International Journal of Yoga, Physiotherapy and Physical Education
ISSN: 2456-5067
Impact Factor: RJIF 5.24
www.sportsjournal.in
Volume 3; Issue 4; July 2018; Page No. 59-67

A study to assess the efficacy of balances in second trimester by using swimming, yoga and balance exercises: A comparative study

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Abstract
Aims and Objectives: The aim of the study is to know the efficacy of balances in second trimester pregnancy by using swimming, yoga, and balance exercise.
Methodology: 30 pregnant women (aged 18–28 years) were tested for their balance using TUG test.
Subjects: 30 subjects between the age group of 18 - 28 years with significant second trimester pregnancy as per the inclusion and exclusion criterion were selected for the study
Procedure: Using random sampling method 30 subjects were divided into 2 equal groups with 15 patients each. Group A given swimming, yoga and balance exercise. The Group B received swimming and balance exercises, 2 sets of 10 repetitions per session for 5 days per week. The study duration was of 12 weeks. Evaluation was done before starting the treatment and then after 3 weeks. Outcomes were evaluated using TUG test
Results: The results shows that the use of swimming, yoga and balance exercise is most effective for balance gaining than the swimming and balance exercise.
Conclusions: A swimming, yoga and balance exercise is improvement in balance gaining for the second trimester pregnancy, more than swimming and balance exercise.

Keywords: pregnancy, time up and go test, swimming, yoga, balance exercise

Introduction

Pregnancy, also known as gestation, the condition of having a developing embryo/fetus in the body after union of an ovum and spermatozoon

Maintaining a regular exercise routine throughout your pregnancy can help you stay healthy and feel your best. Regular exercise during pregnancy can improve your posture and decrease some common discomforts such as backaches. Regular exercise during your pregnancy can also improve heart health and stamina, as well as overall health. Maintaining a healthy body and healthy weight gain.

These days, maintaining and even improving fitness levels is encouraged while pregnant, especially as exercise has a number of benefits such as

- Boosting the energy levels,
- Supporting better sleep,
- Helping prevent excess weight gain and
- Increasing stamina and Muscle strength.

There is evidence that physical activity may prevent

- Gestational diabetes (diabetes that develops during pregnancy),
- Relieve stress, and
- Build more stamina needed for labor and delivery

The exercise uses developing baby and other internal changes require more oxygen and energy

Growth of embryo

These are divided in to three trimester

First trimester

- The first trimester carries the highest risk of miscarriage (natural death of embryo or fetus) By 5-8 Weeks
  - ✓ All major organs and external body structures have begun to form.
  - ✓ Your baby's heart beats with a regular rhythm.
  - ✓ The arms and legs grow longer, and fingers and toes have begun to form.
  - ✓ The sex organs begin to form.
  - ✓ The eyes have moved forward on the face and eyelids have formed.
  - ✓ The umbilical cord is clearly visible.
  - ✓ At the end of eight weeks, your baby is a fetus and looks more like a human. Your baby is nearly 1 inch long and weighs less than one-eighth ounce.
- By 8-12 Weeks
  - ✓ The nerves and muscles begin to work together. Your baby can make a fist.
  - ✓ The external sex organs show if your baby is a boy or girl. A woman who has an ultrasound in the second trimester or later might be able to find out the baby's sex.
  - ✓ Eyelids close to protect the developing eyes. They will

not open again until the 28th week.
- ✓ Head growth has slowed, and your baby is much longer. Now, at about 3 inches long, your baby weighs almost an ounce.

Second Trimester

The second trimester is from week 13 through 28. Around the middle of the second trimester, movement of the fetus may be felt. At 28 weeks, more than 90% of babies can survive outside of the uterus if provided with high-quality medical care.

Once you enter the second trimester you may find it easier than the first. Your nausea (morning sickness) and fatigue may lessen or go away completely. However, you will also notice more changes to your body. That "baby bump" will start to show as your abdomen expands with the growing baby. By the end of the second trimester you will even be able to feel your baby move!

