CHAPTER II

REVIEW OF LITERATURE

The review of literature is an important component of a research. It enables the researcher to become acquainted with the studies conducted in the related area. It is also serves as guide to formulate a new research by considering its vital aspects which could be undertaken as it is with different locale or adding an unexplored element.

A number of sources were searched for assembling the review of the present research. They included national journals, international journals, books, dissertation and websites. In order to present the reviewed of literature, it has been divided into two sections as follows:

Section 1: Theoretical Orientation

- Schools system in Gujarat State
- Primary School Teachers
- Primary School Teacher's Activity during the Day
- Need for Teacher Training
- Musculoskeletal Pain and Primary school Teachers

Section 2: Empirical Studies

- Studies conducted in India
- Studies conducted outside India

Section 1: Theoretical Orientation

The theoretical mater on the relevant topics related to present research is presented in this section. For ease of understanding it is divided in to sub-topics.

School system in Gujarat

The education department of the state pays special attention on the improvement of elementary education in Gujarat. The state government has launched the district primary education program for making primary education compulsory and free for all students up to standard - 8. It has also taken up several measures for checking the rate of dropout at schools in Gujarat (3). Gujarat state has more than 32,700 grant-aid primary schools run by municipal corporations. The school has divisions like Pre-primary section (Play section and kindergarten section), Primary section, secondary section, higher secondary section. Primary section includes students studying in standard 1 to standard 8. So the teachers teaching in the standard 1 to standard 8 were called Primary School Teachers.

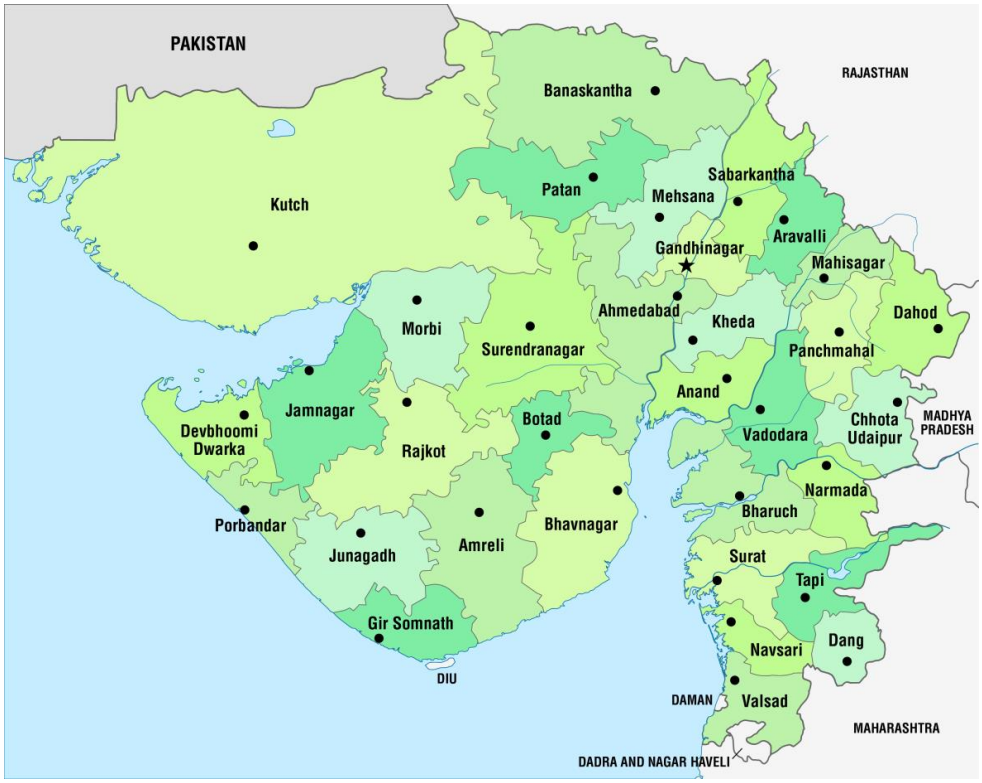

Plate 1: Map of Gujarat[13]

In order to improve the enrolment numbers of students the government had taken initiatives like mid-day meal programmes, distribution of free books and no fees for primary education that is standard 1 to standard 8. These kinds of efforts attracts the parents to send their children to

schools and the children also look forward to come to the school to get the free meal and free education for them.

Plate 2: Map of Vadodara City[14]

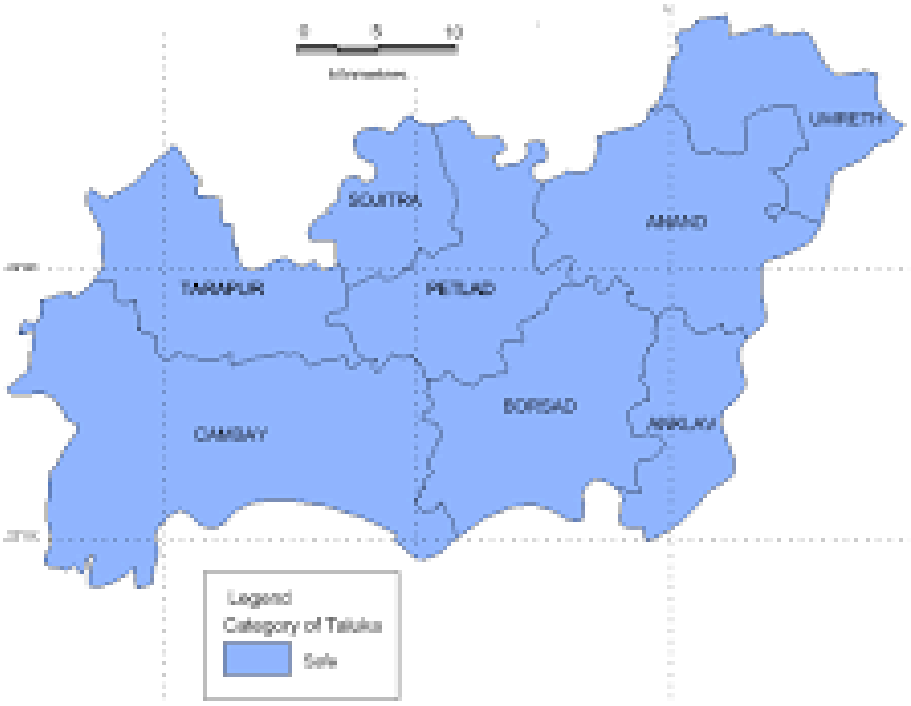

Plate 3: Map of Anand City[15]

