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# Prevalence of Sciatica in Pregnancy and Its Impact on Quality of Life - A Cross Sectional Study

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## ABSTRACT

**Background:** Sciatica is a rare clinical entity of LBP that is experienced during pregnancy which can be caused due to various factors and may or may not affect the quality of life during pregnancy.
**Objectives:** The aim of this study was to find out the prevalence of sciatica in pregnant women and its related quality of life in pregnant women with sciatica symptoms
**Methods:** A cross sectional study including total of 812 who are in their third trimester pregnant women who visited the Obstetrics and Gynaecology outpatient department of SDM hospital and gave the consent were included in this study. Age, BMI, occupation, trimester, MC-LBP, PR-PBP and sciatica symptoms were recorded. The severity of the sciatica symptoms were measured using Sciatica Bothersomeness Index and quality of life was assessed using WHOQOL-BREF
**Results:** Prevalence was found out to be 16.9% in 812 pregnant ladies. Age, BMI,
MC-LBP, PR-LBP, were significantly associated with sciatica in the third trimester of pregnancy. Physical domain of WHOQOL-BREF had a significance difference between the sciatica pregnant women and non-sciatica pregnant women.
**Conclusion:** Prevalence rate is 16.9% and is associated with QOL with or without sciatica symptoms in third trimester pregnant women.

***Keywords:*** Pregnancy, Sciatica, QOL, pregnancy related back pain.

## INTRODUCTION

Pregnancy is a period of transition or a normal process, comprised of rapid biological change in all organ systems. During pregnancy, the lady undergoes significant anatomical, physiological, and biochemical changes to nurture and accommodate developing foetus, starting shortly after fertilization, and continuing throughout the pregnancy.[1,2,3]

On an average, during course of pregnancy, women gain weight about 25to35 pounds and undergo various hormonal changes and biomechanical variations that strain the pelvis and axial skeleton. These hormonal changes during pregnancy affect the maternal physiology in all 3phases of pregnancy (i.e. preconception phase, pregnancy, and the initial postpartum period). The profound adaptations in the body anatomy and metabolism affect the musculoskeletal system as well. It is assumed that hormones such as progesterone, estrogen, prolactin and relax in play a major role in some of these musculoskeletalmanifestations.[5,6]

In pregnancy, this function of pelvis is even more important because body weight increases over 10 kgs in the pregnancy process in the total span of 40 weeks. This primary function requires that the pelvic bones be in a balanced position. As pregnancy progresses, there is a forward tilting of pelvis. The hormones released during the pregnancy cause increase mobility of joints such as sacroiliac joint

and this may cause increase in the possibility of distortion of alignment.[7]

Significant physiological changes occurring during the normal pregnancy often give rise to musculoskeletal issues. It is therefore important to be aware of various musculoskeletal problems throughout the pregnancy. Several musculoskeletal problems encountered during pregnancy include diastasis of rectus abdominis, low back pain, pelvic pain, osteitis condensans ilii, hip pain, De Quervain's tenosynovitis, carpal tunnel syndrome, meralgia paresthetica, plantar fasciitis and thoracic outlet syndrome.[6]

The other pain experienced along with the back pain in pregnant women is in posterior aspect of pelvis, distal and lateral lumbosacral junction. The pain radiates to the posterior part of thigh may extend below the knee and thus may be misinterpreted as sciatica or posterior jointsyndrome.[8] Sciatica is considered as symptom rather than a clinical diagnosis and it is a rather rare clinical entity of low back pain that is experienced during course of pregnancy appearing in only 1% of the women. Sciatica describes a set of symptoms which includes radiating pain in the lower extremities, caused by a compression or inflammation of sciatic nerve root within the intervertebral foramina due to herniated nucleus pulposus in the lumbar region of spine.[9,10,11]

In pregnancy, an enlarged uterus is a cause of sciatica. The gradual onset of sciatica is related with menstruation, gestational period or endometriosis and is sometimes worsened by long time sitting indicating entrapment of sciatic nerve. Sciatic pain typically begins as low back pain and radiates to lower buttock and narrow band down the leg. When the sciatic nerve is pressed in the pelvis the pain is experienced which is the form of band, down the leg is much broader and often there is no associated back pain. Sciatica is commonly late in pregnancy as sciatic nerve is trapped between the fetal head and pelvicbrim.[12]

