

## Sound Traditional and Nontraditional Prepartum Exercise for Good Health

Jacalyn J Robert-McComb\*

Department of Kinesiology and Sport Management, Texas Tech University, USA

### Abstract

There has been a progressive evolution in the concept of exercise for prepartum women. Per contra, screening guidelines have not changed. All women should have a thorough clinical evaluation by the health care team before an exercise program is recommended. This is true for previously sedentary women or women who have been active before their pregnancy. The consensus today is that given no medical contraindications to exercise during pregnancy women with uncomplicated pregnancies should participate in moderate exercise, such as brisk walking, 30 min a day or more. The use of heart rate to guide intensity is not valid for prepartum women because of the large variability of heart rate during pregnancy. Rather, metabolic equivalents (METs), the Rating of Perceived Exertion Scale (RPE) or methods such as the talk test should be used to monitor exercise intensity. The recommendation is 3-5 METs, an RPE of 12-14 (somewhat hard) on the 6-20 scale, or women should be able to maintain a conversation while exercising. Strength-conditioning activities are also advocated in uncomplicated pregnancies. However, there is less evidence on strength conditioning and weight training in pregnancy. The research on yoga and Pilates on gravid women is too limited to make a position stand on these activities. Regardless of the type of activity, all goals should be reasonable. Furthermore, pregnancy it is not a time to reach peak fitness levels or train for an athletic competition. Elite athletes who train during pregnancy require supervision by an obstetric care provider with knowledge of the impact of strenuous exercise on fetal outcomes.

**Keywords:** Prepartum; Moderate exercise; Yoga; Strength-conditioning

### Sound Traditional and Nontraditional Prepartum Exercise for Good Health

Pregnancy is a time of joyful expectation. The mother wants to do everything in her power to ensure a safe delivery and a healthy baby. One of the key questions for the safety of exercise during pregnancy has been: does the selective redistribution of blood flow during regular or prolonged exercise in pregnancy interfere with the transport of oxygen, carbon dioxide, and nutrients? The indirect evidence does not support this concern [1]. In fact, research has shown that regular exercise during pregnancy provides health and fitness benefits to both the mother and the child [2].

Conventional exercise for women has most notably been aerobic exercise. Resistance training, while still considered a traditional exercise, has historically been male dominated. This trend has changed dramatically. Today we see more and more women engaging in resistance training, even during pregnancy. Most probably, water exercise, yoga, and Pilates would not be considered traditional exercise in the United States (US), especially not as a form of resistance training. Yet all of these movement patterns are a form of resistance training. Yoga and Pilates use body weight, or small props such as balls and bands to increase resistance. Water exercise uses the weight of the water for resistance.

For the sake of discussion in this paper, traditional exercise will be referred to as aerobic exercise and resistance training using weights. Nontraditional exercise will be referred to as yoga, water exercise, and Pilates.

### The Importance of Screening and a Clinical Evaluation before Exercise Participation

A thorough clinical evaluation of each pregnant woman should be conducted before an exercise program is recommended. Minimally, the Canadian Society for Exercise Physiology Physical Activity Readiness Questionnaire, termed the PARmed-X for Pregnancy should be used

for health screening for pregnant women <http://www.csep.ca/CMFiles/publications/parq/parmed-xpreg.pdf> [3]. The examining physician as well as the pregnant female should be well aware of the absolute and relative contraindications to exercise as well as indications to terminate exercise. The American College of Obstetricians and Gynecologists (ACOG) have outlined these conditions in their ACOG Committee Opinion 267 [2]. Absolute means that exercise should not be initiated until this condition is controlled or abated and relative means that a decision should be made by the healthcare team regarding the cost benefit ratio. For example, will more good be gained from exercising than not exercising during the pregnancy for both the mother's well-being and that of the fetus? Table 1 lists the absolute contraindications with an (A) following the condition, a (R) following the relative contraindication, and a (T) following the condition for terminate exercise (Table 1).