Schools at Vadodara and Anand City

Vadodara city and Anand city have many schools; some of them are funded and run by municipal body, some by private body and few by both. The municipal (corporation) primary schools are distributed in wards for easy access of these schools by the children residing in different areas of the city. A pilot survey conducted by the researcher revealed that, 105 schools in Vadodara and 27 schools in Anand are run and funded by Municipal Corporation of Vadodara respectively. And the 27 schools in Anand are run and funded by Municipal Corporation of Anand respectively.

The other schools in Vadodara and Anand are either privately owned and funded fully by the private organizations or some were partially funded by the government body. The total population of Vadodara city numbered 13,05,546 is spared over in 12 wards located in different areas of the Vadodara city. The total population of Anand city is 2,092,745 spread over in 13 wards located in different areas of Anand city in year 2018 at the time of data collection. All the students who wish to study can get enrolledand don't have to pay fees for primary education that is standard 1 to standard 8. The facilities like mid day meal is provided in the all the schools of Vadodara and Anand city.

Primary School Teachers

In view of this by, Directorate of Education Government of NCT of Delhi.**(2005)** had issued guidelines regarding their duties and responsibilities of primary school teachers. They are as follows--

A teacher should do in school-

- Attend the morning assembly regularly.
- Help the students on moral principles, social and environment issues
- Keep a Teacher's Diary updated with the lesson plan.
- Be on time for teaching in the class.

- Regularly evaluate the student's performance.
- Conduct regular staff meetings and discuss the teaching methods for improvement (for faculty in-charge).
- Develop and use relevant teaching learning materials.
- Prepare well before the delivery of the lesson in the class.
- Relate the current topic with the previous knowledge of the students
- Use a combination of different methods and techniques of teaching
- Interact with the students to induce curiosity, motivate, and provoke thinking, imagination and application of the concept taught
- Assign students to work on various topics related to their subject using various resources beyond their books.
- Maintain cleanliness and discipline.
- Mark the attendance of the students in the class register with the help of the class monitor
- Create a learning environment for the students by decorating the board with noble work of great personalities to inspire the students
- Have regular parent teacher meetings to keep them informed and guide them about the progress of their children.
- Prepare a schedule and distribute the homework as per the schedule to avoid over burdening of the students.

The teacher should not do in school-

- Leave the assembly or the class unattended.
- Stand in groups and talk during the assembly

- Keep one way communication with students without any discussion or interaction
  - Use guides, help books for teaching
  - Humiliate a child or use corporal punishment

These guidelines indicate the routine work pattern of primary school teachers. It indicates that a teacher's job is not just a teaching but also

it includes their responsibility as a guide, mentor, supervisor, instructor, and motivator and so on. They have more workload than it is seen from their routine timetable. The increased responsibilities elevate the work pressure. Hence, it would not be wrong to assume that they might be facing problems related to their psychological, social, physical wellbeing. Musculoskeletal Disorder is considered to be one of the common occupational health problems globally.

Primary School Teacher's Activity during the Day in the school

The primary school teachers broadly perform the following tasks everydayare as follows:

- Teaching all areas of the primary curriculum.
- Taking responsibility for the progress of a class of primary-age students.
- Organizing the classroom and learning resources and creating displays to encourage a positive learning environment.
- Planning, preparing and presenting lessons that cater for the needs of the class.
- Motivating students with enthusiastic, imaginative presentation and maintaining discipline.
- Preparing and marking work to facilitate positive student development.
- Meeting requirements for the assessment and keeping record of student's development.
- Providing feedback to parents and caregivers on a student's progress at parents' evenings and other meetings.
- Coordinating activities and resources within a specific area of the curriculum, and supporting colleagues in the delivery of this specialist area; working with others to plan and coordinate work.
- Keeping up to date with changes and developments in the structure of the curriculum.
- Organizing and taking part in school events, outings and activities which take place at weekends or in the evening.

- Working with parents and School Boards to maximize their involvement in the school and the development of resources for the school.
- Doing other assignments given by the government like census survey, counting of population helping in election duty, exam duty in board exams (10)

The need for teacher training in various areas:

The need for teacher training in areas as follows-

- **A teacher should learn Dynamic Teaching Technique**

  The teachers should update their teaching skills and knowledge as per the need of the curriculum and time. Therefore, the teaching technique has to be dynamic. This will ensure the involvement of modern teaching aids and techniques into the existing curriculum.

- **A teacher should learn New Methods of Teaching**

  The education system has been evolving time to time viz. from Ashrams to schools, classroom teaching to online teaching. The different teaching approaches demands different teaching and learning materials like games, audio-visual aids, graphic aids, presentations, and so on. The incorporation of various teaching learning material according to the requirement can be learnt through teacher's training programmes. It encourages creative thinking among the students.