Some changes you may notice in your body in the second trimester include:

- Back, abdomen, groin, or thigh aches and pains
- Stretch marks on your abdomen, breasts, thighs, or buttocks
- Darkening of the skin around your nipples
- A line on the skin running from belly button to pubic hairline (linea nigra)
- Patches of darker skin, usually over the cheeks, forehead, nose, or upper lip. This is sometimes called the mask of pregnancy (melasma, or Chloasma facies).
- Numb or tingling hands (carpal tunnel syndrome)
- Itching on the abdomen, palms, and soles of the feet.
- Swelling of the ankles, fingers, and face.

As your body changes in the second trimester, your baby continues to develop.

1. The musculoskeletal system continues to form.
2. Skin begins to form and is nearly translucent.
3. Meconium develops in your baby's intestinal tract. This will be your baby's first bowel movement.
4. Your baby begins sucking motions with the mouth (sucking reflex).
5. Your baby is about 4 to 5 inches long and weighs almost 3 ounces.

At about 20 weeks in the second trimester, your baby continues to develop

- Your baby is more active. You might feel movement or kicking.
- Your baby is covered by fine, feathery hair called lanugo and a waxy protective coating called vernix.
- Eyebrows, eyelashes, fingernails, and toenails have formed. Your baby can even scratch itself.
- Your baby can hear and swallow.
- Now halfway through your pregnancy, your baby is about 6 inches long and weighs about 9 ounces.

By 24 weeks, even more changes occur for your growing baby

- The baby's bone marrow begins to make blood cells.
- Taste buds form on your baby's tongue.
- Footprints and fingerprints have formed.
- Hair begins to grow on your baby's head.
- The lungs are formed, but do not yet work.
- Your baby has a regular sleep cycle.
- If your baby is a boy, his testicles begin to descend into the scrotum. If your baby is a girl, her uterus and ovaries are in place, and a lifetime supply of eggs has formed in the ovaries.
- Your baby stores fat and weighs about 1½ pounds, and is 12 inches long.

Third Trimester

The Third Trimester is from 29 weeks through 40 weeks.

The third trimester is the final stage of pregnancy. Discomforts that started in the second trimester will likely continue, along with some new ones. As the baby grows and puts more pressure on your internal organs, you may find you have difficulty breathing and have to urinate more frequently. This is normal and once you give birth these problems should go away. In the third and final trimester you will notice more physical changes, including:

- Swelling of the ankles, fingers, and face.
- Tender breasts, which may leak a watery pre-milk called colostrum
- Your belly button may protrude
- The baby "dropping," or moving lower in your abdomen
- Contractions, which can be a sign of real or false labor
- Other symptoms you may notice in the third trimester include shortness of breath, heartburn, and difficulty sleeping

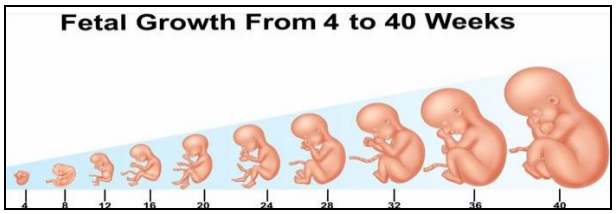

Fig 1

At 32 Weeks

- Your baby's bones are fully formed, but still soft.
- Your baby's kicks and jabs are forceful.
- The eyes can open and close and sense changes in light.
- Lungs are not fully formed, but practice "breathing" movements occur.
- Your baby's body begins to store vital minerals, such as iron and calcium.
- Lanugo begins to fall off.

Your baby is gaining weight quickly, about one-half pound a week. Now, your baby is about 15 to 17 inches long and weighs about 4 to 4½ pounds

At 36 Weeks

- The protective waxy coating called vernix gets thicker.
- Body fat increases. Your baby is getting bigger and bigger and has less space to move around.
- Movements are less forceful, but you will feel stretches and wiggles.
- Your baby is about 16 to 19 inches long and weighs about 6 to 6½ pounds.

