

# Effect of Muscle Energy Technique along with Segmental Stabilization Exercise on Pain, Range of Motion and Function in Subjects with Chronic Mechanical Low Back Pain A Randomized Clinical Trial

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## ABSTRACT

**Background & purpose:** Mechanical low back pain most commonly occurs due to prolonged sitting or forward bending. Muscle Energy Technique (MET) and Segmental Stabilization Exercise (SSE) are one of those Physiotherapeutic techniques which can be used in clinical set up to relieve the symptoms of mechanical low back pain. The purpose of the study was to find out the effect of muscle energy technique along with segmental stabilization exercise on chronic mechanical low back pain.

**Subjects and methods:** Thirty four (n = 34) subjects were randomly assigned into 2 groups. Subjects in Group-A (n=17) were treated by muscle energy technique (MET) along with segmental stabilization exercise (SSE), moist hot pack and subjects in Group-B (n=17) were treated by segmental stabilization exercise and moist hot pack. Numerical pain rating scale (NPRS), Modified-modified Schobers test (MMST) and Oswestry Disability Index (ODI) was measured at pre and post intervention level.

**Result:** Data analysis revealed statistical significant improvement after 10 sessions of intervention in all outcome parameters. But between group comparison showed non-significant result for active flexion range of motion of lumbar spine (p value >0.05).

**Conclusion:** This study revealed that MET with SSE has a significant effect in improving pain and functional status. However, they do not have significant effect on lumbar spine flexion ROM in subjects with chronic mechanical low back pain.

**Keywords:** MET, SSE, MMST, NPRS, ODI.

## INTRODUCTION

Low back pain (LBP) is characterized by slowly or suddenly occurring pain with or without radiation to the buttock or down the lower leg which may or may not be associated with concomitant restriction in range of motion. [1] LBP is the second most common reason for absenteeism from work and a more frequent use of health services and work leave entitlements. [2] It is estimated that 70-80% of adults may have an episode low back pain at least once in their lifetime. [3] Low back pain is one of the most common musculoskeletal conditions worldwide, with a lifetime prevalence of 80-85%. [4] LBP pain that is exacerbated by mechanical movements (e.g. prolonged sitting or forward bending) is usually predominantly nociceptive in nature, is referred as mechanical low back pain (MLBP). Mechanical low back pain varies with physical activities (e.g. prolonged sitting or forward bending) and with time. [5] Only 15% of low back pain has an identifiable cause while the rest of the 85% is non-specific low back pain. [6] The characteristic features of the mechanical low back pain are ache, tension or stiffness in the back, weakness of core muscles. The pain over the low back region can be triggered by sitting in poor posture, not maintaining proper ergonomics during work or incorrect lifting of heavy weight. [7]

When a healthy subject begins to bend forward the erector spinae (ES) muscle contracts powerfully to control the movement and then suddenly relax completely to achieve full flexion. In mechanical low back pain erector spinae fails to relax completely during flexion, this leads to failure in achieving the full spinal flexion range of motion. Each vertebra needs stiffness and stability to work effectively to reduce degeneration of joint structures. [8] The core serves as the muscular corset that works as a unit to stabilize the body and the spine with or without limb movement. Transversus Abdominis (TrA) provides support for the abdominal wall and has vital role in maintenance of posture, allows for trunk movement (flexion, extension, lateral flexion) and also responsible for raising intra-abdominal pressure. Lumbar Multifidus (LM) provides a stiffening effect on the lumbar spine through its attachment to the thoracolumbar fascia and works to provide joint stabilization at each segmental level. Poor core muscles stability increases the stress along with the risk of injury to supporting structures of spine and develops low back pain. [9]

There are several treatment approaches for low back pain which includes: patient education, lifestyle modification, medication, electro-physical agents, exercises etc. [1] Various physiotherapeutic measures are available to treat chronic mechanical low back pain such as therapeutic modalities, exercise involving neuromuscular re-education, resistance training and manual therapy (myofascial release, muscle energy technique (MET) and strain-counter strain technique etc.). [10] Muscle energy technique (MET) is a versatile technique traditionally used to address muscular pain, joint dysfunction, improve range of motion (ROM) and increase strength of muscle. [11] Muscle energy technique such as post isometric relaxation stretch has been used to lengthen a shortened or contracted muscle. [12] According to current evidence-based clinical guidelines, the mechanical low back pain is treated with training on specific muscles of the lumbar spine such as LM and TrA. [13] These muscles are involved on segmental

  
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are very few literature evidences which compare the effect of muscle energy technique along with segmental stabilization exercise and segmental stabilization exercise alone in subjects with chronic mechanical low back pain. Therefore this study was designed to determine the effect of the Muscle energy technique (MET) along with segmental stabilization exercise (SSE) and segmental stabilization exercises alone on pain, range of motion and function in subjects with chronic mechanical low back pain.

#### MATERIAL AND METHODS:

This study was performed at National Institute for Locomotor Disabilities (Divyangjan), Kolkata, India. Approval of Institutional Ethical Committee (IEC) was taken before commencement of the study. The subjects of age group between 20-45 (both male and female population) with complaint of low back pain from previous three months and having pain intensity at NPRS between 3 to 8 were included in this study. Subjects with low back pain with unilateral/bilateral radiations (e.g. sciatica, disc herniation, canal stenosis), lower limb and spinal structural deformity (scoliosis, spondylolisthesis etc), fracture of lumbar spine or pelvis, any history of spinal surgery (e.g. laminectomy, discectomy), infectious disease of spine (TB), Ankylosing Spondylitis, Rheumatoid arthritis, Transverse myelitis, Pre-diagnosed cardio respiratory diseases or neurological disorders (stroke, SCI etc), red flag sign including thoracic pain, previous history of carcinoma, tumor and steroid injection (in last 3 month), psychiatric disorders or unco-operative subjects were excluded from this study.