The pain explained is like shooting pain, sharp, feels like electric shock, discomfort/numbness. Pain usually begins in gluteal region and radiates along the back of thigh and the lateral side of leg, dorsum of foot. Worsening of pain may be by certain activities like sneezing/coughing as these activities increases abdominal pressure. The activities like sitting, bending and prolonged standing, rising from sitting position can aggravate the pain. Relieving factor is supine lying as it decreases the pressure on herniated disc and subsequently decrease thepain.[13,14,15]

Quality of life (QOL) definition given by World Health Organization (WHO) is "individual's perception of their position of life in the context of culture and value systems in which they live and in relation to their goals, expectations, standards and concerns. This is a very broad concept and one that can be influenced in complex way by the physical health of the subject, his/her psychological state and level of independence, social relationship with the essential elements of his/her environment." [16]

WHO-BREF instrument which measures four domains physical, psychological, social relationship and environmental. This instrument comprises of 26 items and is a validated shortened version of WHOQOL. A lower score on the summary scales represents a poorer health related quality of life.

The sciatica bothersomeness index can be used to investigate patient perception of the symptoms that are experienced during the sciatica pain patterns in the period of pregnancy. It is a self-reported ratings of the symptom's intensity of leg pain, numbness and tingling in the foot, leg or groin, weakness in the leg or foot and back or leg pain while sitting.

Prevalence of sciatica in pregnancy has rarely been investigated and on the few occasions that it has been significantly or predominantly in conjunction with the low back pain. The studies done early identified only 1% of pregnant women experienced

sciatica. More recent data has identified prevalence rate of 17% to 22%.[7] The routine check-up of pregnant women does not include the assessment of sciatica and it remains undiagnosed or unnoticed. As there is a wide gap between the two studies done earlier in the western countries, no study in India is done and according to social lifestyle, it might vary in Indian population comparing to other countries that is why there is the need of the study to know the prevalence of the sciatica in pregnant population and possible methods to educate or train the pregnant women to prevent or treat the sciatica in pregnancy.

## MATERIALS AND METHODS

For this study, ethical clearance was obtained from Shri Dharmasthala Manjunatheswara Institutional ethical Committee, Dharwad before commencement of the study and clinical trial registration (REF/2019/08/027802AU) was also done.

The present cross-sectional study conducted on all third trimester pregnant women who registered by inpatient/ outpatient department of Obstetrics and Gynaecology in S.D.M college of Medical Science and Hospital, Dharwad, were screened as per the inclusion and exclusion criteria.

Subjects willing to participate in the study were included. Prior to the interview, a written consent was taken from the participants. Demographic variables such as age, occupation, body mass index, MC-LBP, PR-LBP, Sciatica symptoms were collected. Further, of all participant's Quality of Life was assessed with self-reported Quality of Life Questionnaire (WHOQOL-BREF) and participants with sciatic symptoms rated their sciatic pain using SBI from 0 to 6, 0 being not bothersome and 6 being extremely bothersome experienced by them.

**Materials Used for the Study**

Consent Form.
Data collection sheet.
WHO Quality of Life-BREF Questionnaire.
Sciatica Bothersomeness Index

**Inclusion criteria**

1. Subjects who agreed to sign the informed consent form.
2. Subjects with an age group 18-35years.
3. Third trimester pregnant women
4. Subjects previously experienced low back pain.
5. Subjects, those who had a history of low back pain were consulting on/off orthopaedician or gynaecologist.

**Exclusion criteria**

1. Subjects not willing to participate in the study.
2. Subjects with any other neurological, cardiovascular problems
3. Any history of vertebral fracture or surgery

**Study design:** A cross-sectional study

**Study duration:** The study duration is one year

**Sampling method:** Simple random sampling

**Procedure**

In this cross-sectional study, all third trimester pregnant ladies who registered in inpatient/outpatient department of Obstetrics and Gynaecology were included for the study. All descriptive characteristics were coded for statistical analysis using SPSS version 23.

The participants answered comprehensive questionnaire assessing demographic variables includes such as age group coded:1=18to23,2=24to29,3=30to35 of years old. Body mass index defined as kg/m2 and was represented in 3 categories: 18-24.9 kg/m2 (coded as 1), 25-29.9kg/m2 (coded as 2), 30 -34.9kg/m2 (coded as 3)

Occupational status of the pregnant women in the study was represented as working (coded as 1) and non-working (coded as 2). Parity of the subjects in the study was represented as primipara (coded as 1) and multipara (coded as 2). The

history of LBP during their menstrual cycle was taken and if yes coded as 1 and if no was coded as 2. The history of LBP during their pregnancy was taken and if yes coded as 1 and was coded as 2. The history of sciatica symptoms during their pregnancy was taken and if yes coded as 1 and if no was coded as 2. Further the participants who met the inclusion and exclusion criteria were asked to fill WHOQOL-BREF questionnaire and participants with sciatica symptoms were rated their symptoms bothersome on the scale of Sciatica Bothersomeness index.

