Impact of physical exercise in cardiovascular and metabolic parameters in post-menopausal women

Impacto do exercício físico nos parâmetros cardiovasculares e metabólicos em mulheres na pós-menopausa

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ABSTRACT

Backgound: understanding how physical exercise changes vascular and metabolic health of women with hormonal changes resulting from the menopausal period is essential for

better discernment of therapeutic anti-sedentary indications. Besides that, the effects of physical exercise in post-menopause women is not entirely understood.
Objectives: the aim of the present study was to investigate the effect of physical exercise on specific parameters in post-menopause women's cardiovascular and metabolic health.
Design: a total of 31 participants, assisted in a primary health care were included. Twenty (20) women from a program promoted by the health service were assigned to the physically active group (AG), in which they performed many types of exercise, including stretching, aerobic and resistance training of varying intensities. Eleven (11) women on the control group (CG) were recruited at the same service and attended the institution for other ends related to their health.
Results: arterial pressure had a significant diference between AG adn CG: mean systolic blood pressure (SBP) in the AG was 111±6mmHg *versus* 118mmHg in the CG; mean diastolic blood pressure (DBP) was 71mmHg in the AG *versus* 82mmHg in the CG. The fact that the majority of women in the AG (60%) had more than 8 years of formal education versus 37% in the CG drew attention. In both groups, most women had less than 3 children. Most women in the CG reported formal work while domestic work prevailed in the AG. Despite this, per capita income showed no difference.
Conclusion: blood pressure, an important cardiovascular risk factor, is significantly lower in post-menopause women that practised regular physical exercises; in addition, socioeconomic factors is very close influencer in physical exercise engagement. Other studies are necessary to evaluate more cardiovascular variables.

Keywords: physical exercise; menopause; cardiovascular system; hipertension.

RESUMO
Backgound: compreender como o exercício físico altera a saúde vascular e metabólica da mulher com alterações hormonais resultantes do período menopausal é essencial para um melhor discernimento das indicações terapêuticas anti-sedentárias. Além disso, os efeitos do exercício físico na mulher após a menopausa não são totalmente compreendidos.
Objetivos: o objetivo do presente estudo foi investigar o efeito do exercício físico sobre parâmetros específicos na saúde cardiovascular e metabólica da mulher na pós-menopausa.
Desenho: um total de 31 participantes, assistidos em um atendimento primário de saúde foram incluídos. Vinte (20) mulheres de um programa promovido pelo serviço de saúde foram designadas ao grupo fisicamente ativo (AG), no qual realizaram muitos tipos de exercício, incluindo alongamento, aeróbico e treinamento de resistência de intensidades variadas. Onze (11) mulheres do grupo de controle (GC) foram recrutadas no mesmo serviço e frequentaram a instituição para outros fins relacionados à sua saúde.
Resultados: a pressão arterial teve uma diferença significativa entre AG e CG: a pressão arterial sistólica média (PAS) no AG foi de 111±6mmHg versus 118mmHg no GC; a pressão arterial diastólica média (PAD) foi de 71mmHg no AG versus 82mmHg no GC. O fato de que a maioria das mulheres no AG (60%) tinha mais de 8 anos de educação formal contra 37% no GC chamou a atenção. Em ambos os grupos, a maioria das mulheres tinha menos de 3 filhos. A maioria das mulheres do GC relatou trabalho formal enquanto o trabalho doméstico prevaleceu no GC. Apesar disso, a renda per capita não mostrou diferença.
Conclusão: a pressão arterial, um importante fator de risco cardiovascular, é significativamente menor nas mulheres na pós-menopausa que praticavam exercícios físicos regulares; além disso, fatores socioeconômicos influenciam muito de perto o

engajamento em exercícios físicos. Outros estudos são necessários para avaliar mais variáveis cardiovasculares.

Palavras-chave: exercício físico; menopausa; sistema cardiovascular; hipertensão.

1 INTRODUCTION

In developed countries, approximately 95% of women go through reproductive life and reach the final menstrual period (the last menstrual cycle after 12 months of amenorrhea) due to ovarian activity's decrease[1]. The perimenopause is a stage in women's biological life that represents the transition between the reproductive and non-reproductive periods[2].