- **A teacher should Improving Domain Skills**

  By improving the domain skills a teacher could attain expertise in any subject and gain in depth knowledge of the same. The knowledge about the lessons, subjects, trending teaching learning materials and their applications may help in improvement, problem solving, better utilizing the expertise during the training and teaching sessions.

- **Building up Self Confidence**

The training programme helps in building up the self confidence among the trainers. It ensures the use of new technology among teachers with diverse range of students and topics as well. The training should integrate the change in curriculum and present need of the students.

- **High Demand For Pre School Teachers**

The consistent growth of primary education in India demanding more number of competent and trained primary teachers. Thus, it is important to impart primary teachers training at various levels.

(Intesol Worldwide 2019)

Musculoskeletal Pain and School Teachers

Musculoskeletal pain may occur due to damaged tissues in the body caused by the routine activities. Other major causes could be trauma in a body part such as fracture, accidents, sprains or postural strain, repetitive movements, overtime at work, prolonged sitting and so on. Hence, these changes in body movement or body posture might cause spinal alignment problem (Der Sarkissian, **2021**).Muscle pull, twitching or burning of muscles, fatigue, disturbed sleep are the common symptom of musculoskeletal pain and so of musculoskeletal disorder.

This is one of the most common occupational disorders observed across the globe by many researchers. The musculoskeletal disorder (MSD) is more common in those professions that requires a person to be in one posture for longer duration like bank professionals, front desk operators, corporate employees and also among the teachers.

Teachers have to work for a minimum of five hours a day from Monday to Friday and three and a half hours on Saturday in primary municipal corporation school of Vadodara city. If the strength of students is more, the schools run in two shifts, one in the morning from 7 am to 12:30 pm and other in the afternoon from 12pm to 5:30 pm every day. Some

schools have more than one recess then they have a small refreshment break of 15 minutes. If school is providing mid-day meal to all the students then they are having recess time duration of 45 minutes. These recess time varies according to school timings. The teachers have to come 15 minutes early and leave 30 minutes after the school hours.

In a single day a teacher has to perform activities (tasks) like teach specific subject to children, check the note-books of students, maintain class discipline, write on the black board, dictate notes to students and take attendance. It was found that in many schools non-adjustable furniture were used which made it more difficult to match the students as well as teachers (who can be in all sizes) leading to poor posture and negative physical health effects that had long term implications on their musculoskeletal growth and health in their future (Szeto, **2003**).

Teachers have a full working day; they spend 32 to 34 hours per week, as found through the pilot study conducted by the researcher on selected municipal primary schools of Vadodara. Grandjean and Hunting **(1997)** reported that, sometimes, while doing such tasks they feel pain in different body parts. One of the common and frequently occurring illness resulting from abnormal posture over a period of time are Musculoskeletal problems, such as low back pain, pain in the neck/ shoulder, arm, pain in joints, bones and muscles. It is often noticed in many working situations (in schools) that teachers are forced to assume bad working postures due to poor design of workplace (classroom) and tools (furniture and equipment).

The school teachers of Turkey, China, Australia, Brazil, Sweden, USA, Germany, Estonia, Japan, Malaysia, Philippines, France and Greece, have confirmed higher occurrence of musculoskeletal disorders with frequency rate between 40 per cent and 95 per cent then other working professional groups (Erick and Smith, **2012**).

Because of teaching conditions and related work environment the

teachers were affected by many physical health issues. The activities of teachers during the whole day includes not only teaching students but also lesson making, checking students work, student assessment and doing extra work like sports in schools. Teachers are also involved in day to day communities. The teachers are exhausted at mental and physical level. These activities may create mental and physical health problems because of various task at hand (Chong and Chan **2010**).

It had been found that, various tasks are being performed by the nursery school teachers including taking care of child, moving load which affected constant trunk flexion. It was found that pain in neck, shoulder, arm, legs, knee and low back disorders were experienced by the nursery school teachers. The activities involved postures like kneeling, squatting and bending for long duration cased musculoskeletal pain (Pillastrini, et. al., **2009**). A research conducted on hand-wrist pain in 2007 found that, the force but not repetition and position were related to hand-wrist pain and possible tendonitis in the baseline analyses showing an exposure-response pattern. Increasing levels of force were associated with prevalent and incident hand-wrist pain and possible extensor tendonitis. Regardless of this, the effect of Musculoskeletal pain affecting the primary school teachers have not provided adequate attention (Thomsen, et. al, **2007**).

The present study aimed at studying the work environment of Municipal Primary School and the musculoskeletal pain faced by their teaching faculties. The independent variables selected for the study were gender, teaching experience and psychosocial factors induced musculoskeletal pain.

Section 2: Empirical Studies

In order to present the research done in related fields, it has been divided into two sections as follows:

The Studies Conducted Outside India:

Hamberget. al., (2007)conducted a study on “Physical Capacity in Relation to Low Back, Neck, or Shoulder Pain in a Working Population”. The sample of the study comprised of 1789 Dutch workers whose isokinetic lifting strength, static endurance of the back, neck, and shoulder muscles, and mobility of the spine were measured in the pain free workers, as well as potential confounders, including physical workload. The data gathered revealed that an increased risk of neck pain was shown for workers with low performance in tests of isokinetic neck/shoulder lifting strength (RR=1.31; 95% CI 1.03 to 1.67) and static neck endurance (RR=1.22; 95% CI 1.00 to 1.49). The findings of this study concluded that low back or neck endurance were independent predictors of low back or neck pain, respectively, and that low lifting neck/shoulder strength was an independent predictor of neck pain and no association was found between lifting trunk strength or mobility of the spine and the risk of low back pain, nor between lifting neck/shoulder strength or endurance of the shoulder muscles and the risk of shoulder pain.