**Statistical analysis**

**SAMPLE SIZE ESTIMATION**

**Sample size**: 812

Sample size was obtained based on the prevalence of sciatica during pregnancy which was 17%.

Sample size was calculated based on the formula,

$n = 4pq/L^2$

Where, n = sample size

p = prevalence rate

q = 1-p

L= allowance of error According to the formula.

At allowable error of 10% Sample size worked out to be 812

## RESULTS

A total of 812 pregnant women who registered in the Department of Obstetrics and Gynecology were included in the study (100 % participation). The participants were aged 18 to 35 with a mean age of 25.43 (SD=3.65). Demographic characteristics of all the 812 pregnant women in their third trimester are presented in TABLE1 and TABLE 2.

Table1 depicts the descriptive characteristics of the subjects who took part in the study. It represents the frequency and percentages of age group 18-23 years (coded as 1), 24- 29 years (coded as 2), 30-35 years (coded as 3) was 279 (34.4%), 423 (52.1%), 110 (13.5%) respectively. BMI was calculated and was represented in 3 categories 18 - 24.9kg/m2 (coded as 1), 25-29.9kg/m2 (coded as 2), 30-34.9kg/m2 (coded as 3) and their frequency, percentages were 287 (35.3%), 423 (52.1%), 110(13.5%) respectively. Occupational status of the pregnant women in the study was represented as working (coded as 1) and non-working (coded as 2), and found out to be 214 (26.4%) and 598 (73.6%) respectively. Parity of the subjects in the study was represented as primipara (coded as 1) and multipara (coded as 2) and found out to be 439 (54.1%) and373 (45.9%) respectively. The pregnant women participated in the study were in their third trimester of the pregnancy (812, 100%). The history of LBP during their menstrual cycle was taken. It was found out to be that 226 (27.8%) of the total participants complained of LBP in their menstrual cycle whereas 530 (72.2%) did not complain of LBP in their menstrual cycle. The history of LBP during their pregnancy period was taken was found to be that 282 (34.7%) of the total participants complained of LBP during their pregnancy whereas 530 (67.3%) did not complain LBP in pregnancy period. The history of sciatica symptoms during pregnancy was taken and was found out that 137 (16.9%) of the total participants complained of sciatica symptoms whereas 675 (83.1%) did not complain of sciatica symptoms during their pregnancy period.

Table 2 depicts the prevalence of sciatica with their percentage in pregnant women which showed 16.9% of the total participants had the symptoms of sciatica.

Table 3 depicts the association of age, BMI, occupation, parity, MC-LBP, PR-LBP with the sciatica. This was done using the chi-square test where the p-value was less than 0.05. The results showed that there was significant association of all the age groups with sciatica (z=6.756, p=0.034). There was also significant association of all categories BMI with sciatica (z=13.501, p=0.001) There was significant association of MC-LBP with sciatica (z=31.561, p=0.0001) There was a significant association of PR-LBP with sciatica

(z=136.773, p=0.001). But the results showed no significant association for occupation (z=2.150, p=0.088), trimester (z=0.407, p=0.691), parity (z= 0.908, p = 0.195) with sciatica.

Table 4 shows the comparison of domains of WHOQOL-BREF scores between the sciatica and non-sciatica pregnant women. This was done by using Mann-Whitney U test.