Weeks 37-40

- By the end of 37 weeks, your baby is considered full term. Your baby's organs are ready to function on their own
- As you near your due date, your baby may turn into a head-down position for birth. Most babies "present" head down.
- At birth, your baby may weigh somewhere between 6 pounds 2 ounces and 9 pounds 2 ounces and be 19 to 21 inches long. Most full-term babies fall within these ranges. But healthy babies come in many different sizes.

Epidemiology

About 213 million pregnancies occurred in 2012 of which 190 million were in the developing world and 23 million were in the developed world. This is about 133 pregnancies per 1,000 women between the ages of 15 and 44. About 10% to 15% of recognized pregnancies end in miscarriage. Globally 40% of pregnancies are unplanned. Half of unplanned pregnancies are aborted. Of pregnancies in 2012.

- 120 million occurred in Asia,
- 54 million in Africa,
- 19 million in Europe,
- 18 million in Latin America and the Caribbean,
- 7 million in North America,
- 1 million in Oceania.

Pregnancy rates are 140 per 1000 women of childbearing age in the developing world and 94 per 1000 in the developed world. The rate of pregnancy, as well as the ages at which it occurs, differ by country and region. It is influenced by a number of factors, such as cultural, social and religious norms; access to contraception; and rates of education. The total fertility rate (TFR) in 2013 was estimated to be highest in Niger (7.03 children/woman) and lowest in Singapore (0.79 children/woman).

In Europe, the average childbearing age has been rising continuously for some time. In Western, Northern, and Southern Europe, first-time mothers are on average 26 to 29 years old, up from 23 to 25 years at the start of the 1970s. In a number of European countries (Spain), the mean age of women at first childbirth has crossed the 30-year threshold.

This process is not restricted to Europe. Asia, Japan and the United States are all seeing average age at first birth on the rise, and increasingly the process is spreading to countries in the developing world like China, Turkey and Iran. In the US, the average age of first childbirth was 25.4 in 2010

Globally, an estimated 270,000 women die from pregnancy-related complications each year.

Maternal changes during pregnancy

During pregnancy, the changes are noticed in various organs, body weight, the metabolic activities and functional status of different physiological systems in the mother.

Structural changes

- Ovaries
- Uterus
- Vagina
- Cervix
- Fallopian Tube
- Mammary gland

Increase in body weight

Average weight gained by the body during pregnancy is about 12 kg. Approximate weight of various structures, which adds to the weight gain:

- Fetus : 3.5 kg
- Amniotic fluid : 2.0 kg
- Placenta : 1.5 kg
- Increase in maternal : 5.0 kg body weight

If proper prenatal care is not taken, the body weight increases greatly by about 20 to 30 kg.

Metabolic changes

The metabolic activities are accelerated in the body due to increased secretion of various hormones like thyroxin, cortisol and sex hormones.

- Basal Metabolic Rate
- Protein Metabolism
- Carbohydrate Metabolism
- Lipid Metabolism
- Water and Mineral Metabolism

Changes in physiological systems

- Blood
- Cardiovascular System
- Nervous system
- Endocrine system
- Respiratory system
- Excretory system
- Digestive system

Hormonal changes in pregnancy

Pregnant women experience sudden and dramatic increases in estrogen and progesterone, as well as changes in the amount and function of a number of other hormones. These changes can not only affect mood, they can also create the “glow” of pregnancy, significantly aid in the development of the fetus, and alter the physical impact of exercise and physical activity on the body.

Estrogen and progesterone changes

Estrogen and progesterone are the chief pregnancy hormones. The increase in estrogen during pregnancy enables the uterus and placenta to improve vascularization, transfer nutrients, and support the developing baby.

In addition, estrogen is thought to play an important role in helping the fetus develop and mature. The rapid increase in estrogen levels during the first trimester may cause some of the nausea associated with pregnancy and, during the second trimester, plays a major role in the milk duct development that enlarges the breasts.

