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HEART RATE BEHAVIOR IN PREGNANT WOMEN PARTICIPATING IN WATER AEROBICS

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ABSTRACT
During pregnancy, changes such as increase in heart rate (HR) at rest occur in the body in the first trimester, followed by a moderate increase toward the end. The goal of this study was to assess the HR behavior of 15 pregnant women in the second trimester and 15 in the third trimester, before and after practicing water aerobics. The instrument used for data collection was composed of medical records of individual data from January 2008 to December 2009. Systematic, descriptive and statistical analysis and the paired t-test were performed considering a significance level of 5%. When the HR averages of the pregnant women in the second trimester were compared, before (89.46) and after (85.08) water aerobics, a significant decrease in this frequency was observed (p=0.02). Comparing the HR averages in pregnant women in the third trimester, before (86.92) and after water aerobics (81.33), there was no reduction considered statistically significant (p=0.08). It is concluded that physical activity in the water is able to prevent the increase of HR in pregnant women, including significant reduction of this variable in the second trimester of pregnancy.

Keywords: Heart rate. Pregnant women. Aquatic environment.

INTRODUCTION

Physiologically, pregnant women suffer from hormonal, cardiovascular, respiratory, nutritional, and thermoregulatory changes[1]. Heart rate (HR) at rest increases sharply in the first trimester of pregnancy and then it increases moderately until the end[1].

The contribution of regular and guided physical activity during pregnancy has been already recognized[2], although there is not yet consensus on the establishment of an ideal conduct for this practice and standardization of activities recommended by specialized bodies[2]. A study with 12 recent mothers cared for in a public hospital of the city of Maringa, State of Parana, with high education level (At least complete high school up to a graduate degree), showed that those women had received various guidelines in the three periods studied (prenatal, childbirth and postpartum) from health professionals. As important gap, the study pointed out the need for guidance for physical activities performed by pregnant women[3].

Currently, there is a growing concern about the behavior of the cardiovascular system involving activities with the body immersed in water. This is justified by the number of people, especially women at different stages of pregnancy, that choose to perform water-based exercises as a regular practice of physical activity[4,5].

Water aerobics is an excellent fitness program for pregnant women. The benefits include: improvement in cardiopulmonary condition; control over weight gain; decreased risk of gestational diabetes; lower incidence of varicose veins of the lower limbs; increased diuresis; decrease in edema formation; relief of spinal pain; reduction of the risk of preeclampsia; increased muscular endurance and flexibility; well-being; improvement of self-image; socialization; and decreased accumulation of heat[6,7].

Water aerobics has been prescribed due to its low impact on the joints and the lowest HR and blood pressure (BP) behavior. There is evidence that it may cause similar energy expenditure and lower HR when compared to the same type of exercises performed on land. It is of great

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importance for people who want to obtain similar energy expenditure than that of land-based exercises, but requiring exercises with less cardiovascular and joints overload[7].

The HR at rest is reduced with the immersion in water; however, it is important to point out that factors such as water temperature, body position, depth of immersion, and initial HR can minimize or maximize this response. The studies that have addressed the responses of oxygen consumption are not conclusive; however, unlike the HR, those studies confirmed similar or greater response during immersion at rest. Thus, it can be concluded that, due to cardiopulmonary changes observed during immersion in water, prescription of exercises in this medium must be differentiated from that of land-based exercises[8].

The literature is restricted as to the modality, intensity, frequency and duration of exercises performed by pregnant women; although studies have affirmed that water aerobics is an ideal activity for pregnant women, being increasingly recommended by obstetric gynecologists[9,10].

This study is justified due to the lack of published research addressing the HR behavior in pregnant women, with differentiation by trimesters of pregnancy and weekly assessments of HR in pregnant women. In addition, the sample of pregnant women followed up in this study was larger than those in studies that investigated this topic[4-6].

The hypothesis of this study is that the HR at rest in pregnant women can be reduced with the immersion in water and thus there may be decreased HR in these women after participating in water aerobics. It is also possible that there is differentiation regarding the trimesters of pregnancy. In this context, the goal of this work was to analyze the HR behavior during pregnancy, before and after participating in water aerobics.

MATERIAL AND METHOD

The sample of this study was composed of 30 pregnant women, 15 in the second trimester and 15 in the third trimester. All of them were participants of a water aerobics program targeted specifically at pregnant women (Active Mother Project) in a gym located in the city of Aracaju, State of Sergipe, from January 2008 to December 2009. Those women included in the study were selected from the 15th week of pregnancy and followed up until the end of the pregnancy. Women with twin pregnancy, smokers, without medical health certificate, and those that refused to sign an informed consent form were excluded from the study.