70 subjects with chronic MLBP were approached with proposal of this study. Out of 70 subjects 19 subjects were excluded and 10 subjects were not willing to participate. 41 subjects who met the inclusion criteria were explained in detail in their preferred language about the study. Written informed consent in their preferred language was taken from subjects who agreed to participate. The subjects were randomly allocated into two groups by cheat picking method. Subjects in Group A (n=20) were treated by Muscle Energy Technique along with Segmental Stabilization Exercise. Subjects in Group B (n=21) were treated by Segmental Stabilization Exercise alone. Seven (07) subjects (Group-A=03; Group-B=04) were dropped out from this study and were excluded from analysis as shown in consort flow diagram (Figure-01).

#### Outcome Measures:

Pain intensity after activity was measured by Numerical Pain Rating Scale (NPRS), active spinal flexion range of motion by Modified Modified Schobers Test (MMST) and functional status was measured by Oswestry Disability Index (ODI) at pre-intervention and after 10 sessions (5 sessions per week for 2 weeks) of intervention.

The 11-point NPRS was used to assess the subject's self-reporting pain intensity after activity. The NPRS was administered verbally or graphically for self completion. The subjects were asked to indicate the numeric value from 0-10 points on the segmented scale which best described their pain intensity. Higher score indicated greater pain intensity.<sup>[15]</sup>

To measure the active Spinal flexion ROM by MMST, the subject stood erect; arms at side, with feet placed apart on the floor. The therapist stood behind the subject and identified the posterior superior iliac spines (PSIS) by marking the PSIS of both sides. Then a body mark on the midline of the spine horizontal to PSIS was made and another mark on the spinous process 15 cm superior to the PSIS line was made. Then the subject was instructed to bend forward as far as they can (within pain free range) while keeping their knee straight. After reaching forward bent position, the new distance between the superior and inferior skin marking was measured again.<sup>[16]</sup> Oswestry Disability Index is an extremely important tool used by researcher to measure a subject's functional disability with low back pain. The test is considered the 'gold standard' of low back functional outcome tools. The ODI is comprised of 10 items related to ADL like walking, standing, sitting, sleeping, lifting, etc. with associated statements for the subject to select their ability to manage their everyday life while dealing with pain. Each 10 items in the ODI has 6 statements from which the patients were requested to select one.<sup>[17]</sup> For each section total possible score was 5. The points obtained were added in each section and the level of disability was calculated by the following formula:

$$\frac{\text{Subject Score}}{\text{Number of sections completed} \times 5} \times 100 = \% \text{ of disability}$$

#### INTERVENTIONS:

All subjects in Group-A and Group-B had received moist hot packs (MHP) over the paraspinal area for 15 minutes prior to exercise and home exercise program were demonstrated to all of them by the primary investigator.<sup>[18][19]</sup> All the subjects in Group-A were treated with Muscle energy technique along with segmental stabilization exercise. Muscle energy technique was performed in the form of post-isometric relaxation technique for erector spinae muscle. The contraction was held for 7-10 seconds and relaxed for 2-3 seconds. Appropriate breathing instructions were given. After that, on exhalation, the trunk was taken very slightly beyond the restriction barrier and was held there for 10-30 seconds.<sup>[20]</sup>

All subjects in Group-B were treated by segmental stabilization exercise. SSE of Transversus Abdominis (TrA) and Lumbar Multifidus (LM) muscle was taught to the subject by using pressure biofeedback unit (PBU). Details of SSE and its progression were given in Table-01.<sup>[21]</sup> These procedures were repeated 3 times per session for 10 sessions (5 sessions per week for 2 weeks). Ergonomic advice was explained to all the subjects in Group-A and Group-B.<sup>[22]</sup>

#### Statistical Analysis:

Statistical analysis was performed using Statistical Package for Social Science (SPSS) version 28. In demographic data, nominal level of data was analysed by non-parametric test using Chi Square Test; ordinal, interval or ratio level of data was analysed by parametric test using Independent Sample T test. For outcome measures, within group difference were analysed by using Paired Sample T-test and between group differences were analysed by using Independent Sample T Test. The tests were applied at 95% confidence interval with a value set at 0.05. For level of significance P value was set to below 0.05 to be considered as significant difference.

#### RESULTS:

The age and gender distribution and pre-intervention data of all outcome parameters (n=34) in both the groups were statistically insignificant (p>0.05) which was indicative of the homogeneous nature of the data (Table-02). Intra-group comparison revealed significant statistical difference (p< 0.05) in respect to pain intensity (NPRS), active flexion range of motion of lumbar spine (MMST) and functional status (ODI) in both Group-A and Group-B (Table-03). In inter-group comparison, Group-A showed

  
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**DISCUSSION:**

This study was aimed to find the effect of muscle energy technique along with segmental stabilization exercise and segmental stabilization exercise alone on pain, range of motion and function in subjects with chronic mechanical low back pain. Both the groups showed significant improvement in pain intensity, active spinal flexion ROM and functional status after 10 sessions of treatment. This study showed that subjects in Group-A had more significant improvement in respect to pain intensity and functional status than Group-B after 10 sessions of treatment. But non-significant difference was found in active spinal flexion ROM in Group-A as compared to Group-B after 10 sessions of treatment.