Progesterone levels also are extraordinarily high during pregnancy. The changes in progesterone cause a laxity or loosening of ligaments and joints throughout the body. In addition, high levels of progesterone cause internal structures to increase in size, such as the ureters (which connect the kidneys with the maternal bladder). Progesterone also is important for transforming the uterus from the size of a small pear in its non-pregnant state to a uterus that can accommodate a full-term baby.

Relaxin

Relaxin is secreted from maternal ovary (corpus luteum) during the initial period of pregnancy. It is secreted in large quantity at the time of labor by placenta and mammary glands.

1. Helps labor by softening the cervix and loosening the ligaments of symphysis pubis, so that the dilatation of cervix occurs
2. Increases the number of receptors for oxytocin in the myometrium
3. Simultaneously suppresses the inhibitory action of progesterone on uterine contraction so that the uterus starts contracting
4. Facilitates the development of mammary glands.

Operational Definitions

Swimming

Swimming is an individual or term sport that involves using arms and legs to move the body through water. Typically, the sport takes place in pools or in open water (e.g. in a sea or lake)

Yoga

The word "yoga" comes from the Sanskrit root yuj…. Yoga is an ancient art based on a harmonizing system of development for the body, mind and spirit. The continued practice of yoga will lead you to a sense of peace and well-being, and also a feeling of being at one with their environment

Balance exercises

Is one of the four type of exercises along with strength endurance and physical activity routine exciting. Many different types of exercises can improve strength, endurance, flexibility and balance.

Need for the study

Statement of problem

A study to know the efficacy of balances in second trimester by using swimming, yoga, and balance exercises

Objective

The objective of the study is to compare the efficacy of balances in Second trimester by using swimming, yoga, and balance exercises"

Hypothesis

a. Null Hypothesis

There is no significant difference in the effectiveness of balances in second trimester by using swimming, yoga, and balance exercises.

b. Alternate Hypothesis

There is a significant difference in the effectiveness of balances in second trimester by using swimming, yoga, and balance exercises.

Materials and methodology

Materials

- Straight-backed chair
- Chalk
- Yoga mat
- Swimming pool
- Swiss ball
- Hydrotherapy pool
- Tape measure,
- Tape
- Stop watch

Methodology

Study Design

- Quasi experimental deign
- Pre and post experimental study design

Study Setting

- The study was conducted from
- Sabari Seciality Hospital, Erode
- Dharshan Hospital, Erode
- Senthil Speciality Hospital, Erode

Study sampling

- Convenient Sampling Method

Study population

Patients will age group 18 – 28 years having second trimester pregnancy.

Sampling size

- Group A – 15 Women
- Group B – 15 Women

Study Duration 9 Months

Treatment Duration

- Treatment duration 12 weeks.
- Total training frequency 2 alternate days per weeks.12-15 repetition set.

Parameter

- Time Up Go Test

Selection Criteria

Inclusion Criteria

- Age group between 18-28 years
- Normal young females with second trimester pregnancy
- Non-athletes

Exclusion criteria

- Age group more than 28 years and below 18 years
- Musculoskeletal disease
- Neurological disease
- Psychological disease
- Psychiatric disease
- Dermatological deficits disease
- Vestibular pathologies/ infections
- Any systemic illness
- Any complications of pregnancy
- Diabetes mellitus
- Not taken the test tube pregnancy

Procedure

- Subjects were selected by convenient sampling method. 30 subjects who fulfilled inclusion and exclusion criteria were

selected by random sampling method, out of them 15 were allotted in Group A Group B.