All data collection procedures were initiated after due approval by the Research Ethics Committee of the Tiradentes University (Protocol No. 0112/08). The instrument used for data collection comprised medical records with pregnant women's individual data. This instrument[11] had questions regarding: personal data (address, occupation, phone number, and date of birth); health data (history of diseases, family history and smoking habit); maternity data (previous pregnancies, premature births, delivery type, last delivery, maternity, pregnancy week, and baby's sex); physical data (physical activities prior to pregnancy, physical activity during pregnancy, previous weight, current weight, HR frequency at rest, BP, waist circumference, contact in case of emergency, weekly data of pregnant women's waist circumference, initial HR at rest (HRR), and final HR (FHR).

Data were collected before starting the program in order to obtain the age and body mass index (BMI), on the basis of mass, height and gestational age data. Still, the date, variables of HRR and FHR of the pregnant women included in the study were collected. The whole collection was held once a week, from the first class to the last class before delivery.

To calculate the BMI, it is necessary to divide the weight (Kg) by the height (m) squared, resulting in a value expressed in Kg/m^2[12].A precision scale with maximum capacity of 150 kg, divisions of 100 g and precision of 0.1 Kg was used for calculation of body mass. The measurement was performed with the pregnant woman at the center of the base of the scale, in orthostatic position, without shoes and heavier objects. Height was measured using a stadiometer, with the pregnant women standing in orthostatic position, the body raised in full extension and the head erect, staring straight ahead, with the inferior orbital arch aligned in a horizontal plane with the auricles and the feet together.

For the beginning of the collection, every pregnant woman remained sitting at rest in order to obtain the HRR with the use of a frequency meter (Polar®). At the end, after getting out of the swimming pool, the FHR was measured in the same way as it was measured at rest.

Water aerobics was performed in a swimming pool measuring 15 x 7 m, with immersion depth varying between the xiphoid process and the armpit and the water temperature ranged between 31 and 32 °C. The activity was performed for 50 minutes, being divided into a beginning stage for warming-up (10 minutes), a main stage with aerobic and localized exercises (30 minutes) and a final stage for stretching and relaxation (10 minutes). The intensity of the exercises during the aerobic exercises was controlled using the perceived exertion scale keeping an effort between the 13 and 14 indexes, which has been recommended as a good indicator for prescribing exercises to pregnant women[13].

The collected data were subjected to systematic, descriptive and statistical analysis. Paired *t*-test was conducted using a significance level of 5% to check the differences between average HR of pregnant women participating in the exercises in the second and third trimesters of pregnancy.

RESULTS AND DISCUSSION

The age, gestational week and BMI that characterized the sample were initially assessed using descriptive analysis. The averages and standard deviations were sorted and calculated by trimesters of pregnancy according to Table 1.

The data for the characterization of the sample showed normal and homogeneous distribution regarding age, both in the second and third trimesters of pregnancy. It can be observed that the BMI was greater in the third trimester. However, it was still lower than in other studies that followed up women from the 16th to the 36th weeks of pregnancy[6].

The behavior of women's average HR in the second trimester of pregnancy showed statistically significant reduction for pregnant women corresponding to PW10 with p=0.005 and PW13 with p=0.001. However, when the average HR of this group was compared before water-based exercises (89.46) and after the exercises (85.08), the reduction was significant (p=0.02).

Table 1. Sample characterization: averages and standard deviations (SD) of age, week of pregnancy and BMI of the pregnant women in the 2nd and 3rd trimesters. Aracaju, SE, 2009.

2nd Trimester	**Values**		
	Average		SD
Age	31.06	±	4.38
Week/Pregnancy	19.26	±	2.76
BMI	19.5	±	0.70
3rd Trimester			
Age	33.2	±	3.87
Week/Pregnancy	29.33	±	1.63
BMI	20.57	±	0.78

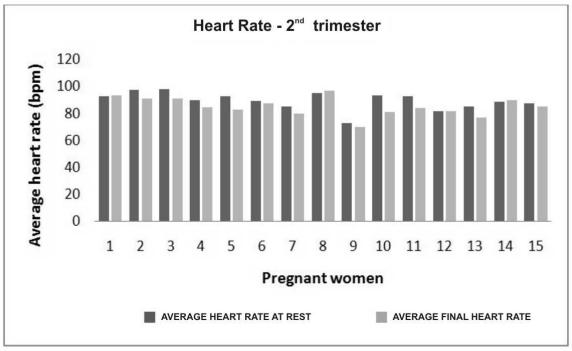

Figure 1. Behavior of average HR in the 2nd trimester of pregnancy, before and after water-based exercises. Aracaju, SE, 2009.

