them (50 %) of the respondents belonged to the frequency range group of 274 – 387 for filling third bag (4kg Roses). Regarding the frequency of repetitive task Viz; **Heaping**, one-half (50%) of the respondents repeated Heaping task four times (4 trips) during the Rose harvesting process.

The collected data revealed that time duration spent on Rose harvesting process, distance covered during Rose harvesting process, the quantity of Rose harvested during Rose harvesting process) varied with the age of the respondents. And also there exists a Significant relationship between the frequency and severity of musculoskeletal discomfort experienced by the Rose farm workers during Rose harvesting processs and duration of maintaining adopted posture during Rose harvesting process, time spent on Rose harvesting process, distance covered during Rose harvesting process, the quantity of Rose harvested and frequency of repetitive task perfomed during Rose harvesting process by the Rose farm workers.

Hence, it can be concluded that frequency and severity of musculoskeletal discomfort experienced by the Rose farm workers was higher due to the age, duration of maintaining adopted posture during Rose harvesting process, time spent and time spent on Rose harvesting process, distance covered during Rose harvesting process, the quantity of Rose harvested and frequency of repetitive task done during Rose harvesting process of the Rose farm workers.