### The Evolution of Exercise Guidelines for Pre-partum Women

In 1985, certified aerobics instructors were trained not to allow pregnant women to exceed a heart rate (HR) of 140 beats per minute during exercise [2]. Today the professional community of certified instructors understands that HR is not a valid tool to use during pregnancy to monitor intensity. Historically, duration of the exercise was also expected to be monitored closely; ACOG recommended

\*Corresponding author: Jacalyn J. Robert – McComb, Texas Tech University; Department of Kinesiology and Sport Management, USA, Tel: 806-834-6306; Fax: 806-742-1688; E-mail: [Jacalyn.mccomb@ttu.edu](mailto:Jacalyn.mccomb@ttu.edu)

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Hemodynamically significant heart disease (A)
Restrictive lung disease (A)
Incompetent cervix/cerclage (A)
Multiple gestation at risk for premature labor (A)
Persistent second- or third-trimester bleeding (A)
Placenta previa after 26 weeks of gestation (A)
Premature labor during the current prganacy (A)
Ruptured membranes (A)
Preeclampsia/ pregnancy-induced hypertension (A)
Severe anemia (R)
Unevaluated maternal cardiac arrhythmias (R)
Chronic bronchitis (R)
Poorly controlled tpe I diabetes (R)
Extreme morbid obesity (R)
History of extremely sedentary lifestyle (R)
Intrauterine growth restriction in current pregnancy (R)
Poorly controlled hypertention (R)
Orthopedic limitations (R)
Poorly controlled seizure disorders (R)
Poorly controlled hyperthyroidism (R)
Heavy smoker (R)
Chest Pain (T)
Dyspnea prior to exertion (T)
Dizziness (T)
Headache (T)
Vaginal bleeding (T)
Muscle weakness (T)
Calf pain (T)
Pretrm labor decreased fetal movement(T)
Amniotic fluid leakage (T)

**Table 1:** Absolute (A), Relative (R), and Reason to Terminate Exercise (T) from the American College of Obstetricians and Gynecologists.

no more than 15 min of continuous exercise due to issues with thermoregulation. It is true that hyperthermia is a concern given that both exercise and pregnancy raise the metabolic rate. Furthermore, it can be considered a teratogenic effect for the mother's core temperature to rise above 102.6 F, especially in the first trimester [4]. However, these concerns about the teratogenic effect of high core body temperatures in the early first trimester have not been demonstrated in studies of exercising women [5]. Therefore, a maximal duration of 15 min is not advocated in 2016 unless there are warning signs of hyperthermia. In 2002, the ACOG promoted moderate exercise during pregnancy, suggesting that exercise may play an important role in the prevention and management of gestational diabetes mellitus, particularly in morbidly obese women (BMI > 33) [2]. In the 2002 updated guidelines, the ACOG even encouraged sedentary women to begin exercising in the absence of medical contraindications after a thorough evaluation with their physician. In 2003, the Joint SOGC/CSEP Clinical Practice Guidelines stated that in uncomplicated pregnancies, women with or without a previously sedentary lifestyle should be encouraged to participate in aerobic and strength conditioning exercises as part of a healthy lifestyle [6]. They further advocated that women and their caregivers should consider the risks of not participating in exercise during pregnancy, including the loss of muscular and cardiovascular fitness etc.

### Physiological Changes during Pregnancy

While there are many physiological changes, gravid women who

exercise during their pregnancy need to be aware of the increase in energy requirements. Women should increase their caloric intake by 300 kcal per day per fetus after the 13th week of pregnancy [7]. Exercise activities must also be compensated for with increased caloric intake. The combined energy requirements of pregnancy and exercise coupled with poor weight gain may lead to fetal growth restriction [1]. At the other end of the spectrum, we have obesity during pregnancy, which also brings about additional complications. Regardless of which way the pendulum swings, prepartum women should work with a nutritionist and exercise physiologist as well as their primary care physician to ensure that they are adjusting their caloric needs appropriately to meet their changing physiology and active lifestyle patterns. Additional physiological changes that occur during pregnancy are highlighted (Table 2).

### Traditional Exercise during Pregnancy

#### Exercise prescription for aerobic exercise during pregnancy

There is sufficient evidence to support 30 min of moderate aerobic conditioning on most if not all days of the week during uncomplicated pregnancies [1-3,6]. Given the variability in target heart rates during pregnancy, it is advisable to use another means to monitor intensity such as: (1) the talk test; (2) the compendium of physical activity chart with metabolic equivalents [(METs)]; or (3) the Borg Rating of Perceived Exertion Scale (RPE) [1,8]. As the talk test name implies, a woman is exercising at a moderate level if she can maintain a conversation during exercise. Moderate exercise is defined as 3-5 METs which means that a woman is exercising 3-5 times above her resting metabolic rate [3]. Table 3 highlights some common MET categories for low, moderate and vigorous exercise. An RPE of 12 to 14 (light to somewhat hard) on the 6-20 Borg scales indicates a feeling of moderate exercise. The Borg Scale accounts for an individual's fitness level. Perceived Exertion matches how hard an individual feels they are working with numbers from 6 to 20; thus, it is relative to fitness levels (Table 3).