Failure of relaxation of erector spinae muscle during lumbar flexion (Flexion Relaxation Phenomenon) may lead to abnormal strain to erector spinae muscle which causes development of low back pain. [23] MET of erector spinae muscle was performed by using post isometric relaxation (PIR) procedure which may stimulate the stretch receptors of Golgi Tendon Organ (GTO) of erector spinae muscle after the isometric contraction that resulted in activation of both muscle and joint mechanoreceptors. [24] This leads to sympathetic excitation of nociceptive large diameter afferent fiber and resulted in activation of the periaqueductal gray (PAG) which plays an important role in descending modulation of pain by sending the inhibitory stimulus to dorsal horn of the spinal cord. This effectively closes the spinal gate to the cerebral cortex and decreases the sensation of pain. This mechanism is known as 'Pain gate control theory'. [25] This study supports the findings of El-Bandrawy A.M et al (2014), who concluded that Muscle energy technique is an effective and safe method in alleviating postnatal low back pain because MET may help in repositioning a dysfunctional joint and treat the affected muscle along with voluntary isometric contraction of MET may improve the neuromuscular control and reduce the low back pain. [18]

By using pressure biofeedback unit, low load exercises of transversus abdominis and lumbar multifidus may help in restoring the recruitment order of core muscle. That may result in generation of muscle response pattern to activate and promote the co-ordinate action of the spinal muscles, provide mechanical stability and improve recruitment order. Thus in turn SSE helped in reducing the compressive load on spine which might have led to reduction of pain intensity. [19] According Hodges (1999) and Morris et al (1961), the activation of TrA may develop rise in intra abdominal pressure within the abdominal cavity which creates a distraction of the lumbar spine which may result in decrease in the compressive load on it and so pain decreases. [26]

When PIR was given to agonist muscle i.e. to the erector spinae muscle, it may cause increase in extensibility of agonist muscle by inducing 'reflex relaxation' of that muscle caused by presynaptic inhibition and 'autogenic inhibition' of Golgi tendon organ which inhibit the activation of alpha motor neuron. [27] Also in MET muscle was taken into extreme lengthened position which may lead to increase in myofascial tissue extensibility that may be due to viscoelastic phenomenon. [28] The Golgi tendon inhibitory reflex is activated by isometric contraction and relaxation of the muscle may be induced by passive lengthening of that muscle, thus MET can decrease the overall stiffness and increase in flexion ROM of lumbar spine. [29] This study supports the findings of Sewani R. et al (2017), who concluded that MET not only increases ROM of joints but also increases extensibility of muscle by means of a mechanism expressed as "increased tolerance to stretch". [30]

Weakened muscles may cause mechanical irritation to pain sensitive structures which may be responsible for reduction of lumbar flexion ROM. The contraction of TrA and LM in SSE that may strengthen the deep trunk muscle, induce normal joint loading and enhance lumbar stability by maintaining spinal balance. [31] Bhaduria E. et al (2017) concluded that the lumbar stabilization group proved to be more effective form of exercise on improving lumbar flexion ROM than the dynamic strengthening groups, and the Pilates group due to improvement of strength and endurance of deep trunk muscles and also improve the control and co-ordination of deep trunk muscles. [32]

In MET of erector spinae muscle, passive lengthening followed by isometric contraction may help in improving proprioceptive feedback and recruitment of motor units in erector spinae muscle. This leads to improvement of pain and flexion ROM of lumbar spine in subject with LBP. Thus MET of erector spinae muscle reduces the functional limitation of life. [33]

While training the deep trunk muscles with SSE improves the activation of motor control mechanism and improvement of coordination of trunk muscles. [34] Thus SSE improves ROM of lumbar spine and reduces pain around the low back area. This results in improvement of quality of life and reduces the functional limitation. Kapetanovic A. et al (2016) concluded that segmental stabilization exercise was an effective method in improving pain and functional disability due to restoration of the motor control of deep trunk muscle and reduction of pain may improve the functional disability. [35]

So, in this study MET along with SSE was more effective in reduction of pain and improvement of functional status than SSE alone in subjects with chronic mechanical low back pain. But MET along with SSE could not effectively increase lumbar spine flexion ROM as compared to SSE alone.

**CONCLUSION:** The result of this study showed that MET along with segmental stabilization exercise had a significant effect in improving pain and functional status as compared to segmental stabilization exercise alone but MET along with segmental stabilization exercise does not have significant effect on lumbar spine flexion ROM as compared to segmental stabilization exercise alone in subjects with Chronic Mechanical low back pain.

**LIMITATIONS:** This study has small sample size and short period of intervention. No follow up was included in data analysis. The therapist was not blinded so it was single blinded and true control group was absent in this study. It was a single centre study.