- Subjects were clearly explained about the study and written informed consent was obtained from the subjects who fulfilled the criteria
- After completing the informed content and they were explained about the scale the scale was administered
- Proper instructions such as purpose, safety measures, comfort, precautions and psychological support were given to the subjects.
- All vital signs were checked.
- While doing the assessment, the subject`s willingness to continue the procedure with or without rest was given preference
- Both Group A and Group B subjects were involved for pretest assessment.
- Group A and underwent swimming for 15 min per day 15 min for whole body) for 12 weeks with yoga exercises for 15min per day (15 min for 5 days per week) for 12 weeks and also continue the balance exercises 2 times a day (15 min for 5 days per week).
- Group B subjects underwent swimming and balance exercises for 12 weeks.
- The total duration is 1 hour

Treatment technique

Group-A swimming, yoga, balance exercises

Swimming

Before entering to the swimming pool, the subject has given 3 min warm up exercise. Exercise duration was about 9 min. Final 3 min cool up exercise. Total exercise duration was 15 min. Each subjects were given 5 days/week for 3 months.

1. Vertical stabilization exercises

Patient position: standing position

Movement: Patient do the alternate movement of the arm and leg.

2. Push up the wall

Patient position: Walk standing position

Movement: Both the hand place the wall and the one leg is straight and another one leg is half flexion of the knee. The leg only alter the movement

3. Flutter Kick

Patient position: supine position

Movement: patient do the alternative knee flexion and extension exercises

Fig 2: Vertical Stabilization

Fig 3: Push Up

Fig 4: Flutter Kick

Yoga

1. Mountain Pose

Sit in the Sukhasan pose. Keep your back straight, raise your arms and join your palms in the Namaste position while keeping your elbows straight. Hold this position for few seconds and then relax

2. Butterfly Pose

Sit with your spine erect. Fold your legs so that both your feet touch each other. Hold your feet with your hands and inhale. While exhaling press your knees and thighs downward, you can push your elbows in your thighs to achieve this, if necessary. Repeat this process to mimic the flapping wings of a butterfly. Do this for a few minutes and relax

3. Sitting side stretch

Sit on the floor with folded legs. Stretch out your left leg and raise your arms and bend towards your left side so that your left palm touches your left foot, hold this position for few seconds relax and repeat on the other side. If you find bending difficult don't go all the way and support your belly with one hand

Fig 5: Mountain Pose

Fig 6: Butterfly Pose

Fig 7: Sitting Side Stretch

Balance Exercises

1. Wall squat

A great exercise to work your legs. To work harder don't completely straighten your legs between reps; keep them slightly bent staying in the muscle.

- Start with your feet hip width apart and your ball between your mid to lower back and the wall.
- Keep your hands on your hips or by your sides if you are holding weights. Keep your shoulders back and tummy muscles pulled in throughout.
- Slowly squat down, bending your knees and rolling the ball down the wall until your knees are bent at approx. 90 degrees.
- Now slowly return to the starting position. Have a chair nearby for support in case you get stuck in your squat!
- Repeat 15-20 times and do two sets.

2. Wall push up

This great exercise works your arms and chest. Less intense than a regular push up and saves getting up and down from the floor!

- Stand upright facing a wall roughly a meter away. Keep your shoulders back and tummy muscles pulled in throughout.
- Hold the ball against the wall in front of your chest and have your hands flat on the ball in front of your shoulders.
- To do the push up bend your arms and lower your chest to the ball, keeping your body straight and rolling your heels off the floor.
- Hold briefly at your lowest point then return to the starting position.
- Repeat 15-20 times and do two sets

3. Seated pelvic tilt

Work your deep tummy muscles and keep your pelvis mobilized. Don't be afraid of sucking your tummy in, baby won't feel it!

- Sit upright on the ball, with your shoulders back and feet flat on the floor.
- Breathe in deeply and let your chest expand. Then, as you exhale, draw your belly button in so that you feel like you are wearing a tight corset. Without moving your feet, tilt your pelvis forward and upward.
- Hold for a couple seconds and return to start position. To mix it up you can also try side to side and figure of eight movements.
- Repeat 15–20 times and do two sets.

Fig 8: Wall Squat

Fig 9: Wall Push Up

Fig 10: Seated Pelvic tilt

Group: B

The Group B subjects underwent the same exercise protocol for both the swimming and balance exercises for 5 days / week for 12 weeks.