Previously sedentary women's exercise progression should follow a gradual progression of up to 30 min a day beginning with 15 min a day 3 times a week. Reasonable goals for women who were previously active would be to maintain a good fitness level without trying to reach peak fitness or train for an athletic competition. Elite athletes who continue to train during pregnancy should work under the supervision of their obstetric care provider with knowledge of the impact of strenuous exercise on maternal and fetal outcomes [6]. A summary of recommendations for aerobic exercise during pregnancy can be found (Table 4).

#### Exercise prescription for resistance training during exercise

While there is less evidence on strength-conditioning and resistance training (RT) using weights in pregnancy, it seems that appropriate RT provides an enhanced level of muscular fitness. Enhanced muscular fitness may help compensate for the postural adjustments that typically occur during pregnancy [9,10]. Nonetheless, the recommendation from the ACOG [2] is that exercise in the supine position should be avoided whenever possible because of the relative obstruction of venous return and, therefore decreased cardiac output and orthostatic hypertension, especially after the first trimester. Furthermore, heavy lifting during pregnancy is never appropriate since it may expose the joints, connective tissue, and skeletal structures of a gravid woman to excessive forces [11].

All RT exercises should be performed in a slow and controlled

SYSTEM	FUNCTION	MECHANISM
Cardiovascular	<ul style="list-style-type: none"> <li>a) Higher peripheral oxygen demands (from 50 ml/min to 500 ml/min)</li> <li>b) Cardiac Output increases by 40% (Heart rate increases at the beginning up to 10 – 15 bpm and systolic volume by 10 to 12%)</li> <li>c) Peripheral resistance decreases from week 12 to week 24, becoming normal later</li> <li>d) Blood returning to the heart is more oxygenated</li> <li>e) Resting respiratory rate is reduced whilst vital capacity is preserved</li> </ul>	<ul style="list-style-type: none"> <li>a) Oxygen uptake increases from 15 to 20 % during the 2nd half of pregnancy This is caused by growing oxygen uptake from the uterus, placenta and fetus</li> <li>b) Resting HR in the pregnant woman increases by the increase in gonadotropin hormone, the lower activity of the parasympathetic system, and reduced concentration of blood catecholamine</li> <li>c) This is caused by vasodilation produced by hormones</li> <li>d) Minute volume increases more than oxygen uptake</li> <li>e) This is caused by a slight increase in inspiratory capacity</li> </ul>
Blood	<ul style="list-style-type: none"> <li>a) Plasma volume increases gradually until the 32 weeks (30 to 60%),</li> <li>b) Red blood cells number and size increase</li> <li>c) The veins increase their capacity and peripheral vascular resistance decreases</li> </ul>	<ul style="list-style-type: none"> <li>a) This causes a hemodilution of the blood causing the physiological anemia of pregnancy</li> <li>b) Produced by increased renal erythropoietin</li> <li>c) Produced by effect of progesterone</li> </ul>
Respiratory	<ul style="list-style-type: none"> <li>a) Resting hyperventilation to compensate alkalosis (increased ventilation from 6 L/min to 9 L/min)</li> </ul>	<ul style="list-style-type: none"> <li>a) This is produced by the increment of the tidal volume, which removes more CO<sub>2</sub> from blood, this raises PH Also, it helped by chemoreceptors enhanced sensitivity to CO<sub>2</sub> in order to prevent fetal ischemia and acidosis</li> </ul>
Renal and urinary	<ul style="list-style-type: none"> <li>a) Dilated ureters and renal pelvis producing an increase of the dead space and a delay in the elimination of urine</li> <li>b) Increased kidney size</li> <li>c) Diastolic decreases 5 to 10 mmHg</li> <li>d) Increased renal plasma flow, in the first quarter (600ml/min to 836ml/min)</li> </ul>	<ul style="list-style-type: none"> <li>a) This is caused by aldosterone and estrogen release, which balance progesterone</li> <li>b) Caused by progesterone activity</li> <li>c) Increased renin secretion and activation of the axis renin-angiotensin-aldosterone</li> <li>d) The increased glomerular filtration Later, it decreases</li> </ul>