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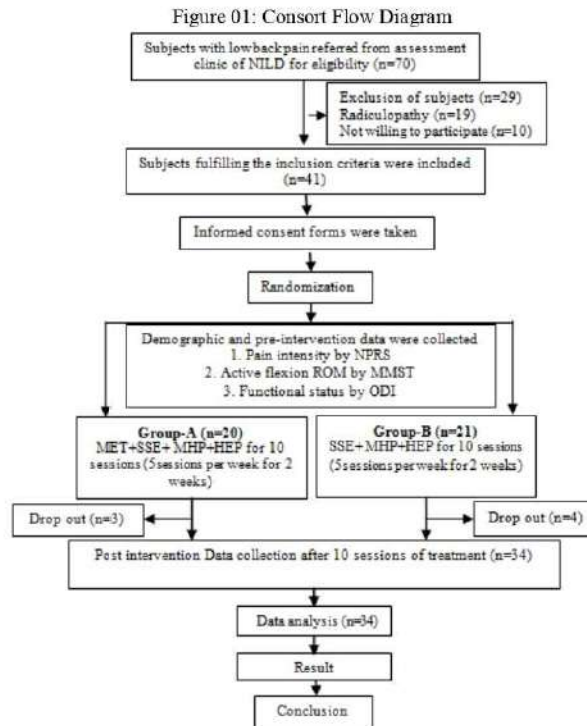


Table-01: SEGMENTAL STABILIZATION EXERCISE EXERCISE

I. Local Segmental Stabilization Exercise with PBU for TrA
II. Local Segmental Stabilization Exercise with PBU for L.M.
III. Closed Chain Segmental Control (CCSC) with PBU
IV. Open Chain Segmental Control (OCSC) with PBU And Progression Into Function

TABLE-02: DEMOGRAPHIC AND PRE-INTERVENTION DATA

	Group-A (n=17) (Mean± SD)	Group-B (n=17) (Mean± SD)	t-Value	P-Value
Age	32.00 ± 8.75	32.35 ± 7.25	-0.12	0.89
Male/Female	06/11	10/07	(χ <sup>2</sup> -value) 1.88	0.16
NPRS <sub>0</sub>	06.11± 0.85	06.70 ± 0.91	-1.92	0.063
MMST <sub>0</sub>	05.33 ± 0.87	05.38 ± 0.79	-0.16	0.871
ODI <sub>0</sub>	52.06 ± 7.94	54.06 ± 9.25	-0.67	0.504

Table-03: INTRA-GROUP & INTER-GROUP COMPARISON

	Group-A (n=17)			Group-B (n=17)			INTER-GROUP
	Pre-intervention	Post-intervention	p-Value	Pre-intervention	Post-intervention	p-Value	p-Value
NPRS	06.11 ± 0.85	01.88 ± 1.36	0	06.70 ± 0.91	03.41 ± 1.58	0	0.005
MMST	05.33 ± 0.87	06.41 ± 0.73	0	05.38 ± 0.79	06.41 ± 0.83	0	1.00
ODI	52.06 ± 7.94	27.24 ± 5.44	0	54.06 ± 9.25	33.94 ± 8.62	0	0.01

  
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# A Qualitative Study on Awareness of Hearing Health, Hearing Impairment and Intervention among Pregnant Women and Mothers of Newborn in Rural Khordha District

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## Abstract

**Background & Objectives:** The study was aimed to investigate the awareness regarding hearing health, causes and prevention measures for hearing disability at natal stages and awareness regarding the intervention among the pregnant women and mothers of newborn in rural areas. **Subjects & Methods:** Information from 51 pregnant women and 105 mothers of newborn living in rural areas were gathered via help of hospitals, nursing homes and maternity care. **Results:** Mothers of newborn were more aware with respect to the pregnant women however both the groups could not achieve 100% awareness in any of the selected parameters. Two-way ANOVA was suggesting  $p < 0.0001$ , a statistically significant difference between mothers of newborn and pregnant women for awareness of hearing health, causes and prevention of natal stages as well as for intervention. Post hoc analysis was done using unpaired t test by applying bonferroni correction in order to check which of the selected parameters are significantly differ from each other  $p < 0.01$ . Suggesting a significant difference for all the selected parameters for mothers of newborn and pregnant women. The obtained p value is 0.0001, suggesting a significant difference of selected parameters among pregnant women and mothers of newborn. **Conclusion:** It's very much important to utilize the existing knowledge of the mothers and pregnant women by attempting to bridge the gaps in acquiring information regarding the awareness of hearing impairment in children which can be done only by creating the awareness and spreading adequate information regarding hearing disability.

**Keywords:** Hearing health; Hearing impairment; Newborn; Prevention; Natal stages; Intervention

## Introduction

According to WHO, 5% of the world's population (466 million people) are having hearing disability out of which 34 million children are with disabling hearing loss. [1,2] Although it's not possible to prevent all cases of hearing loss in infants but early and consistent information regarding the awareness regarding hearing health, causes and prevention measures for hearing disability along with the intervention taken by pregnant women and mothers of newborn during the pre to postnatal stage, can be a leading source for reducing the occurrence of hearing impairment in newborn especially in rural as well as urban parts of low and middle-income countries.[3]

Incident of hearing impairment was found to be 0.6% in rural and 0.4% in urban parts of Odisha followed by 28.45% prevalence rate of hearing disability since birth. [4] However, there are less evidence regarding the awareness of hearing impairment in children among the mothers of newborn and pregnant women in Odisha and lack of literature and documents can lead to

was implemented to provide a record for awareness of hearing impairment in children amongst the mothers of newborn and pregnant women.

## Aim and Objective


To determine the awareness of causes and prevention of hearing impairment, hearing health and intervention among pregnant women and mothers of newborn.