Additionally, the postmenopause is divided into two periods: the early period, which comprises the first 5 years after the final menstrual period (FMP); and the late period, which takes place from after the early period until the woman's demise[3]. This period induces biological and psychological changes in women's bodies, which in turn may contribute to the beginning of comorbid conditions[4]. Some changes include: reduction in collagen, osteoporosis, reduction in sexual and reproductive functions, and metabolic syndromes[5].

Metabolic syndrome is defined as a group of metabolic changes that occur and result in sequential disfunction in lipid and glycemic serum concentrations, promoting the development of negative characteristics in women's bodies, such as visceral fat deposition (central obesity), insulin resistance and dyslipidemia[6]. The prevalence of metabolic syndrome in post-menopause women is higher than in reproductive-age women, mainly due to reduced oestrogen levels; factor that is not present in young women. Furthermore, in this stage of life there is less energy expenditure, consequently altering the lipid profile and increasing weight gain; therefore increasing the likelihood of metabolic and cardiovascular diseases[7].

In this significant context of changes in post-menopause women, the practice of physical exercises is a crucial aspect in improving overall health and quality of life for women in post-menopause. Physical exercise is defined as a systematized activity being planned, structured and repetitive; thus enabling the maintenance, or development, of physical aptitude[8].

Unfortunately, studies point to a trend in reduction of the practice of physical exercises as individuals get older, especially in the female population; which is a prospect

that negatively impacts women's cardiovascular risks, since inactivity acts as an additional risk factor alongside the reduction of oestrogen levels, which itself has a cardio-protective role for women in reproductive age[9]. These factors also play a role in higher incidence of fractures associated with osteoporotic states.

There has been studies evaluating different types of exercise-based interventions in perimenopause/postmenopause women with different comorbidities. The FLAMENCO project[10], for instance, analyzed the association between sedentary time and physical fitness parameters with ideal cardiovascular health (ICH) behaviour index, which has become a term proposed by the American Heart Association and is composed of health behaviours attributed to development of CVD; as well as sought the ability of sedentary time and physical fitness to predict the presence or absence of ICH status in perimenopause women; the authors found that, without considering cardio-metabolic markers, there was an association of physical fitness and ICH behaviour index. In another study[11], the authors analyzed the effects of resistance training *versus* aerobic exercise in post menopause women with hypertension, and found that, in this population, moderate aerobic exercise was superior with more impact regarding nitric oxide availability, lipid abnormality, CV function and cardiorespiratory fitness. Furthermore, other studies observed a positive impact of resistance training, with varying intensities, in cardiovascular and hemodynamic parameters in postmenopausal women [12, 13, 14].

In the present study, we highlight sociodemographic indicators and general health profile of women assisted in primary health care. In this perspective, we hope to know the factors that possibly contribute to the prevalence of cardiovascular and metabolic diseases in active or sedentary postmenopausal women. The identification of factors that may intervene in the years following the menopause, that is proposed in this study, reveals itself as a contribution to women's health-related programs, making it possible to improve preventive actions by utilising physical exercise, as well as enabling a scientific debate, in the role this practice has in women's overall quality of life in post-menopause. With these considerations, this study aims to evaluate the impact of the regular practice of small intensity physical exercise in cardiovascular and metabolic parameters in post-menopause women.

2 METHODS

2.1 STUDY DESIGN

This research had an analytical, cross-sectional, quantitative study design, which included the population of menopausal women between 45 and 65 years old in Belo Horizonte, Brazil; assisted in a Primary Health Care, where cardiovascular and metabolic aspects of health were compared. Research Ethics Committee of the Belo Horizonte Municipal Health Department had approved the research project (CAAE 30619520.2.3001.5140).

2.2 RECRUITMENT AND STUDY POPULATION

Thirty-one women were recruited by invitation of the researchers that highlighted the goal of the study, as well as its risks and benefits. The women from the active group (AG) were recruited in the Family Health Support Nucleus of the Primary Health Care, which in turn were participants in the No Pain Project promoted by the institution; in addition, the women on the control group (CG) were recruited at the same service and attended the institution for other ends related to their health, not being stimulated to maintain physical inactivity, with the researchers maintaining an impartial stance. All participants were informed about the procedures and its implications, and confirmed their participation by signing an informed consent term.