Gastro-intestinal	<ul style="list-style-type: none"> <li>a) Nausea, vomiting</li> <li>b) Predisposition to tooth decay and gum hyperemia</li> <li>c) Delay in time for gastric evacuation producing constipation</li> <li>d) Pirosis</li> </ul>	<ul style="list-style-type: none"> <li>a) Associated with hormone secretion (gonadotropins and estrogens)</li> <li>b) Related to hormone concentration in saliva</li> <li>c) The growing of the uterus, moves bowel and stomach</li> <li>d) Cardias sphincter relaxation causes the hydrochloric acid in the stomach to reflux into the esophagus</li> </ul>
Metabolic	<ul style="list-style-type: none"> <li>a) Diabetogenic effect of pregnancy</li> <li>b) Change in blood lipid profile</li> <li>c) Increased resting metabolic rate</li> </ul>	<ul style="list-style-type: none"> <li>a) This is due to some hormones like cortisol, estrogens and lactogen from placenta can have blocking effects on insulin (insulin resistance)</li> <li>b) Pancreas can naturally produce more insulin, causing gestational diabetes</li> <li>c) Lipids increase from 600mg/ml to 900mg/ml Produced by the influence of estrogens and cortisol</li> <li>d) Caused by the increased demands from gestational state</li> </ul>
Water Metabolism	Increment in total body water	<ul style="list-style-type: none"> <li>a) Hydrostatic vessels pressure</li> <li>b) Increase in lower limb blood flow return</li> <li>c) Capillary permeability</li> <li>d) Sodium retention</li> </ul>
Dermatological	<ul style="list-style-type: none"> <li>a) Increased pigmentation</li> <li>b) Possible appearance of stretch marks</li> <li>c) Increased sweat secretion</li> </ul>	<ul style="list-style-type: none"> <li>a) Caused by estrogen activity</li> <li>b) Hormonal activity produces muscle distension and low ligament elasticity</li> <li>c) Sweating glands tend to have a higher activity due to elevated hormonal secretion</li> </ul>
Skeletal system	<ul style="list-style-type: none"> <li>a) Ligaments become more relaxed (Sacroiliac, Sacrococcygeal and Pubic joints)</li> <li>b) Increased lumbar dorsal curvature (lordosis)</li> <li>c) Pain in zones around peripheral innervations</li> <li>d) Frequent muscle cramps in the third term, especially in legs</li> </ul>	<ul style="list-style-type: none"> <li>a) Caused by relaxin</li> <li>b) Produced by the displacement of the center of mass</li> <li>c) Produced by liquid retention and relaxation of ligaments by hormonal increase</li> <li>d) Related to sodium depletion</li> </ul>
Hormonal changes	<ul style="list-style-type: none"> <li>a) Human chorionic gonadotropin</li> <li>b) Estrogens</li> <li>c) Progesterone</li> </ul>	<ul style="list-style-type: none"> <li>a) Human chorionic gonadotropin develops the placenta</li> <li>b) Estrogens increase the size of the uterus and prepare milk ducts for breastfeeding</li> <li>c) Progesterone retains pregnancy and develops the lobules of the breast</li> </ul>
Body Weight	Increase between 9 and 12 kgs	This is due to fetus growth also mother gains fat mass, liquid, uterus blood volume, amniotic liquid, and placenta and breast tissue

Table 2: Physiological Changes during Pregnancy

manner. An intensity of 9 (very light) to 14 (somewhat hard) or moderate exertion on the RPE scale would be appropriate for RT during pregnancy. RT on machines is preferred to free-weights because machines can be more easily controlled and require less skill [11]. RT should occur every other day with one day of rest between sessions. One to three sets is appropriate depending on the exercise and the stage of pregnancy. An exercise set consisting of at least 12-15 repetitions without undue fatigue is recommended for the lower body and 10-12

repetitions for the upper body for the desired goal [11]. If the prepartum female cannot perform the desired number of repetitions initially, she should start with fewer repetitions and build up to the desired number before adding additional weight. Increased recovery time between sets may be needed with fewer repetitions and less weight as time of pregnancy increases. Prepartum women interested in resistance conditioning are encouraged to read, Fit to Deliver, an exercise program for you and your baby [11] (Table 5). Table 5 summarizes guidelines for