**Table 1: Descriptive Characteristics of Subjects during Pregnancy [All Women (N =812)]**

| Variables | Frequency (%) | Mean(Sd) |
|---|---|---|
| **AGE(years)** | | 25.43(3.65) |
| 18-23 | 279(34.4%) | |
| 24-29 | 423(52.1%) | |
| 30-35 | 110(13.5%) | |
| **BMI(kg/m2)** | | 26.14(2.54) |
| 18-24.9 | 287(35.3%) | |
| 25-29.9 | 464(57.1%) | |
| 30-34.9 | 60(7.5%) | |
| **OCCUPATION** | | |
| Working | 214(26.4%) | |
| Non-working | 598(73.6%) | |
| **PARITY** | | |
| Primipara | 439(54.1%) | |
| Multipara | 373(45.9%) | |

**Table 2: Descriptive Characteristics of Subjects during Pregnancy [All women (n =812)]**

| Variables | Frequency (%) | MEAN±SD |
|---|---|---|
| **TRIMESTER** | | |
| Third | 812(100%) | |
| **MC-LBP** | | |
| Yes | 226(27.8%) | |
| No | 530(72.2%) | |
| **P-LBP** | | |
| Yes | 282(34.7%) | |
| No | 530(65.3%) | |
| **SCIATICA** | | |
| Yes | 137(16.9%) | |
| No | 675(83.1%) | |

BMI: Body mass index, MC-LBP: Menstrual cycle low back pain, P- LBP: Pregnancy low back pain

**Table 3: Prevalence of Sciatica in Pregnant Women (N= 812)**

| Variables | Sciatica | % | No sciatica | % |
|---|---|---|---|---|
| **Sciatica** | 137 | 16.9% | 675 | 83.1% |

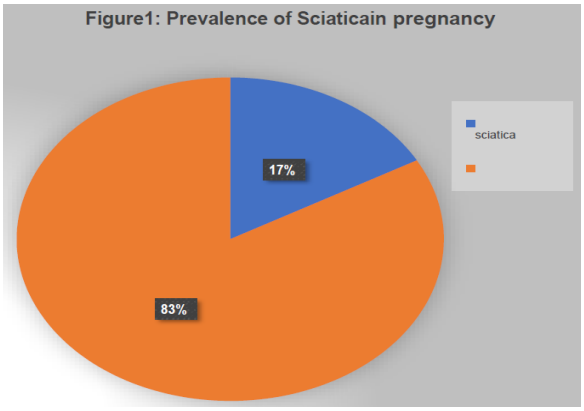


**Table 4: Association of Age, BMI, Occupation, Parity, MC-LBP, P-LBP with Sciatica (n=812)**

| Variables | Sciatica | | No sciatica | | Total | | Chi- square | P-value |
|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | | |
| **AGE (years)** | | | | | | | | |
| 18-23 | 42 | 15.1 | 237 | 84.9 | 279 | 100 | | |
| 24-29 | 67 | 15.8 | 356 | 84.2 | 423 | 100 | 6.756 | 0.034* |
| 30-35 | 28 | 25.5 | 82 | 74.5 | 110 | 100 | | |
| **BMI (kg/m$^2$)** | | | | | | | | |
| 18.5-24.9 | 51 | 17.8 | 236 | 82.2 | 287 | 100 | | |
| 25-29.9 | 66 | 14.2 | 398 | 85.8 | 464 | 100 | 13.501 | 0.001* |
| 30-34.9 | 20 | 32.8 | 41 | 67.2 | 61 | 100 | | |
| **Occupation** | | | | | | | | |
| Working | 43 | 20.1 | 171 | 79.9 | 214 | 100 | 2.150 | 0.088 |
| Non-working | 94 | 15.7 | 504 | 84.3 | 598 | 100 | | |
| **TRIMESTER** | | | | | | | | |
| Third trimester | 137 | 16.9 | 675 | 83.1 | 812 | 100 | 0.407 | 0.691 |
| **PARITY** | | | | | | | | |
| Primipara | 69 | 15.7 | 370 | 84.3 | 439 | 100 | 0.908 | 0.195 |
| Multipara | 68 | 18.2 | 305 | 81.8 | 373 | 100 | | |
| **MC-LBP** | | | | | | | | |
| Yes | 65 | 28.8 | 161 | 71.2 | 226 | 100 | 31.561 | 0.001* |
| No | 72 | 12.3 | 514 | 87.7 | 586 | 100 | | |
| **P-LBP** | | | | | | | | |
| Yes | 107 | 37.9 | 175 | 62.1 | 282 | 100 | 136.77 | 0.001* |
| No | 30 | 5.7 | 500 | 94.3 | 530 | 100 | | |

Table 4 shows association of age, BMI, MC-LBP and P-LBP. There was statistical significance with $x^2$ (n=812) =6.756, 13.501, 31.561 and 136.773, p < 0.05