Thomsen et. al., (2007) conducted a research on “Risk factors for hand-wrist disorders in repetitive work” with an aim to identify the risk of hand-wrist disorders related to repetitive movements, use of hand force and wrist position in repetitive monotonous work. Questionnaires and physical examinations were used as tools for data collection. With the use of questionnaires and video recordings of homogenous work tasks number of wrist movements, hand force requirements and wrist position were analysed as risk factors for hand-wrist disorders, controlling for potential personal and psychosocial confounders. The data revealed that force but not repetition and position were related to hand-wrist pain and possible tendonitis in the baseline analyses showing an exposure-response

pattern. Odds ratios for the risk of hand pain was found to be 1.7 (95% CI 1.3 to 2.2) and for possible tendonitis was found to be at 1.9 (95% CI 1.1 to 3.3). There was no significant interaction between the ergonomic factors. The study concluded that increasing levels of force were associated with prevalent and incident hand-wrist pain and possible extensor tendonitis. The results for repetition were less consistent and working with the hand in a non neutral position could not be identified as a risk factor.

On Textile Manufacturing Industry

Perez and Anda (2007)conducted a study on “Musculoskeletal disorders among male sewing machine operators in shoemaking industry” with an objective identify the body regions more liable to develop musculoskeletal disorders and the rates both of appearance of such troubles and of sick leave resulting from them, becausedearth of information is based upon male sewing machine operators in other industries, in less developed countries. The study involved 143 Mexican men operating sewing machines in eight shoe factories from which 132 of them operated flat-type machines, 11 column-type machines for a period of one year. Questionnaire was used as a mode of data collection. The data revealed that 47·5% of the subjects declared current musculoskeletal disorders, low back pain was found to be the most frequent at a rate of 18·2% for both groups; the shoulder was a site of complaint for 14% of the subjects, being three times more frequent among column-machine operators; the back as a whole was mentioned also by 14% of the subjects, all of them flat-machine operators; 4·9% of the subjects complained of neck pain and again none of the column-machine operators was affected. Therefore, it was concluded that the body regions affected were those expected from the analysis of the video recordings and were consistent with those reported for occupations involving similar postures and movements. The rates of musculoskeletal complaint found in this study are lower than those reported by other authors who have studied sewing machine operators; taking sick leave is a very rare choice for the workers studied.

Larsson et. al., (2008) carried a research on “Effects of work ability and health promoting interventions for women with musculoskeletal symptoms: A 9-month prospective study” with an aim to describe the effects of a self-efficacy intervention and an ergonomic education intervention for women with musculoskeletal symptoms, employed in the public sector because in order to maintain the level of health and work ability and strengthen the potential resources for health, it is important that employees gain greater control over decisions and actions affecting their health – a process associated with the concept of self-efficacy. The design of the study was a 9-month prospective study describing the effects of two interventions, a comprehensive self-efficacy intervention (*n* = 21) and an ergonomic education intervention (*n* = 21). Data obtained by a self-report questionnaire on health- and work ability-related factors at baseline, and at ten weeks and nine months’ follow-up. the data resulted that over the time period there were small magnitudes of improvements within each group as well as self-efficacy intervention group positive effects in perceived work ability were shown. The ergonomic education group showed increased positive beliefs about future work ability and a more frequent use of pain coping strategies. Hence it was concluded that both the interventions showed positive effects on women with musculoskeletal symptoms, but in different ways.

Wong et. al., (2009) undertook a study on “The association between back pain and trunk posture of workers (Teachers) in a special school for the severe handicaps” aiming todetermine the time spent in different static trunk postures during a typical working day of workers in a special school for the severe handicaps. For the study eighteen workers with low back pain (LBP) and fifteen asymptomatic workers were recruited. A cross-sectional design was employed to study the time spent in different static trunk postures which was recorded by a biaxial accelerometer attached to the T12 level of the back of the subjects.The results of ANCOVA revealed that subjects with LBP spent significantly longer percentage of time in static trunk posture when compared to normal ($p < 0.05$). It was also shown that they spent significantly longer time in trunk flexion for more

than 10° ($p < 0.0125$). It also concluded that an innovative method has been developed for continuous tracking of spinal posture, and this has potential for widespread applications in the workplace. In order to minimize such risk, frequent postural change and awareness of work posture are recommended.

Erick and Smith (2011) reviewed "A systematic review of musculoskeletal disorders among school teacher" with an objective to collect the researches related to musculoskeletal disorders from world over and to investigate the prevalence and risk factors for musculoskeletal disorders among teachers. The study involved an extensive search of MEDLINE and EMBASE databases in 2011 wherein all studies reported on prevalence and risk factors for MSD in the teaching profession were selected for inclusion. 80 studies from worldwide gathered from the data base and initially located, a final group of 33 researches met the inclusion criteria and were examined in detailed. The review suggested that the prevalence of self reported MSD among teacher ranges between 39% and 95%, nursery school teachers appear to be more likely to reported suffering from low back pain. Factors such as gender, age, length of employment and awkward posture have been associated with higher MSD prevalence rate.The study concluded that school teachers are at a high risk of MSD.

Textile Manufacturing Industry

Sealetsa **and** Thatcher **(2011)** undertook a study on "Ergonomics issues among sewing machine operators in the textile manufacturing industry in Botswana" aiming to identify and describe possible ergonomics deficiency in the work station of sewing machine operators in a textile industry and to find out the perception of work load and bodily discomfort.157 women sewing machine operators were the sample of the study. Their relevant anthropometric measurements and workplace layout was collected. A modified corlett and Bishop body-map and NASA TLX questionnaire was used for data collection. The data revealed that there was high Prevalence of Musculoskeletal disorder in major affected areas of body were back,

neck and shoulder. The study concluded that the women experienced discomfort in their neck, back and shoulder and which needed redesigning of workstations and provision of training in basic ergonomics principles should be given for improving work life.