Physical Activity Intensity	MET
Light intensity activities	< 3
sleeping	0.9
watching television	1
writing, desk work, typing	1.8
walking, 1.7 mph (2.7 km/h), level ground, strolling, very slow	2.3
walking, 2.5 mph (4 km/h)	2.9
Moderate intensity activities	3 to <6
resistance training (weight) training, multiple exercises, 8-15 repetitions at varied resistance	3.5
calisthenics (e.g., push ups, sit ups, pull-ups, lunges), moderate effort	3.8
Pilates, general	3.8
yoga, Hatha	3
water aerobics, water calisthenics, water exercise	2.5
bicycling, stationary, 50 watts, very light effort	5.3
	3
walking 3.0 mph (4.8 km/h)	3.3
calisthenics, home exercise, light or moderate effort, general	3.5
walking 3.4 mph (5.5 km/h)	3.6
bicycling, <10 mph (16 km/h), leisure, to work or for pleasure	4
bicycling, stationary, 100 watts, light effort	5.5
Vigorous intensity activities	≥ 6
jogging, general	7
calisthenics (e.g. pushups, sit-ups, pull-ups, jumping jacks), heavy, vigorous effort	8
running jogging, in place	8
rope jumping	10

Note: 1 MET = 1 kcal kg<sup>-1</sup> hr<sup>-1</sup> or 1 MET = 3.5 ml kg<sup>-1</sup>min<sup>-1</sup> of O<sub>2</sub>

**Table 3:** Metabolic Equivalents (MET) Values for Physical Activity Levels

RT during pregnancy.

## Non-Traditional Exercise during Pregnancy

### Yoga during pregnancy

Even though yoga has been classified as a non-traditional exercise in the US, yoga is an ancient tradition designed to bring balance and health to the physical, mental, emotional, and spiritual domains of an individual [12]. This ancient discipline is often represented metaphorically as a tree consisting of eight “limbs” or aspects: Yama (universal ethics), Niyama (self-discipline), Asana (physical postures), Pranayama (breath control), Pratyahara (control of the senses), Dharana (concentration), Dyana (meditation), and Samadhi (bliss or transcendent meditative awareness) [13]. In contrast to other branches of yoga, the type known as Hatha focuses on the body and fitness [14]. Indeed, what most people refer to as simply “yoga” is hatha yoga, the most popular type practiced in the West [13,14].

While there is little research on the effects of yoga on pregnancy, yoga has been shown to produce significant health benefits in other healthy and clinical populations. Many of the clinical effects would be beneficial for conditions associated with pregnancy, such as gestational diabetes, hyper or hypotension, and an increased resting and exercising HR. Therefore, the statements made in this paper on Yoga are based on following the recommended exercise guidelines for prepartum women from leading experts in the field and published research on other clinical populations regarding the physiological effects of yoga on these conditions [2,3,6]. While some of these changes during pregnancy are to be expected given the additional demands of carrying a fetus, the endocrine system of pregnant women undergoes significant changes Adrenocorticotrophic hormone [15]. The stimulation of the

- The Centers for Disease Control and the American College of Sports Medicine recommendation for exercise, aimed at improving the health and well-being of nonpregnant individuals, suggests that an accumulation of 30 min or more of moderate exercise a day should occur on most, if not all, days of the week. In the absence of either medical or obstetric complications, pregnant women can also adopt this recommendation.
- Moderate exercise is defined as activity with an energy requirement of 3-5 metabolic equivalents (METs). This is equivalent to brisk walking.
- Given the variability in heart rate during pregnancy, ratings of perceived exertion have been found to be useful during pregnancy. Moderate exercise is defined as a “perceived exertion” of 12 to 14 on the 6-20 Borg scale. This feeling to total bodily exertion ranges from light to somewhat hard.
- The Talk Test is another easy way to define moderate. Women should be able to maintain a conversation while exercising.
- Because of issues of thermoregulation and energy-balance, exercise sessions longer than 45 min may not be well tolerated, caution should be used. Women should monitor hydration status and body temperature and be sensitive to subjective feelings of heat stress.
- Additional caloric intake is warranted for exercising prenatal women. The recommendation is 300 kcal per day per fetus after the 13th week of pregnancy. Exercise activities must also be compensated for with increased caloric intake as the weight of the fetus increases.
- Although an upper level of exercise intensity has not been established, female athletes (athletes vs. sedentary) are generally able to maintain their level of fitness (VO<sub>2</sub>max, power output, heart rate at anaerobic thresholds) during pregnancy if they continue to train. However, they require supervision by an obstetric care provider.