**Table 5**: **Difference between the WHO-QOL BREF Domain among Sciatica and Non-Sciatica Pregnant Women:**

| Variable | Median (IQR) | U – value | z-value | p-value |
|---|---|---|---|---|
| Physical domain<br>Sciatica<br>Non-Sciatica | 63<br>(50-69) | 40270.50 | -2.405 | 0.016* |
| Psychological domain<br>Sciatica<br>Non-Sciatica | 56<br>(50-69) | 42238.00 | -1.612 | 0.107 |
| Social domain<br>Sciatica<br>Non-Sciatica | 69<br>(50-81) | 46154.50 | -0.033 | 0.973 |
| Environmental Domain<br>Sciatica<br>Non-Sciatica | 63<br>(50-69) | 46180.00 | -0.023 | 0.982 |

Mann-Whitney U test was conducted to compare the domains of WHOQOL-BREF score. Physical domain showed significant difference among the sciatica and non-sciatica pregnant women with p-value 0.005

**Table 6: Sciatica Symptoms Bothersomeness Scores Of Pregnant Ladies Who Experienced Sciatica**

| Sciatica Symptoms | Low score (%) | Medium score (%) | High score (%) |
|---|---|---|---|
| **Leg pain** | 21 (15.32) | 73 (53.28) | 43 (31.38) |
| **Tingling and numbness in foot** | 53 (38.68) | 61 (44.52) | 23 (16.7) |
| **Weakness in the leg or foot** | 81 (59.12) | 49 (35.76) | 7 (5.109) |
| **Back or leg pain while sitting** | 36 (26.27) | 66 (48.17) | 36 (26.27) |

## DISCUSSION

Pregnant women who reported to the SDM Medical Hospital, out of them according to the inclusion and exclusion criteria 812 were selected for the study out of which 137 pregnant women reported with sciatica during the pregnancy period and 677 women with no pain.

When the prevalence of sciatica during pregnancy in this part of Karnataka was consideredas16.9%when compared to women with no sciatica (83.1%). Despite some studies of other countries which have reported 17% to 22% sciatica symptoms during pregnancy. As the prevalence rate was like the other studies done, we can conclude that in this part of Karnataka, more or less same percentage of pregnant women were affected by the sciatica.

This study reports the prevalence of sciatica in pregnancy and its impact on QOL amongst a sample of pregnant women drawn from the study done. Our analysis supports the findings from the previous research showing a substantial percentage of women suffer from sciatica during their course of pregnancy. For sciatica, the prevalence rates are mostly in line with the previous research.

A study done, estimated that almost all pregnant women experience some degree of musculoskeletal discomfort and 25% have at least for the time being disabling symptoms. Various physiological changes during normal pregnancy are likely to give rise to musculoskeletal symptoms and thus it becomes important to be aware of various musculoskeletal problems seen during pregnancy.

Our findings regarding the prevalence of sciatica in pregnant ladies was found to be 16.9% which is similar to the previous research reported that 17% to 22% of pregnant women experience sciatica during pregnancy. Our finding reported there is association of BMI with sciatica in pregnancy. Study done to know the pregnancy in patients with the low back pain reports that there is about10-12kg weight gain is expected during the pregnancy. Weight gain also causes extra pressure on spine leading to back pain. Another study, reported that weight gaining during pregnancy causes an increase in the axial loading of spine leading to decrease in the height of intervertebral disc along with increased body pressure leading to compression of spine and thus causing prolonged pain in pregnancy. Another study