School Children

Erne and Elfering (2011)conducted a research on “Low back pain at school: unique risk deriving from unsatisfactory grade in mathematics and school-type recommendation” aiming to study the association of educational selection and other risk factors with pain in the upper back (UBP), lower back pain (LBP), peripheral (limb) pain (PP), and abdominal pain (AP). The sample comprised of one hundred and ninety-two schoolchildren, aged between 10 and 13 from 11 classes of 7 schools in Switzerland participated in the cross-sectional study. In logistic regression analysis, predictor variables included age, sex, BMI, participation in sport, physical mobility, weight of satchel, hours of daily TV, video, and computer use, pupils’ back pain reported by the mother and father, psychosocial strain, unsatisfactory grade in mathematics, and school-type recommendation. The analysis of data collected revealed that there washigh prevalence rates of musculoskeletal pain in the last 4 weeks (UBP 15.3%, LBP 13:8%, PP 33.9%, AP 20.1%) whereas psychosocial risk factors were uniquely significant predictors of UBP (psychosocial strain), LBP (psychosocial strain, unsatisfactory grade in mathematics, school-type recommendation), and AP (school-type recommendation). In conclusion, the selection in terms of educational school system was uniquely associated with LBP in school children. Stress caused by educational selection should be addressed in primary prevention of musculoskeletal pain in schoolchildren.

Yueet. al., (2012) conducted a research on “Neck /shoulder pain and low back pain among school teachers in china, prevalence and risk factors” with an objective to investigate the prevalence of and risk factors for neck and shoulder pain and lower back pain among primary, secondary and high school teachers. A cross-sectional study of 893 teachers from 7

schools was selected.The data on participant demographics, work characteristics, occupational factors and musculoskeletal symptoms and pain was collected. Dutch musculoskeletal questionnaire (DMQ) was used to assess occupational risk factors and Nordic musculoskeletal questionnaire (NMQ) on musculoskeletal symptoms were assessed. This resulted that among the 893 teachers the prevalence of NSP and LBP was 48.7% and 45.6% respectively. There was significant association between the level and prevalence of NSP and LBP among teachers in different schools. The prevalence of NSP in female teachers was much higher than that of male. LBP was more consistently associated with twisting posture, uncomfortable back support, static posture and prolonged sitting. The study concluded that NSP and LBP are common among teachers with strong associations in different individual, ergonomic and occupational factors.

MSD (low back pain) in high school adolescents

Onofrioet. al., (2012) conducted a study on “Acute low back pain in high school adolescents in Southern Brazil: prevalence and associated factors” with an aim to investigate the prevalence of acute low back pain (ALBP) and associated factors in high school students from a Southern Brazilian city. The study was cross-sectional and interviewed 1,233 students 13- to 19-year-olds, attending high schools. A total of 25 schools were selected as the sample (15 state institutions, 7 private, 2 federal and 1 municipal). The ALBP was evaluated using two questions. The results revealed that the prevalence of ALBP was 13.7% and the prevalence of ALBP is relatively high for non-white students who commuted to school walking. The study also suggested that further studies with follow-ups to adulthood are needed to investigate whether physical cumulative loads on the lumbar spine (for example, duration/transport, school bags and inadequate school furniture) during adolescence, may influence the development of ALBP later in life.

Hospital workers and Nursing profession

Sacoucheet. al., (2012) conducted a research on “Impact of Ergonomics Risk among Workers in Clothes Central Distribution Service in a Hospital” aiming to study the effect of ergonomic factors at work in the musculoskeletal system for employees in this sector because the workers from laundry and linen services are exposed to various occupational hazards, including the ergonomic risk. Cross-sectional study was selected as the research design where site visit were conducted to apply recognition of occupational hazards and work activities flow. Medical evaluation of twenty-one workers was performed for designing the health status of them, focusing on orthopedic disorders. The data collected resulted that the principal complaints were of back pain (43%) and shoulder pain (24%). The ergonomic risk happens due to repeated movements of lumbar flexion in sealing, raising the arms above shoulder level in storage and transportation of loads on the distribution of clean clothes. It was also recommended to adjust anthropometrically the sealing workplace; the availability of stairs; the implantation of trolleys with four swivel wheels; short breaks during the workday and to stretch the muscles before and during work.

Abdulmonem et.al., (2014) investigated “The prevalence of musculoskeletal pain and its associated factors among female teachers” with an objective to quantify the prevalence and identify the associated factors of musculoskeletal pain among Saudi female school teachers. An observational quantitative cross-sectional survey of female Saudi school teachers in five different areas of Saudi Arabia was carried out between August and October 2013. A self-administered questionnaire was used in which the items related to participants’ demographic information and pain information were included. A numeric pain rating scale was used for patient self-reporting of pain. Data analysis was carried out using SPSS Pc+ version 21.0 statistical software which revealed that severe low back pain was reported by 38.1% of teacher, followed by knee pain (26.3%), heel (24.1%), shoulder (20.6%), upper back (17.7%), hip joint

(16.5%),ankle (12.3%), neck (11.3%). Sever pain of elbow (5.6%) and wrist (7.4%) was the least reported. Pain affected work at school in 46.1% of school teachers. Therefore, the results of self-reported prevalence of musculoskeletal pain among female Saudi school teachers was useful to educate the school teachers for adequate care so as to prevent these pains. There is a need for the higher authorities to address this issue and implement intervention programs to alleviate the pain and suffering of these school teachers.