## Materials and Methods

A cross sectional study was conducted among 156 sample comprising both the pregnant women and mothers of newborn residing in rural areas, collected from 5 panchayat (25 villages) of Khordha district of Odisha, who had visited and being

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treated at govt. and private hospitals, maternity home and nursing homes over a period of 6months *i.e.*, from July 2019 to January 2020. Participants were selected through purposive sampling. All the participants were divided into two groups consisting 51 pregnant women considered as group I and group II consisting 105 mothers of newborn. The inclusion criteria for pregnantwomen were considered to be the time period from conceived to 9 months while for mothers of new born was after delivery to 6months. Beyond this considered time period for both the group was regarded as an exclusion criteria.

An ethical approval consent was taken from the higher authority of selected hospitals and other setups. A survey was done by visiting the hospitals and maternity homes to get information regarding the pregnant women and mothers of newborn, who have visited them. Once the information was documented, an approach was made to all the participants to participate in the survey. All the interested participants were introduced with the aims and the objectives of the study and a written consent and permission was sought from them.

A close ended questionnaire was used to obtain responses from pregnant women and mothers of newborn from different hospitals and maternity care homes after the due permission granted from the setup. A close ended questionnaire and a small survey was taken into consideration as strategy for data collection.

The questionnaire relevant to awareness regarding hearing health, causes and prevention of hearing disorder during

prenatal, perinatal and postnatal stage and awareness for the intervention were considered in case of a hearing impaired child, was constructed by investigators and validated by 5 ASLPs. The questionnaire was initially developed in English which was further translated into Odia language by native Odia speaker and then back translated along with proofread in order to ensure that the meaning of the content remains the same. The duly filled questionnaire from the participants of the groups were collected and their responses were noted down which were further compiled for statistical analysis.

The recorded data were documented in Microsoft excel 2018 and analyzed using Statistical Package for Social Sciences (SPSS) version 18.0.0. Mean  $\pm$  SD were used to summarize the overall score of both the groups. Each factor under every under selected parameters were calculated in the form of percentile score. In order to determine the effects of selected parameters,two-way ANOVA was applied andpost hoc analysis using unpaired t test was used to check the difference between subgroups.

## Results

The information was collected from 51 pregnant women in group I and 105 mothers of newborn in group II. The mean age range of pregnant women wasfound to be 24.2 years. Mothers of newborn have an average age range of 26 years. The demographic details of subjects participated in the study were given in terms of educational qualification and gross annual income. More than 50% of the participants (both mothers of new born and pregnant women) surveyed were well educated,

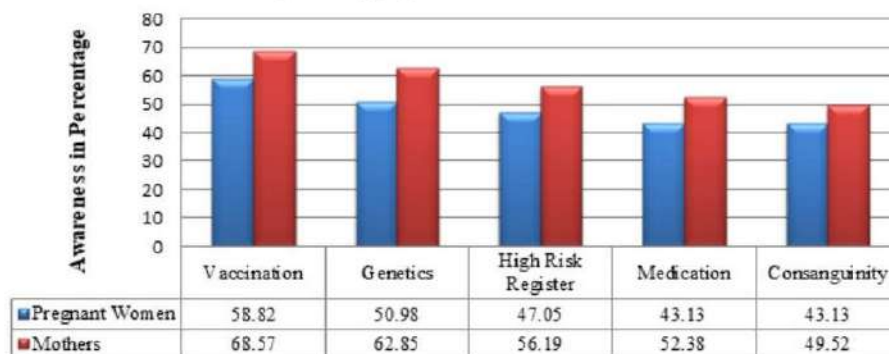
Table 1: Distribution of subject based on educational level.

Subjects	Up to secondary and other qualifications n (%)	Bachelor and higher degrees n(%)	Total (n)
Pregnant women	29 (56.86%)	22 (43.13%)	51
Mothers of new born	57 (54.28%)	48 (45.71%)	105

Table 2: Distribution of subjects by gross annual income.

Subjects	<1,00,000 P.A n (%)	1L-3L P.A n (%)	>5L P.A n (%)
Pregnant women	24 (47.05%)	16(31.37%)	11(21.56%)
Mothers of new born	44(41.90%)	38(36.19%)	23(21.90%)

Awareness of causes and prevention measures for Hearing Impairment at Prenatal stage among pregnant women & mothers of newborn



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with secondary and other qualifications [Table 1]. More than 40% of the participant's gross annual income was less than lakh [Table 2].

Results of each single factor in selected parameters were depicted as percentile score in the form of graphs. Mothers of newborn were more aware of genetic (62.85%) and high risk register factors (56.19%) as prenatal causes with respect to pregnant women. However, 69% mothers of newborn and 59% pregnant women have knowledge regarding the vaccination, as a preventive measure at primary level of prevention for any future disorder in new born, especially hearing impairment [Figure 1]. In terms of causes and prevention in the perinatal stage, mothers of new born and pregnant women have scored less than 50% for each factor although participants in each group had more than 55% awareness regarding the complications during caesarean, which may lead to hearing loss in children. Nevertheless,

45% participants in both the groups have perception regarding premature birth as a risk factor [Figure 2].