**Table 4:** Summary of Recommendations for Aerobic Exercise During Pregnancy.

- Medical advice and physician recommendations should be obtained prior to resistance training during pregnancy.
- Resistance training for all pregnant women may not be appropriate. If women have any of the contraindications to aerobic exercise as proposed by American College of Obstetrics and Gynecology they should not participate in resistance training.
- Women should be encouraged to breathe normally during resistance training, breath holding reduces oxygen delivery to the placenta. The Valsalva movement should be avoided
- Relatively low weights with multiple repetitions lifted through a dynamic range of motion appear to be safe.
- In the third trimester arm lifting more than 15 pounds or arm pushing more than 25 pounds should be avoided.
- An exercise set consisting of at least 12-15 repetitions without undue fatigue is recommended.
- As training occurs, overload initially by increasing number of repetitions and, subsequently, by increasing resistance.
- Resistance training on machines is preferred to free-weights because machines can be more easily controlled and require less skill.
- Heavy resistance should be avoided since it may expose the joints, connective tissue, and skeletal structures of an expectant woman to excessive forces.
- Exercise in the supine position should be avoided whenever possible because of the relative obstruction of venous return and, therefore decreased cardiac output and orthostatic hypertension, especially after the first trimester or approximately 16 weeks gestation.
- Motionless standing is also associated with a significant decrease in cardiac output so this position should be avoided as much as possible especially during the third trimester.
- The ability to perform abdominal exercise may be impeded by the development of diastasis recti and associated abdominal muscle weakening.

**Table 5:** Recommendations Regarding Resistance Training during Pregnancy

Sanskrit Asana	English Translation	Needed Modification	Spiritual Affirmation
Padmasana	Lotus Pose	Simply sit with crossed legs	I sit serene uplifted in Thy light
Simhasana	Lion Pose		I purify my thoughts, my speech, my every action.
Janushirasana	Head-to-Knee Pose	Lean forward only as far as possible	My thoughts and energy rise up to touch the sky
Virabhadrasana I	Warrior Pose I	Practice the pose from a kneeling position	I attune my will to the Source of all power
Tadasana	Standing Mountain Pose	Emphasize full abdominal breaths as much as possible	I stand ready to obey Thy least command
Muktasana	Freedom Pose	May need a wider base	I am free! am free!
Vrikasana	Tree Pose	Hold onto a chair and do not raise the arms overhead	I am calm, I am poised
Virabhadrasana II	Warrior Pose II	Decrease the lowering of the hips and maintain a steady base	I joyfully manifest the power of God
Adho Mukha Svanasana	Downward facing Dog Pose	Bend the knees or kneel	Calmness radiates from every fiber of my being
Arda Chandrasana variation	Half-Moon Pose	Do not go up on toes, stand vertically bending your body laterally, do not touch the floor with your hands or raise one leg	Strength and courage fill my body cells
Prasarita Padottanasana	Wide-Stance Forward Bend	Brace palm of hands on thighs and limit forward bend	I relax and cast aside all mental burdens
Baddha Konasana	Bound Angle Pose; Butterfly Pose	Limit forward movement and concentrate on hip flexibility	Secure in myself, I accept whatever is
Vajrasana	Thunderbolt Pose	Sit on chair	In stillness I touch my inner strength

**Table 6:** Sample Yoga Asanas for Gravid Women without Contraindications to Exercise During Pregnancy with Uplifting Affirmations from Ananda Yoga

pituitary adrenal axis during pregnancy raises the production of Adrenocorticotrophic hormone (ACTH). This is associated with an increase of total and free cortisol [16]. Yoga is associated with rapid stress reduction and anxiolysis, significant decreases in heart rate, systolic and diastolic blood pressure, as well as increases heart rate variability (HRV) [17-20]. Data also shows that yoga decreases levels of salivary cortisol, blood glucose as well as plasma renin levels, and 24-hour urine norepinephrine and epinephrine levels [18,19,21,22]. Many of the postures in yoga would have to be adapted to avoid compromised positions and to stay within the guidelines promoted by experts in the field [1,2,6].