MM (2017) conducted a study on "Work Related Musculoskeletal Disorders among Preparatory School Teachers in Egypt" with an aim to determine the prevalence of neck, back, and upper and lower limb musculoskeletal disorders, the associations between teacher characteristics and musculoskeletal disorders and the links between physical risk factors and musculoskeletal disorders among teachers at Cairo, Egypt's preparatory government schools over the previous year because preparatory school teachers represent an occupational group who are prone to work related musculoskeletal disorder but its prevalence among teachers in Egypt has not been reported. A convenience sample of 200 preparatory school teachers were selected from governmental schools in Cairo, Egypt, to fil a modified Nordic questionnaire which assisted musculoskeletal disorder due to their work in last 12 months. The responses indicated that the prevalence of work related musculoskeletal disorders among Egyptian preparatory school teachers were 96% in the previous 12 months. The prevalence was significantly higher among females compared to males. The neck and back (83.5%) were the most commonly affected parts followed by upper limb. Standing for long periods of time and high workload were significantly related to upper limb, lower limb, neck and back injuries. About 18.9% of teachers took sick leave (from 1to 7 days) due to their injuries. Which proved that the prevalence of work related musculoskeletal disorders among preparatory school teachers in Cairo, Egypt is high as in comparison to their counterparts around the world.

Fernandez et.al., (2021) conducted a study on “Musculoskeletal Disorders Associated With Quality of Life and Body Composition in Urban and Rural Public School Teachers” with an aim to study the association of MSD with QoL perception and body as teachers are a labor group that suffers from high incidence of musculoskeletal illnesses (MSDs), stress, and a significant decline in quality of life (QoL).The study examined urban and rural public schoolteachers from the Valparaiso Region, Chile. Wherein QoL perception was evaluated with the 36-Item Short-Form Survey (SF-36) and Body composition via bioimpe dance. A logistic regression model was used to evaluate the association between MSD, QoL, and body composition, adjusted for age and gender.The findings demonstrated that a total of 88.9% (urban 90%; rural 87%) of teachers felt pain in some body area, 71.2% of them with limitations; 39% of teachers presented body fat obesity, with the highest rate in rural women. The body area with the greatest MSD prevalence was the neck and shoulders (68.6%). Significant differences were observed between teachers with >p75 of MSD (over six pain regions) and those with _p75 (six or fewer painful regions; $p < 0.05$) on six QoL scales and on physical health components (PCSs) and mental health (MCS) in urban teachers. However, rural teachers presented no differences. The association between teachers with >p75 MSD and low QoL perception was significant ($p < 0.05$) in PCS and MCS. The Urban and rural teachers present high rates ofMSD and obesity. Teachers with higher rates of MSD have their mental and physical QoL affected, making workplace intervention in MSD necessary to prevent teacher health deterioration.

Souzaet. al., (2021) carried a research on “Work-related musculoskeletal disorders among school teachers”. The purpose of the study was to determine the prevalence of musculoskeletal conditions among elementary school teachers in Jequié City, State of Bahia, Brazil, and to look into the relationships between these conditions and socio-demographic, occupational, organizational, and health factors as teachers belong to a risk group for the onset of musculoskeletal disorders, which may be justified by some work-related factors, with a direct impact on their

lives. The study examined 304 elementary school teachers in Jequié city using descriptive statistics procedures. The results showed that the prevalence of musculoskeletal disorders was 24.3% for any of the body segments, 15.5% for the back, 16.1% for the upper limbs and 12.5% for the lower limbs. A statistically significant association was found between musculoskeletal disorders and female sex, older age, black, brown and red skin, time working as a teacher of more than 14 years, presence of co morbidities, irregular sleeping pattern, consumption of alcohol and tobacco, and a regular lifestyle. It showed that teachers presented a high prevalence of musculoskeletal disorders in upper limbs, back, and lower limbs.

Ngoenchua. et.al., (2021) conducted a research on “Prevalence and factors associated with musculoskeletal disorders among teachers in Sawankhalok Municipal School, Sukhothai Province”with the aim of determining the prevalence and risk factors for musculoskeletal illnesses among teachers at Sawankhalok Municipal School in the province of Sukhothai. Data of 128 research participants' were gathered, and Chi-square test and Fisher's exact test were used to examine the findings. The findings revealed that the prevalence of musculoskeletal illnesses over the previous week was 48.4% and over the previous year was 60.2%. The shoulder had the highest prevalence of symptoms over the previous seven days, followed by the neck (25.8%) and the lower back (19.5%). In the previous 12 months, shoulders (43.8%), neck (33.6%), and lower back (23.4%) were the areas most likely to have experienced symptoms. The data analysis revealed that visual problems and job positions were associated with musculoskeletal disorders in the previous 7 days (p-value 0.05). Age, dominant and visual problems, drinking caffeine, teaching levels, and job positions were also associated with musculoskeletal disorders in the previous 12 months (p-value 0.05). As a result, the competent authorities should organize for the proper workload and train on how to relax muscles in a lengthy sitting job, health promotion such as educating the amount of caffeinated beverages eaten and exercising or relaxing the eyes.

The Studies Conducted In India:

On Architectures Students

Datar and Gandotra (2010) undertook a study on "Work Posture and Musculoskeletal Problems Experienced by the Architectures Students" with the aim to observe the work posture of the students when working on the drawing board in a standing posture. The other objectives were to identify musculoskeletal problems experienced by the students and to measure the stress of painful muscles of the students when working with drawing board in a standing position were studied in the present research. To measure the stress on the muscles electromyography was used on 5 respondents. A modified 5 point Borg's Scale was utilized to spot the musculoskeletal pain experienced by the respondents. The overall analysis showed that the students were experiencing moderate to severe pain in the cervical and lumbar region. It was concluded that the respondent adopted a very bed posture and hence experienced pain in several parts of the body. The researcher further revealed that the muscles stress recorded in the region of pain was at the minimum level rather than at the negligible level of pain.