For postnatal period, more than half of mothers of newborn (57.14%) and pregnant women (52.94%) have an insight toward ear discharge and less than half of the total participants acknowledged that injury and/or infection can act as an active cause of hearing impairment in children [Figure 3]. Both the groups had scored above 50% regarding the awareness of neonatal hearing loss in infants although at the same time 50% mothers of newborn as well as pregnant women, use sharp objects and/or oil as an intervention part. However, more than one third of pregnant women (37.25%) and less than half of mothers of newborn (46.66%) were familiar with newborn hearing screening [Figure 4].

Mothers of new born and pregnant women are more acquainted

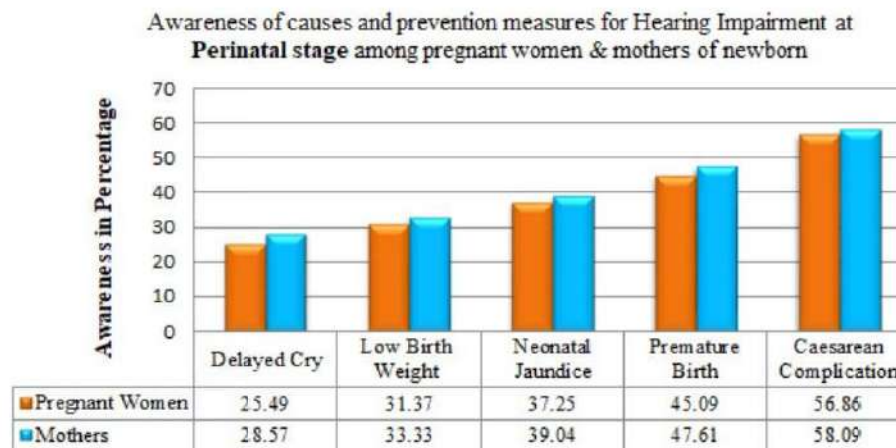
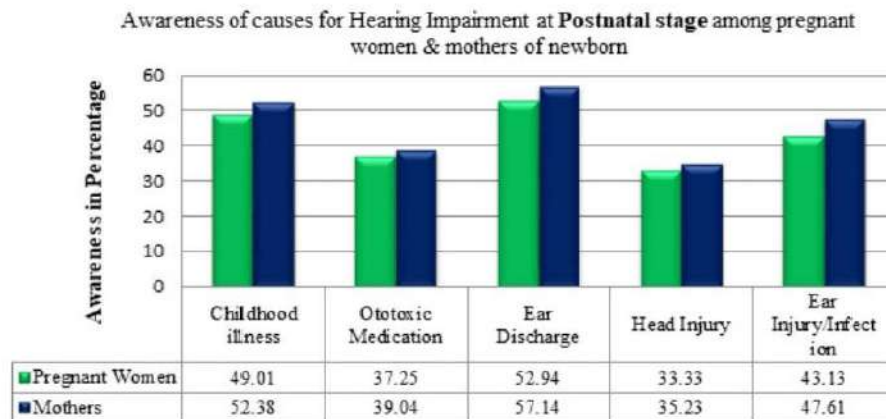


Figure 2: Depicts the percentile score of awareness of causes and prevention of hearing impairment at perinatal stage, among the pregnant women and mothers of newborn of rural areas.



  
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with prenatal causes, its prevention and awareness of hearing health and intervention followed by postnatal and perinatal stage. Mothers of newborn has overall higher percentile score in all selected factors and parameters with respect to pregnant women, although no 100% awareness score was recorded for any of the groups [Figure 5].

Descriptive statistics was done for responses of pregnant women and mothers of newborn in rural are as towards the selected parameters *i.e.* awareness of the causes and prevention of hearing impairment in prenatal stage, perinatal stage, postnatal stage and awareness of hearing health and intervention for hearing impaired [Table 3].

A two-way analysis of variance was conducted to determine the influence of two independent variables (pregnant women and mothers of newborn) on awareness of causes and prevention of hearing impairment, hearing health and intervention in rural areas. All the effects were statistically significant at the .05 significance level [Table 4]. The main effect for pregnant women and mothers yielded an F ratio of F (1,623)=12.84,

p=0.0004, indicating a significant difference between Group I: Pregnant women with mean and standard deviation ( $\pm$ ) were in prenatal stage: 2.43 ( $\pm$  0.50); in perinatal stage: 1.96 ( $\pm$  0.77), in postnatal stage: 2.15 ( $\pm$  0.96); and for the awareness of hearing health and intervention for hearing impaired: 2.39 ( $\pm$  0.60) and Group II-Mothers of newborn in prenatal stage: 2.89 ( $\pm$  0.78); in perinatal stage: 2.06 ( $\pm$  0.81); in postnatal stage: 2.31 ( $\pm$  0.90) and for the awareness of hearing health and intervention for hearing impaired: 2.68 ( $\pm$  0.62) [Table 3]. The main effect for an awareness of hearing health & intervention and awareness of causes and prevention for hearing impairment at natal stages yielded an F ratio of F(3,623)=17.05, p<.0001, indicating a significant difference. The interaction effect was significant, F (3,623)=1.26, p=0.002 [Table 4].

In post hoc analysis using unpaired t test p<0.01, suggesting that the selected four parameters are significantly differing from each other along with a significant difference between pregnant women and mothers of newborn in rural area [Table 5].