With a professional background as a Registered Yoga Teacher (RYT®) instructor and American College of Sports Medicine Certified Program Director and Clinical Exercise Physiologist, the author chose suitable postures in yoga for prepartum women or adapted postures in yoga. The Sanskrit term for the asana as well as the English translation with suggested modifications in posture are listed in Table 6. The author also thinks that the affirmations that are taught with the asanas in Ananda Yoga for Higher Awareness would be beneficial during pregnancy if the gravid female was inclined to spiritual inspirations of this nature. The affirmations could easily be changed to affirmations related to increased health and well-being during pregnancy. The affirmation should be stated softly by the yoga instructor at the beginning of the asana or during the asana and then silently repeated by the yoga participant if desired. There is no published research to support the spiritual inspirations during the asana for pregnant women nor a plethora of research to support or not support yoga during pregnancy. Caution must always be practiced and the guidelines for resistance training must be applied as stated in Table 5 (Table 6).

### Pilates during pregnancy

Similar to yoga, the statements made in this paper on Pilates are based on following the recommended guidelines for prepartum exercise from leading experts in the field and the knowledge and background of the author in exercise physiology [2,3,6]. The author also holds a certification from the American Council of Exercise as a group exercise leader. Because so many of the postures in Pilates are executed while

reclining in a recumbent position and this position should be avoided during exercise as much as possible, Pilates does not lend itself easily as a viable movement form during pregnancy [2]. Albeit, the exercises could be changed to a side lying plane on the floor, and sitting postures on a chair could be used to strengthen the back muscles. It would require advanced knowledge and a manipulation of many of the postures on the part of the Pilates instructor for the exercises to be considered safe. A further concern is that the ability to perform abdominal exercise may be impeded by the development of diastasis recti and associated abdominal muscle weakening [23].

Nevertheless the positions in Pilates could be adapted for gravid women as long as the guidelines for resistance training were applied (Table 5). Nordahl et al. [11] has a chapter on balance training in her book that illustrates exercises using balls and bands. While the word Pilates is not used, these exercises are very similar to the movement patterns in Pilates. The breath control used in Pilates could easily be adapted for these exercises.

### Water exercise during pregnancy

Water aerobics has been viewed as more of an aerobic conditioning exercise rather than a resistance training tool. However, water exercise is a viable form of resistance conditioning during pregnancy. Exercising in water has many physiological benefits for gravid women [1]. The major effect of immersion is a redistribution of extravascular fluid resulting in an increase in blood volume and centripetal shift [24]. Water exercise is highly recommended as a form of resistance training during pregnancy barring no contraindications to exercise [2].

### Concluding Remarks

Providing that there are no contraindications to exercise during pregnancy, the gravid female should be encouraged to perform both moderate aerobic conditioning activities as well as reasonable resistance training activities [2]. These activities can be chosen from traditional and non-traditional exercise as defined in this paper. These activities should be chosen in consultation with the obstetric physician and health care team. Pregnant women should be knowledgeable of the changes that occur during pregnancy and why certain exercises should

be avoided. An excerpt taken from the *Active Female*, co-authored with Cardona Gonzales and Álvarez Carnero, summarizes exercise recommendations during pregnancy very nicely.

The pregnant woman should be monitored closely to adjust training loads as a function of body mass, blood markers and the fetus developmental changes. Individual prescriptions should be based on assessing energy requirements and capacity as tight as possible. A flow networking must be established between gynecologist, nutritionist and exercise physiologist in order to maximize benefits to both the fetus and the mother. The first aim of exercise program must be to guarantee the safety of the mother and fetus more than performance or esthetic outcomes during pregnancy and after-delivery [15].