On Designing students

Dr. Chauhan (2011) researched on "Musculoskeletal Problems Among Interior Designing Students" with the aim to determine the effect of work posture on musculoskeletal problem in college students engaged in interior designing and architecture courses. The researcher used random sampling method and it was conducted in 3 colleges Mumbai city. The students who are engage more than 1.5 to 2 years were selected as sample for the study. The 20 female students from each colleges with a total of 60 female participated in the present study. To study human body for musculoskeletal pain the Standard Nordic Questionnaire was utilized. Posture assessment was done with the help of OWAS – Ovako Working Posture Analyses System, which is entire body assessment system tool. OWAS is a practical method for identifying and evaluating poor working posture. The postures was observed and captured using Sony cyber shot camera.. The students suffered from low back pain 58%, neck pain 48% and shoulder pain 40%. The students also complain about other problems such as headache, eye problem and feeling of fatigue. The conventional OWAS method showed that the students use some harmful postures and

needed postures correction. The study showed students' having complains related to musculoskeletal disorders while working on drawing boards. The new recommended designs will help the colleges to provide better working environment, minimizing the risk of health problems and improving the effectiveness of the respondent.

Damayantiet. al., (2017)conducted a study on "Occurrence of Work Related Musculoskeletal Disorders among School Teachers in Eastern and Northeastern Part of India" with an aim to determine the occurrence of Work related Musculoskeletal Disorder (WMSD), its prevalence and risk factors among school teachers in India. The study examined 100 school teachers using standardized Dutch Musculoskeletal Questionnaire (DMQ). The data revealed that neck pain was the most prevalent musculoskeletal complaint, reported by 53.52% of the teachers. Shoulder and back pain were less prevalent than neck pain but the prevalence of chronic pain in these body sites were higher. Furthermore wrist/hand and knee pain were less prevalent than the other complaints. Working with hands above the shoulder was the highest reported risk factor (62.27%). It concluded that school teachers are susceptible to WMSD with a significant prevalence for neck, shoulder, back, wrist/hand and knee pain. Prolonged working nature like bending the neck forward/backward or holding the neck in a Forward/backward posture, same movements with arms, hands or fingers many times, hands above the shoulder level, reaching with arms or hands and standing were important factors which affect the occurrence of musculoskeletal disorders.

Vaghela and Parekh (2018) studied the "Prevalence of the musculoskeletal disorder among school teachers" with an aims to find out the prevalence of the MSDs among school teachers. The research project was conducted after getting clearance from Human Research Ethics Committee of the K M Patel Institution for Education and Research Centre. This study was conducted in various schools wherein a total of three hundred and fourteen teachers enrolled in the study to investigate the MSDs among school teachers using modified Nordic questionnaire. The data revealed that a total of 314 participants have been recruited in that minimum age of participants is 22 and maximum age is 59 with mean 40.5 ± 9.88. Total prevalence of the MSD is 71.95% among the teachers. In that, female were more affected with 72% than the males with 28%. Therefore, the teachers here in reported a high prevalence of musculoskeletal pain in the shoulder, knee, and back.

Ergonomic assessment in occupational environment

To investigate the postures and related musculoskeletal problems experienced by female residential building sweepers working in urban

Mumbai a study was conducted by **Malhotra and Chauhan (2022)** conducted a cross sectional study. The standardized Nordic questionnaire was utilized to assess the musculoskeletal problems were adapted for 200 sweepers and Ovako Working Posture Analysis System (OWAS) were adapted for 120 sweepers. The sweepers reported back, shoulder and café pain. The activity of putting the garbage in garbage bin was classified in OWAS category 4. It was observed that maximum time was spending in collecting garbage from individual homes followed by sweeping activity. The musculoskeletal problems were caused by repetitive tasks and awkward postures adopted by the sweepers working in residential building. Ergonomic intervention programs were suggested.

Chauhan and Sondhi (2020) had undertaken study on Posture-Related Musculoskeletal Problems among Hotel Receptionists in Mumbai. It was Cross-Sectional Study conducted on 50 receptionists from 11 hotels working in 15 three-star and 35 five-star hotels of Mumbai city were the respondents. The Nordic Musculoskeletal Questionnaire (NMQ), and OWAS posture assessment tool were utilized. The result showed the respondents were feeling discomfort in their low back, calf, neck, ankle and feet. the change in shifts was causing problems in sleep pattern. The researcher found strong association between standing posture and calf pain and ankle pain. The Prolonged standing increased the Musculoskeletal Problems in lower limbs among the receptionists.

A study was conducted by **Kamble et al., (2022)** on "Occupational ergonomic assessment of MSDs among the artisans working in the Bagh hand block printing industry in Madhya Pradesh, India". The study was conducted in Dhar District of Madhya Pradesh among 70 artisans. Objective of the study was to determine the prevalence of MSDs and the risks factors involved. The postures were analyzed using rapid upper limb assessment (RULA) and the occupational repetitive actions (OCRA) method. The artisans were suffering from Musculoskeletal Problems in neck, shoulders, elbows, wrist, forearm, low back, hip and thighs of elder artisans. The result reveled that artisans were at high risk of the development of Musculoskeletal Problems and intervention is needed to eliminate the ergonomic risk among the artisans.

An empirical study was conducted by **Kaur and Singh (2018) on** "**Ergonomic Evaluation of Female Working in Small Scale Handicraft Industries of Patiala District of Punjab".** The study was conducted on 150 women weavers working in organized and unorganized or home based small scale handicraft industries. The information was collected by using observational schedule and taking interview of women weavers. The findings emphasize that weavers body pain was due to their poor posture.

The pain in neck region was prominent. Awkward postures with exertion for longer periods leads to Musculoskeletal Problems and decline in productivity.