Data presentation and statistical analysis

Statistical Tools

The statistical tools used in the study are paired t-test and unpaired t-test.

Paired't' - Test

The paired t-test was used to find out the statistical significance between pre and post t-test values before and after treatment for Group A and Group B.

Formula for paired t-test,

$$S = t = \frac{\bar{d}\sqrt{n}}{s}$$

d = difference between the pretest Vs posttest
$\bar{d}$ = Mean difference
n = Total number of subjects
S = Standard deviation

Unpaired't'- Test

The unpaired t-test was used to compare the statistically significance difference and before and after treatment for Group A and Group B.

Formula for unpaired t

$$S = \sqrt{\frac{(n_1-1){s_1}^2+(n_2-1){s_2}^2}{n_1+n_2-2}}$$

$$t = \frac{|\bar{x}_1-\bar{x}_2|}{s\sqrt{\frac{1}{n_1}+\frac{1}{n2}}}$$

n1 = Total number of subject in group A.
n2 = Total number of subject in group B.
X1 = Difference between pretest and posttest of Group A.
$\bar{x1}$ = Mean difference between pretest and posttest of group A.

X2 = Difference between pretest and posttest of Group B.
X2 = Mean difference between pretest and posttest of Group B.
S = Standard Deviation

Table 1: Mean difference between group a and group b

Groups	Mean Difference
Group A	142
Group B	115

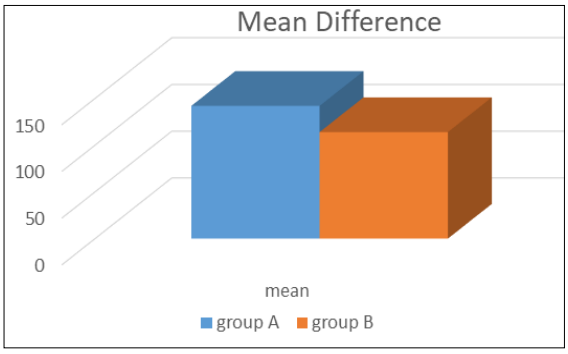

Fig 11

Table 2: Standard deviation between group a and group B

Groups	Standard deviation
Group a	4.8
Group b	4.4

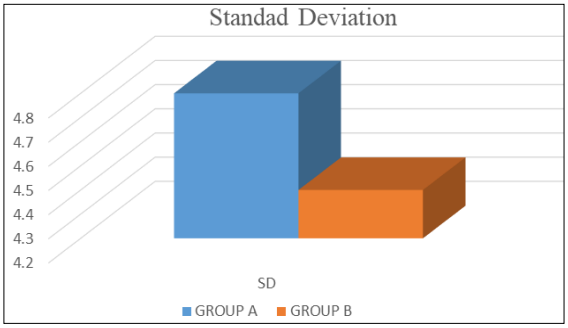

Fig 12

Table 3: Comparision of the paired‘t’ test and table value between group a and group B

GROUPS	Calculated ‘t’ value	Table value	Significance
GROUP A	112.1	2.15	Significant
GROUP B	98.2	2.15	Significant

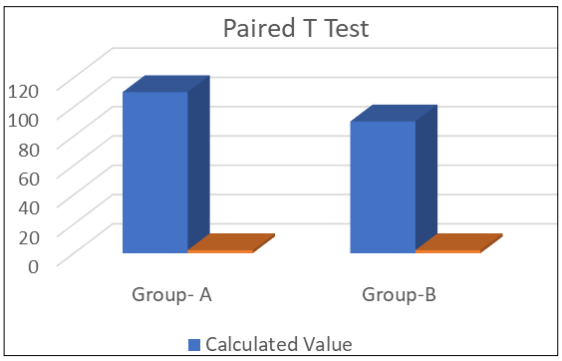

Fig 13

Table 4: Comparision of the unpaired‘t’ test and table value between group a and group b