Pregnant women's HR in the third trimester showed significant reduction with respect to PW2 (p=0.020), PW7 (p=0.017) and PW11 (p=0.028). When the average HR of this group was compared at rest (86.92) and after water-based exercises (81.33), no statistically significant differences were found (p=0.08).

This study corroborates with the data found in studies conducted in 2006 and 2009[5]. When assessing the HR of seven women performing water-based exercises throughout pregnancy, they did not find significant increases in the values of HR throughout pregnancy or between different trimesters of pregnancy[4].When the HR behavior in women participating in water aerobics was compared between being at rest on land and in the water, in the 19th, 29th and 39th

weeks of pregnancy and postpartum, the studies found significant reduction of HR in the water compared to the HR on land[5].

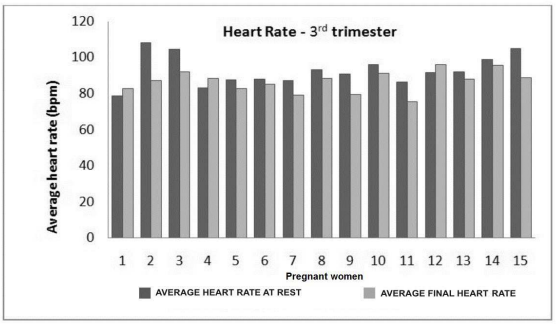

Figure 2. Behavior of average HR in the 3rd trimester of pregnancy, before and after water-based exercises. Aracaju, SE, 2009.

The literature also discusses the reduction of HR during immersion in water at rest or exercising, both with men and non-pregnant women—including old adult women—with significant decrease in HR. Still, the literature shows that the HR behavior is differentiated according to the type or intensity of the exercise performed on land or in the water[14,15].

Physical activity in the human being is responsible for the increase in HR. It is known that HRR increases abruptly in the first trimester of pregnancy, followed by a moderate increase toward the end. This increase is probably due to adjustments of cardiovascular changes resulting from pregnancy[1,4].

However, in this study, it was observed that there was no increase in HR in both the second and third trimesters of pregnancy, at rest after water-based exercises. This finding is important, because although pregnancy is responsible for the gradual increase in HR, water-based exercises were able to avoid this increase after the exercises. The physical properties of water, in particular buoyancy and hydrostatic pressure, which facilitate venous return and reduce the effort of the heart, should have prevented the increase in HR after water-based exercises performed by pregnant women in the second and third trimesters.

Another benefit pointed by the literature is that water-based exercises would be able to prevent the increase in BP in pregnant women, including a significant reduction in systolic BP depending on the level of immersion. The level of the shoulder girdle was the most widely used and which obtained the best results for the decrease in BP. This fact seems to affirm the action of hydrostatic pressure on the cardiovascular system[16].

A study had already been conducted with seven pregnant women in order to assess the HR behavior throughout pregnancy—before, during and after the water aerobics sessions—and the BP before and after the same exercises. The measures of HR and BP had been performed once a week during pregnancy. No significant increases in the values of HRR were found throughout the three trimesters of pregnancy. However, it was pointed out that the fact of not having measured the pre-pregnancy HR, in order to compare it with the value at the end of the first trimester and verify an initial abrupt increase or not, could be a bias of the study, limiting a more complete analysis[17].

The HR is one of the variables most commonly used to control the intensity of the effort during the exercise. Thus, it is necessary to know the response of this variable in water immersion. This behavior has been supported in studies conducted with pregnant women participating in water aerobics, with statistically significant reduction after the exercise compared to the results found at rest[4,6,17].

One study showed that, in order to measure the real maximum HR (HR_{max}) in the water, it would be necessary to apply a test of maximum effort, which should be conducted under conditions of temperature, depth of immersion and movements specific to the type of exercise used in the training program. However, if it is impossible to perform the effort test, the prediction of HR_{max} in the water could be performed by subtracting the bradycardia from the HR_{max} value on land[18].

In this sense, this study suggests the use of the following equation: HR Max in the water = HR Max on land - ^HR, in which ^HR = bradycardia resulting from immersion (in depth, temperature and body position used in the exercise)[18]. The proposal to perform the prediction of HR_{max} in the water would be addressed to determine the bradycardia during immersion at rest, having control of the position, depth and temperature used for the exercises,

subtracting the value obtained from the value of HR_{max} on land. The use of this proposal may have fundamental importance for intensity control in the water.

It is necessary that professionals, who work with water-based exercises, take into account the reduction of HR after the exercises, especially in the second trimester of pregnancy, in order to provide more efficient and safe physical activities to this specific population.