## References

1. Artal R, O-Toole M, White S (2003) Guidelines of the American College of Obstetricians and gynecologists for exercise during pregnancy and the postpartum period. *Br J Sports Med* 37: 6-12.
2. ACOG Committee opinion (2002) Exercise during pregnancy and the postpartum period. *Obstet Gynecol* 99: 171-173.
3. American College of Sport Medicine (2014) ACSM's Guidelines for Exercise Testing and Prescription (9th ed). Lippincott Williams & Wilkins, Baltimore, MA. *J Can Chiropr Assoc* 58: 328.
4. Milunsky A, Ulickas M, Rothman KJ, Willett W, Jick SS, et al. (1992) Maternal heat exposure and neural tube defects. *JAMA* 268: 882-885.
5. Clapp JF (1991) The changing thermal response to endurance exercise during pregnancy. *Am J Obstet Gynecol* 165: 1684-1689.
6. Davies GA, Wolfe LA, Mottola MF, MacKinnon C, Society of Obstetricians and gynecologists of Canada, SOGC Clinical Practice Obstetrics Committee (2003) Joint SOGC/CSEP clinical practice guideline: exercise in pregnancy and the postpartum period. *Canadian journal of applied physiology* 28:330-341.
7. Clapp JF (1990) Exercise in pregnancy: a brief clinical review. *Fetal Medical Review* 2: 89-101.
8. Robert-McComb J, Stovall J (2007) Exercise guidelines and recommendations during pregnancy. In J. Robert-McComb, R Norman, & M. Zumwalt (Eds) *The active female: Health issues throughout the lifespan* (pp. 253-260) Humana Press, Totowa, NJ.
9. Avery ND, Stocking KD, Tranmer JE, Davies GA, Wolfe LA (1999) Fetal responses to maternal strength conditioning exercises in late gestation. *Can J Appl Physiol* 24: 362-376.
10. Byrant C, Peterson J, Graves J (1998) Muscular Strength and Endurance. ACSM's Resource Manual for Guidelines for Exercise Testing and Prescription (3<sup>rd</sup> ed), Williams and Wilkins, Philadelphia.
11. Nordahl K, Petersen C, Jeffreys RM (2005) *Fit to deliver* (2nd ed) Hartley & Marks Publishers, Canada.
12. Robert-McComb J, Tacon A (2014) Evidenced based disordered eating prevention programs for active females. In J. Robert-McComb, R. Norman, & M. Zumwalt (Eds) *The active female: Health issues throughout the lifespan* (pp. 207-220) Springer Science&Business Media. New York, NY
13. Ross A, Thomas S (2010) The health benefits of yoga and exercise: A review of comparison studies. *J Altern complement Med* 16: 3-12.
14. Smith, JA, Greer T, Sheets T, Watson S (2011) Is there more to yoga than exercise? *Altern Ther Health Medicine* 17: 22-29.
15. Gonzales C, Carnero A, Robert-McComb, J (2014) Exercise prescription and pregnancy. In J. Robert-McComb, R. Norman, & M. Zumwalt (Eds) *The active female: Health issues throughout the lifespan* (pp. 389-410) Springer Science & Business Media, New York, NY.
16. Bessinger RC, Rayman C, McMurray RG (2003) Substrate utilization and hormonal responses to exercise in pregnancy. *Clinical Obstetrics and Gynecology* 46:467-478.
17. McCaffrey R, Ruknui P, Hatthakit U, Kasetomboon P (2005) The effects of yoga on hypertensive persons in Thailand. *Holist Nurs Pract* 19: 173-180.
18. Michalsen A, Grossman P, Acil A, Langhorst J, Lütke R, et al. (2005) Rapid stress reduction and anxiolysis among distressed women as a consequence of a three month intensive yoga program. *Med SciMonitor* 11: 555-561.
19. Selvamurthy W, Sridharan K, Ray US, Tiwary RS, Hedge KS, et al. (1998) A new physiological approach to control essential hypertension. *Indian J Physiol Pharmacol* 42: 205-213.
20. Khattab K, Khattab AA, Ortak J, Richardt G, Bonnemeier H (2007) Iyengar yoga increases cardiac parasympathetic nervous modulation among health yoga practitioners. *Evidence-Based Complementary and Alternative Medicine* 4: 511-517.
21. West J, Otte C, Geher K, Johnson J, Mohr DC (2004) Effects of Hatha yoga and African dance on perceived stress, affect, and salivary cortisol. *Ann Behav Med* 28: 114-118.
22. Gokal R, Shillito L, Maharaj SR (2007) Positive impact of yoga and pranayam on obesity, hypertension, blood sugar, and cholesterol: A pilot assessment. *J Altern Complement Med*: 1056-1057.
23. Gilleard WL, Brown JMM (1996) Structure and function of the abdominal muscles in primigravid subjects during pregnancy and the immediate postbirth period. *Phys Ther* 76: 750-762.
24. Epstein M. (1984) Water immersion and the kidney: implications for volume regulation. *Undersea Biomed Res* 2: 113-21.