Parameter	Calculated Value	Table Value	Significance
TUG	55.6	2.05	Significant

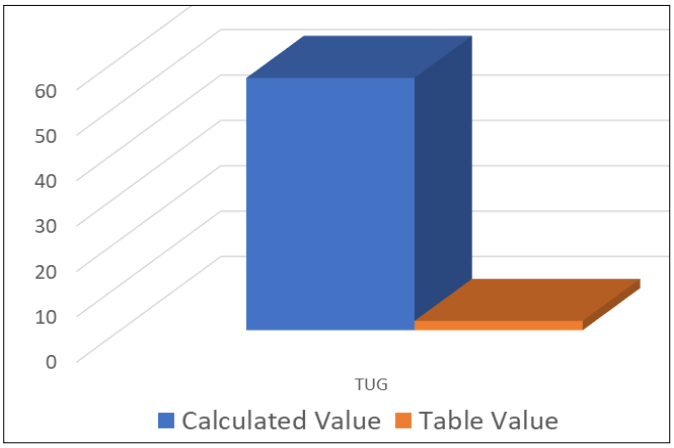

Fig 14

Results and discussion

Results

The study sample comprised 30 patients, of which 30 were female. The mean age of patients was 18 to 28 years. The diagnostic test for TUG test was positive in 30 patients. The swimming, yoga and balance exercise applied 12 weeks. Among 30 patients, 15 were treated with swimming, yoga and balance exercise, and 15 were treated with swimming.

The pre and posttest values were assessed by TUG in group A. The mean difference value is 142 respectively. The standard deviation value is 4.8 respectively. The paired ' t ' test value for 112.1. The paired ' t ' test value is more than table value 2.15 for 50% level of significance.

The pre and posttest values were assessed by TUG in group B. The mean difference value is 114 respectively. The standard deviation value is 4.4 respectively. The paired ' t ' test value for 98.2.The paired ' t ' test value is more than table value 2.15 for 40% level of significance

The calculated ' t ' values by unpaired ' t ' test were 55.6. The calculated ' t ' values were more than the table value 2.05 for 5% level of significance.

The paired 't' test values have shown that swimming, yoga and balance exercise was more effective than swimming for patients with. The unpaired ' t ' test values have shown that there was significant difference between two groups in showing improvement in their functional activity and balance in patients with pregnant women.

Discussion

While consideration of improving their functional activity and improve balance in patients with second trimester of pregnancy, I found there was an effective and good improvement.

There was a statistically significant difference in the impact of balance in the second trimester before and after swimming, yoga and balance exercises in all aspects (physical, functional and emotional). This demonstrates a positive effect of this swimming, yoga and balance exercise on the functional

activity and balance of patients. The effectiveness of repositioning swimming, yoga and balance exercise for the treatment of improve balance was good.

Limitations and recommandations

Limitations

- This study was conducted on pregnant woman only.
- Sample size is small.
- This study was conducted among 18 to 28 age groups only.
- This study took shorter duration to complete
- This study is not extended more than 12 weeks for a patient due to time constraint.
- Low cost treatment, inexpensive and time saving method.

Recommendations

- A similar study may be extended with large sample
- The further study can be compared with various therapies like dance therapy, core strengthening exercise, reflexology, kegil exercise, Pilates,Indoor cycling, brisk walking etc.
- The techniques is also applied to sciatica pain, low back pain, oedema etc.

Conclusion

The present result suggested that swimming, yoga and balance exercise both can be safely used for second trimester. Because we are dealing with a functional problem that is not a disease state, so can truly focus on a holistic approach

This study concluded that 12 weeks intervention involving swimming with yoga, balance exercises. The result in improve the functional ability, improvement of the balance in the second trimester gestation woman

In this study Group a (swimming, yoga and balance exercises) show improvement in balance

Based on the‘t’ values, it could be seen there is significant difference between the calculated values and table values. The TUG differences second trimester gestation woman before and after treatment were statistically significant.

Through the result, alternate hypothesis is accepted and also the study could be concluded that is a significant difference between swimming with yoga and balance exercises

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