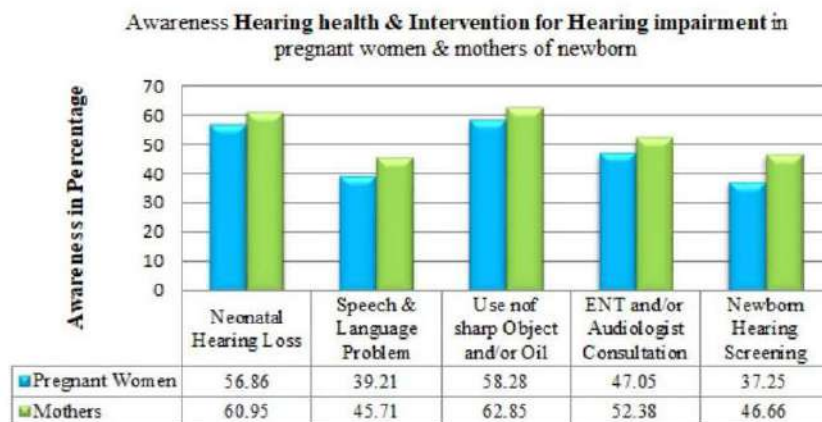
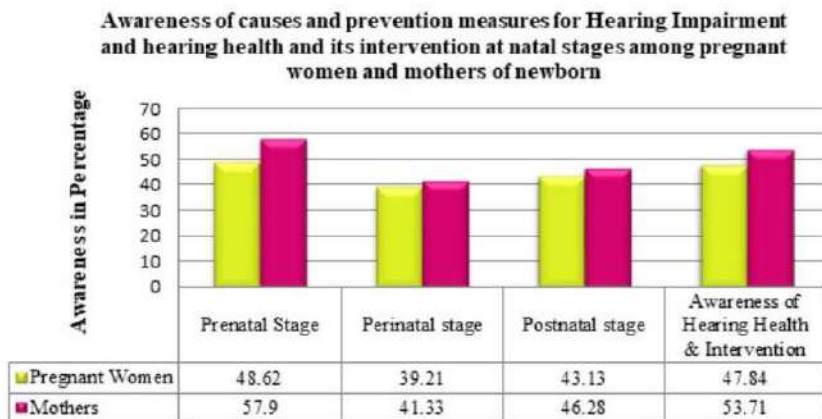


Figure 4: Depicts the awareness of hearing health and intervention taken by both the pregnant women and mothers of newborn in rural areas.



  
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**Table 3: Depicts descriptive statistics for responses of pregnant women and mothers of newborn in rural areas towards the selected parameters.**

Area	Subjects	Awareness of the causes and prevention of hearing impairment in:						Awareness of hearing health and intervention for hearing impaired	
		Prenatal stage		Perinatal stage		Postnatal stage		Mean	SD
		Mean	SD	Mean	SD	Mean	SD		
Rural area	Group I pregnant women	2.43	0.5	1.96	0.77	2.15	0.96	2.39	0.6
	Group II mothers of newborn	2.89	0.78	2.06	0.81	2.31	0.9	2.68	0.62

**Table 4: Depicts results of two-way ANOVA regarding awareness of hearing health and intervention and awareness of causes and prevention for hearing impairment at natal stages among pregnant women and mothers of newborn in rural areas.**

Source	SS	df	MS	F	p
Pregnant women and mothers	8.94	1	8.94	12.84	0.0004
Awareness of hearing health and intervention and awareness of causes and prevention for hearing impairment at natal stages.	35.61	3	11.87	17.05	<.0001
Interaction	2.64	3	0.88	1.26	0.002
Error	428.97	616	0.7	-	-
Total	488.61	623	-	-	-

**Table 5: Depicts post hoc analysis using unpaired t test with applied Bonferroni correction for comparisons of selected parameter for the pregnant women in rural area.**

Selected parameter (in rural area)	Mean difference		Obtained p value		Bonferroni correction
	Pregnant women	Mothers of new born	Pregnant women	Mothers of new born	
Prenatal-perinatal	0.4706	0.8286	0.0002	<.0001	
Prenatal-postnatal	0.2745	0.581	0.0001	<.0001	
Prenatal- awareness of hearing health and intervention	0.0392	0.2095	0.0001	0.001	
Perinatal- postnatal	-0.1961	-0.2476	0.0002	0.0001	p= 0.01
Perinatal- awareness of hearing health and intervention	-0.4314	-0.619	0.001	0.0001	
Postnatal- awareness of hearing health and intervention	-0.2353	-0.3714	0.0005	0.002	

## Discussion

Awareness in pregnant women and mothers towards the conditions that could occur either before, during or after birth *i.e.* all the natal stages, which may place their infant at risk for developing hearing loss, can be the best approach towards achieving early identification and intervention in case of infants with hearing impairment. The causes of hearing loss and deafness can be congenital or acquired. Approximately 50% of the cases are thought to be due to environmental factors (prenatal, perinatal or postnatal factors) and the remaining are due to genetic factors or unknown cause. [5]

Regarding causes and prevention during prenatal stage, WHO states that in prenatal stage, 31% childhood hearing loss are due to infection in mother during pregnancy (e.g. rubella or cytomegalovirus). [2] Govender et al., had reported that 54% mothers are aware of hereditary conditions resulting in hearing loss in infants which is congruent with the present study where both the groups have scored more than 50%. The study also indicated that only 16% of mothers were aware of infection or high-risk factors in them can lead to hearing loss in infant, which is contrasting with the present study results, where awareness in both groups is nearly 50%. [9]

regarding the risk factors in prenatal stage which may lead to hearing impairment in infants, however in the present study, 50% in both groups are aware of the risk factors in prenatal stage, which is also similar to the study done by Olusanya et al. in Nigeria, where 73% of mothers were aware of the risk factors. [6,7] 56% mothers were aware of ill effects of consanguinity while rest 44 mothers were either had wrong or no knowledge regarding the effect of consanguinity on hearing loss as studied by Dudda et al which is incongruent with the present study result for consanguinity. [8-10]