done know the "influence of some biomechanical factors in pregnancy which may lead to LBP" reported that increase in load on the back due to the total weight gain during pregnancy and weight of foetus causes low back pain.[11,21,22] A study done to know low back pain during pregnancy reported some risk factors related to LBP during pregnancy which included LBP during menstrual period and regarding age, it is known that the younger the patient, the greater chance to develop PR-LBP, and due to increased weight which results in SIJ instability. In addition to increased spinal flexibility and consequent onset and worsening of LBP. Another study done to know previous back pain and risk of developing back pain in a future pregnancy reported that history of back pain was an important factor when predicting back pain and pain intensity in future pregnancy and the number of previous pregnancies and the age of the women are less important but were still risk factors. The older women have more pregnancies than younger women. There was a correlation between multiparity and age; women older than 29years of age always have gone through more pregnancies than women younger than 29 years of age.22,23 In pregnancy, musculoskeletal response to shifting COG, weight gain and hormonal factors are responsible for ligament us relaxation and changes in pelvic joints. Due to these responses, it has been reported that back pain is seen in pregnant women in around 50 to 76 % of all the total pregnant women. The gravid uterus approximately weighs around 1100 grams to be added to the average infant birth weight of 3000-3600 grams. This causes direct pressure on the nerve roots and ischemia of neural elements due to uterine pressure on aorta and vena cava when lying down on back may result in back pain with radiation to the lowerextremities.[24] A review done, to know upon LBP management practices in pregnancy explained low back pain in pregnancy can be of two types pelvic girdle pain and lumbar pain. PGP is more common of the two and represents clinically as deeps tabbing continuous or recurrent pain, which can unilaterally or bilaterally. The LBP can be caused due to the hormonal changes that constitute the following changes. As there is a rise in hormone relax in which not only causes ligament laxity but may also be responsible for the generalized is comfort in SIJ as well as in lumbar area. Another theory that explains the pain experienced during night is compression of inferior Vena cava by expanding uterus, which leads to the pelvic compression in pregnancy and if there is no evidence of disc degeneration then other rare causes of sciatica may be considered.[2,12,21,25,26.] Pelvis bone functions in transferring the loads generated by body weight and gravity during daily routine activities and this function is more important during pregnancy as the body weight increases by10kgsin40weeks. There is a forward tilting of pelvis which progresses throughout the pregnancy. The SIJ in women, is small and flat, combined with hormonal weakening of ligament and symphysis during pregnancy, may also lead to the SIJ instability and pain. Besides failed load transfer through the lumbopelvic region due to pelvic malalignment can cause LBP or loss of urethra closure and stress in continence and accordingly these changes significantly reduce QOL for many pregnant women. [7] Isolated LBP is seen 24% to 90% of cases and it occurs approximately twice a soften in women who have previously been pregnant.

Our study results show that QOL is affected during pregnancy in the component of physical domain. A study to know HR-QOL during pregnancy was carried out to evaluate the QOL of pregnant women with full term birth from the first trimester to 9th month reported that in the field of Gynaecology and Obstetrics, several studies suggest that the QOL in pregnant women depends on socioeconomic, medical and psychological factors. Poor QOL during course of pregnancy is associated with an increased risk of preterm labor and intrauterine growth restriction. The results

stated that QOL decreased significantly over time during the course of pregnancy providing the clinicians with a simple and objective representation of modifications of wellbeing perception during pregnancy which helps in paying attention to all components of QOL (mental, physical, social and economic health) and to risk factors that are predictive of a poor QOL, which might lead to adverse obstetrical outcomes. Another study to know the impact on QOL and physical ability of PR-LBP in third trimester of pregnancy reported that many pregnant women have reported that PBP not only compromises their ability to work during course of pregnancy but also interferes with their daily routine activities and HR-QOL. In last trimester of pregnancy physical ability decreases and women with PR-LBP is even more limited in routine activities of daily living. A study reported that the quality of life during the pregnancy with sciatica symptoms was affected and they seek the professional help.[30,31,9]

Hence, we can conclude that the prevalence rate of sciatica during pregnancy is 16.9% among the 812 subjects participated in the study. We can say that sciatica is a symptom caused by multifactor because of the changes which occur during the pregnancy. It may or may not be associated with LBP. As the pregnancy progresses the QOL in pregnant women may or may not be affected due to discomfort that is experienced due to pregnancy related musculoskeletal symptoms likes sciatica. Isolated LBP is seen 24% to 90% of cases and it occurs approximately twice as often in women who have previously been pregnant.

**Limitations**

- Interpretation of the study results is limited because data is based on self-reports.
- Small sample size.
- Physical activity of the pregnant women participated was not reported.
- Study did not measure any dynamic changes that were occurring due to pregnancy which could give objective method to state the changes and relate the cause and symptom.
- The samples for this study were recruited from only one hospital.

**Future scope of the study**

- Second trimester pregnant women can be included for the study.
- Effective methods of management of sciatica in pregnancy can be studied
- Large sample size can be studied
- Multi-centered study must be conducted so that the results can generalized to a larger population.

## CONCLUSION

We can conclude that the prevalence rate of sciatica during pregnancy is 16.9% among the 812 subjects participated in the study. Sciatica is a symptom caused by multifactor because of the changes which occur during the pregnancy. It may or may not be associated with LBP. As the pregnancy progresses the QOL in pregnant women may or may not be affected due to discomfort that is experienced due to pregnancy related musculoskeletal symptoms like sciatica.

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**Ethical Approval:** Approved

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