Malhotra et al., (2018) conducted a research on "Workstation assessment for packaging department: a case study". The respondents were the workers of the packing department of Juhu Sahakari Bhandar. The aim of study was to assess the workstation design and postures adopted during work by the workers. The questionnaire included general information, medical history, health problems of workers and environmental aspects of work space. The findings revealed that workers spend maximum time in weighing activity. The workstation was measured and designed according to activities. The researchers recommended redesigning of workstation to increase productivity.

Chahun and Patel (2015) carried a research "Work Related Musculoskeletal Problems Faced by the Washroom Cleaners Working in Malls". The aim of study was to assess Musculoskeletal Problems and postural problems of women cleaners working in Mumbai malls. 30 women working in 5 similar malls were selected for the same. The Ovako Working Posture Analysis System (OWAS) were adapted for various postures at work using photographic technique. The results showed almost all the women workers were suffering from neck, shoulder, wrist, lower back and knee pain. The repetitive movements were the cause for the various pains. The activities were classified in OWAS category 3 and needed corrective measures soon as possible. The researchers recommended training programs foe right posture at work.

Das et al., (2022) undertaken a study on "Workplace and Process improvements in cashew processing units". The study was conducted on women workers aged between 18-60 years of age working in cashew nut production in the state of Maharashtra. For the study video analysis of processing tasks, postural assessment, biomechanical analysis and anthropometric analysis were done by the researchers on female workers working in cashew nut production. It was found that these women workers were suffering from musculoskeletal disorders and occupational health issues. The women workers were suffering from low back pain, knee pain and cervical pain which was restricting their work life.

A study was conducted by **Mohrana et al., (2022)** on "Problems of Women Workers in Post-harvest Activities of Turmeric Cultivation: Need for Ergonomic Intervention". The study was conducted on tribal women working in turmeric cultivation in kandhamal district of Odisha. The post harvest activities of turmeric cultivation include steps like boiling, drying, polishing and colouring. All the post- harvest activities took lot of time and

physical effort responsible for drudgery and health hazards. It was observed that due to lack of facilities post harvest losses has also been observed. An ergonomic evaluation of each activity with suitable intervention would be helpful for the tribal women working in turmeric cultivation.

Guria, (2022) conducted a research on “Ergonomic Evaluation of Handloom Weaving by Female Weavers”. Aim of the research was to do physical evaluation of tasks performed by female weavers, to identify task related ergonomic risk in work area and to suggest corrective measures. The research was conducted on 30 women weavers working in northwest Bengal. Anthropometric dimensions were taken and postural analysis was done by rapid entire body assessment (REBA) and Nordic Body Map Questionnaire was utilized. The results showed process of weaving was painful for eyes and back. The workspace design is not align with female weavers. Half of the female weavers were underweight which cause strain on their bodies. Recommendations were proposed for making agronomical loom design and other equipments which increase employment opportunities for weavers.

Basak et al., (2022) had undertaken study on “Design of tea basket for small-scale tea plantation workers - An ergonomic approach” The study aims to identify ergonomic issues of the existing tea basket and to redesign the same by incorporating ergonomics and locally available materials. To calculate risk of Musculoskeletal Disorders among the workers with existing design and proposed tea baskets design while plucking the tea leaves REBA and RULA method was applied. The results showed proposed tea baskets design scored better as compared to existing basket design.

Ray and Puntambekar (2022) carried a research on “Evaluation of Ergonomic Factors in Making of Coconut shell Jewelry”. To assess task and workplace of an artist making coconut jewelry and to evaluate physical and cognitive demands and environmental hazards within the workplace were the aims of research. The observation method, questionnaire, photographs, posture assessment tools REBA, RULA and pain scales to identify the risk factors utilized for gathering information. The findings revealed that the workers adopted awkward postures such as hunching and slouching for longer duration. The recommendation was made to design a healthy and safe workspace for doing precision tasks.

A study was conducted by **Qutubuddin et al., (2022)** on “Ergonomic Evaluation of sweetmeat (soan-papdi) making industry”. To evaluate ergonomically the major processes of sweetmeat (soan-papdi) making industry, to design sweetmeat (soan-papdi) making workstation and

workers postures. The posture assessment tools REBA and RULA were utilized and risk identification was done. The environment parameters were measured with appropriate instruments. The results of RULA showed 57% postures in high risk category. The work environment was over all poor which affects productivity. The recommendations were made for the same.

Conclusion

An exhaustive review of literature when introspected for the research trends in the past decades revealed that although many researchers have been conducted on musculoskeletal disorders, there are researches on neck, back, shoulder, back upper and lower, legs and knees problem suffered by office workers, nurses, workers of shoemaking industry, women and men of world over. The review of literature has highlighted that many studies were undertaken on musculoskeletal pain for various professionals and others in general, Hospital Nurses, Teachers in schools and primary school teachers, Academic staff in Institutes, School personnel, Garment makers, Construction workers, Secretaries, Software Professionals and Office workers.

The review of literature further revealed that many efforts had been made on research area of musculoskeletal pain and problems faced by secondary students, primary schools students, students of colleges, designing students, architecture students Designers and Architects students in India and outside India. The information on teachers was difficult to find in India. The literature reviewed further highlighted that some studies were also carried on the impact of workplace risk factors among the teachers outside India. The researcher come across very few studies conducted in India on the musculoskeletal pain among the primary school teachers and Ergonomic assessment in various occupations. The investigator could not come cross a research study on municipal primary school teachers having musculoskeletal problems, psychosocial social factors induced musculoskeletal pain, postural analyses of teachers and designing new classroom furniture was yet unexplored by the Indian researchers which inspired her to conceptualize the present investigation. This became the assertion of planning to undertake the present research.