Regarding perinatal causes and risk factors, 33% of mothers were aware of prematurity birth whereas 50% mothers displayed poor knowledge regarding low birth weight which is similar with the present study results. [5] Korres et al., have also included non-elective caesarean delivery as an emerging risk factor which also included in the present study result. Although how this factor can be directly causing hearing loss is still under research. [8] Research regarding the nature and risk factors for hearing loss, also concluded that hyperbilirubinemia/ neonatal jaundice was the most prevalent risk factor along with low birth weight (<1500gms) which directly correlates with factors contributing to hearing loss considered as a part of the present study.

  
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exhibited good knowledge of risk factors where 54.3% mothers were aware of ear discharge as a risk factor for hearing loss.<sup>[11]</sup> A Nigerian study on mother suggest 50% mothers were aware that ototoxic drugs could affect hearing in infants.<sup>[7]</sup> Govender et al. had information that 58% of mothers have knowledge of head trauma or head injury, which can be a contributing factor for hearing loss.<sup>[6]</sup> Overall mothers are more aware regarding the ear infection and ear discharge as a cause for hearing loss in infants. The same result was documented in the present study.

Regarding the awareness of hearing health and intervention taken by mothers, study 89.2% of mothers were aware that hearing could be screened at birth which is different from the present study score. Only 45% mothers had idea that an audiologist provide services for rehabilitation of persons with hearing loss, however, more than 70% mothers were unaware that an audiologist can only be the professional to provide aural rehabilitation services including screening, assessing, diagnosing and managing hearing loss which correlates with the present study result.<sup>[9]</sup> The findings of the present study and review of literature suggests that this lack of knowledge exists in developing countries, and therefore should be addressed in all public awareness programmes on ear and hearing health.

However, no significant data regarding the awareness of hearing impairment in children among pregnant women could be obtained from literature, so the rationale behind this study found a strong motive to focus on the same and provide a record for the future.

With the aim of preventing avoidable hearing loss (primary prevention), early identification and treatment of ear problems, and rehabilitation of persons with hearing impairment, the Government of India initiated the National Programme for Prevention and Control of Deafness (NPPCD) and integrated it with National Rural Health Mission (NRHM) at the state and district levels.<sup>[13]</sup> Olusanya reported that in South-East Asia and Africa regions, where the burden of hearing impairment is highest, only India has established concrete steps towards nationwide hearing screening but still many rural parts of India are still away from achieving cent percent result.<sup>[13]</sup>

### Conclusion

This study was carried out to gain insights into the knowledge and awareness regarding hearing health, causes and prevention for hearing loss along with intervention in mothers of newborn and pregnant women residing in a rural community.

The result of this study suggests that mothers as compared to pregnant women in rural community were more knowledgeable regarding the aspects of causes of hearing loss and prevention for the same, however, lack of information and misconceptions regarding intervention of a hearing impaired child were also prevalent. It is very much important to utilize the existing knowledge of the mothers and pregnant women by attempting to bridge the gaps in acquiring information regarding the awareness of hearing impairment in children which can be done only by creating the awareness and spreading adequate information regarding hearing disability. This can help in achieving the goals of early identification and early intervention

burden of hearing disability.

### Recommendation

76<sup>th</sup> round of The National Sample Survey (NSS) had surveyed disability in Indian households and found that hearing disability was overall 0.3% out of 2.2% total disability, ranking 2nd most common cause of disability. Public health services in country can help in detecting such hearing health issues as early as possible and responds appropriately to avoid the development of hearing impairment. In an initial attempt for prevention of hearing loss in infants, it is important for pregnant women and mothers of newborn to follow a strategic primary prevention followed by secondary and tertiary during natal stages, which can effectively reduce the impact of deafness and hearing loss in an individual's life. This can be considered as one of the crucial fact for improving and protecting community health and well-being, while emphasizing the prevention among large groups of people. Further it has been recommended that such type present study and/or survey can be conducted using a greater number of subjects in both the groups and including additional factors being considered for awareness of causes and prevention of hearing loss in infants while covering more districts.

### Limitation of the study

The present study included a smaller number of subjects and restricted to selected rural parts of Khordha district. Further, the subject were included only pregnant women and mothers of new born but no other family members or general population for their awareness regarding the hearing loss in infants. Limited numbers of factors were considered in each natal stage.

### Relevance of the study

Various NGO and NRHM partnership are being utilized under the disease control programs, reproductive and child health, routine immunization and Special Immunization Activities (SIAs). The current study was conducted among pregnant women and mothers of new born in order to investigate their awareness level regarding second highest disability *i.e.* hearing impairment and its prevention in infants. The objective was to use the information obtained to create appropriate awareness related to hearing impairment which can be a boon to public health welfare, NGOs and NRHM to reduce the occurrence or severity of hearing impairment in individual's life and to make avail the governmental support and facility being available for hearing impaired individuals. In other words, to reduce the burden of hearing disability and to improve quality of life.

### Author's Contribution

All authors have equally contributed for this study.

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