2.3 PARTICIPANTS

The sample size was obtained considering the number of participants of the No Pain Project, which during the time of observation. Thirty-one women were recruited. The exercise protocol of AG included stretching and gymnastics, as well as strengthening exercises and muscular resistance, balance and flexibility being executed in sixty-minute sessions, twice a week.

A questionnaire with a semi-structured script, including socioeconomic and health questions, was applied. Furthermore, the blood pressure and anthropometric data were collected during the interview. Of all the participants, twenty were regularly undergoing light to moderate intensity physical exercise in the past twelve weeks (AG); and eleven were inactive (CG).

The analyzed variables were: age, years of formal education, family income (in minimal wage per capita), addictions, use of hormone therapy, comorbidities, body mass index (it was considered overweight women who had BMI between 25 and 29 kg/m2, and

obese, women who had a BMI > 29kg/m2), waist-hip ratio (WHR) and blood pressure (BP).

2.4 BLOOD PRESSURE (BP) MEASUREMENT

To measure the BP, the participants were instructed to remain seated and rest for 3-5 minutes, with both legs uncrossed, feet resting leveled with the floor, back straight against the chair, arm in heart's level, rested and with the palm of the hand facing upward.

2.5 ANTHROPOMETRIC EVALUATION

For the measurement of anthropometric data, a mechanical scale was used. For the height, waist, and hip measurements a simple measuring tape was used (with the WHR being calculated as WHR = waist circumference/hip circumference) and the BMI was calculated considering the body mass (in kilograms) and height (in meters), applying the formula: BMI = (body mass)/height^2.

2.6 STATISTICAL ANALYSIS

For the analysis of the results, the data was inserted in the statistical program PrismGraphPad®, version 5.0. The results were presented in tables.

3 RESULTS

The age of the participants in the study period as well as the age at which they reached menopause did not differ. The fact that the majority of women in the AG (60%) had more than 8 years of formal education versus 37% in the CG drew attention. In both groups, most women had less than 3 children. Most women in the CG reported formal work while domestic work prevailed in the AG. Despite this, per capita income showed no difference.

Table 1 describes the socioeconomic data, whereas table 2 presents health profile data of the participants.

Table 1. Socioeconomic data in studied population.

Variables	AG	CG
Age (years +- s.d.)	53,2 ± 7	55,0
Menopause age (years +- s.d.)	47,6	47,5
Education (years):		
< 8	08(40%)	07 (63%)
>8	12(60%)	04(37%)
Number of children:		
None	06(30%)	-
< 3 children	10(50%)	09(81%)
≥ 3 children	04(20%)	02(19%)
Job		
Domestic work	12 (60%)	04 (37%)
Formal employment	08 (40%)	07 (63%)
Family income *per capita*		
≤ 2 minimum wages	11 (55%)	06 (55%)
>2 minimum wages	09 (45%)	04 (45%)

It is noteworthy that the majority of women in the CG did not report the presence of dyslipidemia or hypertension, a fact that may contribute to the lack of demand for physical exercise (table 2).

Table 2. Population distribution regarding habits and comorbidities. Belo Horizonte, MG, 2020.

Variables	AG	CG	Total
Alcohol consumption			
Yes	05 (25%)	03 (28%)	
No	15 (75%)	08 (72%)	100%
Smoking			
Yes	-	02(19%)	
No	20(100%)	09(81%)	100%
Hormonal therapy			
Yes	-	01(10%)	
No	20(100%)	10(90%)	100%
Following a diet plan			
Yes	08(40%)	03(72%)	
No	12(60%)	08(28%)	100%
Comorbidities			
Diabetes Mellitus			
Yes	04 (20%)	-	
No	16 (80%)	11 (100%)	100%
Hypertension			
Yes	10 (50%)	03 (27%)	
No	10 (50%)	08 (73%)	100%
Dyslipidemia			
Yes	08 (40%)	08 (27%)	
No	12(60%)	03(73%)	100%

In the AG the mean BMI was 27,4 kg/m^2, in contrast to 24,0 kg/m^2 in the CG. Furthemore, 40% of women in the AG were classified as overweight (BMI between 25 and 30) during the interview, in contrast to 27% of women from the CG. In both groups was observed a higher than 0,8 WHR, indicating an increased risk for cardiovascular disease, 70% in the AG, and 72% from the CG (table 3).