Taking into account that the recent scientific literature points out evidence that an individual program of physical activity should be recommended before and during pregnancy, including a minimum frequency of three to four times a week with a duration of 25 minutes, and that performing exercises with moderate and vigorous intensity could obtain a protective effect on weight gain and diabetes during pregnancy[19], water aerobics seems to be suitable for pregnant women who are at risk of chronic diseases.

Attention should be given to encouraging water aerobics from the beginning of pregnancy through specific protocols on prenatal care, because a study conducted with pregnant women in the city of Porto Alegre, State of Rio Grande do Sul, demonstrated that these women waited to complete the first trimester of gestation to join the water aerobics program[20].

Due to the importance of water aerobics for pregnant women, it would be appropriate to have the possibility of deploying this physical activity as an alternative health promotion for pregnant women that use the Unified Health System (UHS) from the moment of prenatal care.

Universities could offer support spaces for this demand of referred pregnant women enrolled in the Family Health Strategy for this practice—since some universities have swimming pools for the accomplishment of the activity—and they could also contribute with extension projects that meet this demand. The referral of pregnant women to participate in water aerobics in intersectoral areas of support for the UHS network could prevent complications in pregnancy and childbirth.

CONCLUSION

It is concluded that there was no increase in HR at rest after water-based exercises in both the second and third trimesters of pregnancy. Therefore, water-based exercises seem to be able to prevent the increase in HR in pregnant women participating in water aerobics programs, including significant reduction of this variable in the second trimester of pregnancy. Since water aerobics is a healthy physical activity for pregnant women, it is important that it can be implemented as public health policy of the UHS and offered free of charge in leisure spaces for disadvantaged pregnant women.

COMPORTAMENTO DA FREQUÊNCIA CARDÍACA DE GESTANTES PRATICANTES DE HIDROGINÁSTICA

RESUMO

Na gestação ocorrem alterações no organismo como o aumento da frequência cardíaca (FC) de repouso no primeiro trimestre, seguido de um aumento moderado até o final. O objetivo deste estudo foi avaliar o comportamento da FC de 15 mulheres no segundo trimestre e 15 no terceiro trimestre gestacional antes e depois da prática de hidroginástica. O instrumento utilizado para a coleta de dados estava composto por fichas clinicas de dados individuais do período de janeiro de 2008 a dezembro de 2009. Realizou-se uma análise estatística descritiva sistemática e o teste T pareado, adotando-se um nível de significância de 5%. Quando se compararam as médias da FC entre as gestantes no segundo trimestre antes (89,46) e após o exercício na água (85,08), foi encontrada redução significativa dessa frequência (p=0,02). Comparando-se as médias da FC entre as gestantes no terceiro trimestre antes (86,92) e após o exercício na água (81,33), não foi observada redução considerada estatisticamente significativa (p=0,08). Conclui-se que a atividade física no ambiente aquático é capaz de prevenir o aumento da FC das gestantes, inclusive com redução significativa dessa variável no segundo trimestre da gravidez.

Palavras-chave: Frequência cardíaca. Gestantes. Ambiente aquático.

EL COMPORTAMIENTO DE LA FRECUENCIA CARDÍACA DE MUJERES EMBARAZADAS PRACTICANTES DE HIDROGIMNASIA

RESUMEN
En el embarazo ocurren alteraciones en el organismo como el aumento de la frecuencia cardíaca (FC) en reposo en el primer trimestre, seguido por un aumento moderado hasta el final. El objetivo de este estudio fue evaluar el comportamiento de la FC de 15 mujeres en el segundo trimestre y 15 en el tercer trimestre de embarazo, antes y después de practicar hidrogimnasia. El instrumento utilizado para la recogida de datos estaba compuesto por historiales médicos de datos individuales del período de enero de 2008 a diciembre de 2009. Se realizó un análisis estadístico descriptivo sistemático y la prueba T pareado, adoptándose un nivel de significancia del 5%. Al comparar los promedios de la FC entre las mujeres embarazadas en el segundo trimestre, antes (89,46) y después del ejercicios en el agua (85,08), se observó una reducción significativa de esta frecuencia (p=0,02). Comparándose los promedios de la FC entre las mujeres embarazadas en el tercer trimestre, antes (86,92) y después de ejercicio en el agua (81,33), no se observó reducción considerada estadísticamente significativa (p=0,08). Se concluye que la actividad física en el medio acuático es capaz de prevenir el aumento de la FC de mujeres embarazadas, incluyendo una reducción significativa de esta variable en el segundo trimestre del embarazo.

Palabras clave: Frecuencia cardíaca. Mujeres embarazadas. Ambiente acuático.

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