Table 3 – BMI, WHR, and blood pressure of studied population. Belo Horizonte, MG, 2020

Variables	CG	AG	Total
BMI (kg/m²)			
Mean	24,0	27,4	
18,5 - 24.9	08 (72%)	07 (35%)	
25 - 29.9	03 (28%)	08 (40%)	
>30	-	05 (25%)	100%
WHR (cm)			
>0,80	08 (72%)	14(70%)	
<0,80	03 (28%)	06(30%)	100%
Blood pressure (mmHg)			
SBP	118	111,6	
DBP	82	71	

CG, control group; AG, active group, BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; WHR, waist-to-hip ratio

When comparing systolic and diastolic blood pressures (SBP and DBP, respectively), both groups had satisfactory blood pressures. The AG had a mean SBP of 111+-6 mmHg and a mean DBP of 71mmHg; in contrast to a mean SBP of 118mmHg and a mean DBP of 82mmHg in the CG. Also worth noting that neither of the groups have a high incidence of comorbid conditions, such as diabetes and hypertension.

4 DISCUSSION

This study indicates that the participants were, in average, 47,6 years old when in menopause, age which is considered normal when compared with other studies conducted within a similar population. A study realised in 2006[15] with healthy latin-american women and found an age average of 48,6 years; furthermore a study conducted in the northeastern region of Brazil in 2008[16] found an average menopause age of 48 years old.

It is important to note that when the menopause happens in an earlier age than what was previous found in the current literature, this can be interpreted as an early ageing, fact that is associated with increased all-caused mortality[17]. Furthermore, these women might have an increased mortality risk relating to coronary, respiratory, and metabolic causes. This increased risk might be related to the early deterioration of endothelial and myocardial cells, both of which are sensible to oestrogen activity[17].

Regarding professional occupation, it was observed a higher amount of women from the AG who were home workers (60%), when compared with the CG (37%). Some studies evaluated the perception of barriers to physical activity, and among them were lack of time (40%), with approximately 30% reporting a lack of motivation to practice physical exercises[18]. The time factor seems to be a very common barrier to the adoption of a routine that includes physical exercises, being also correlated with an increased intake of processed goods, since these are easier to consume and lack a need to prepare before eating. However, this lifestyle leads to an increased risk of morbid conditions to occur when compared to active groups.

On the other hand, the years of formal education of women from the AG were higher than 8 years in 60% of women, when compared with 37% of women from the CG. Some publications identified a positive association between years of formal education and the ability to control leisure activities. Furthermore, these researches demonstrate that the practice of physical activity is associated to social-economic factors, especially income and formal education years. The lower education participants are subject to higher levels of unorganised physical activities, such as locomotion to the work place and the intensive physical labour associated with the professional occupancy. On the other hand, the group with higher income and higher number of formal education years are more prone to engage in regular and intentional physical exercises[19].

It is important to note that while the higher income and formal education participants are privileged to be able to regularly practice physical exercises, the lower income participants are, however, less favored to practice physical exercises. It is necessary, therefore, to create public policies to promote health and the regular practice of physical exercise to these vulnerable groups; albeit in a context of reducing the social gap to improve availability of public spaces and services. In our study, besides differences in formal education and job, income per capita was not different between groups.

4.1 CARDIO-METABOLIC PARAMETERS

Regarding cardiovascular and metabolic parameters, both groups displayed a similar comorbidity profile including Diabetes Mellitus, arterial hypertension and dyslipidemia. When observing the WHR, it wasn't observed a significant difference between the studied groups, noting that 70% of women from the AG had a high risk for developing cardiovascular diseases, followed by 72% in the CG. It is well know that cardiovascular disease are the largest cause of mortality in both genders, with women

having an increased risk as they get older and go through menopause. Therefore, primary ovarian insufficiency seems to be a divisive subject regarding its contribution to women's cardiovascular risk[7].

Many studies show the prevalence of metabolic syndrome in post-menopausal women when compared to those still in their reproductive age. This may be the result of the ovarian insufficiency or may be due to metabolic changes that occur with the redistribution of adipose tissue after the decrease in oestrogen levels; which in turn increases overall body weight and progression of possible atherosclerotic processes[20]. All things considered, the practice of physical exercises causes beneficial changes in cardio-metabolic parameters in post-menopausal women, since there is an increase in overall anti-oxidant systems, as well as reduction in factors that head-start the atherosclerotic process, therefore playing an important role in enhanced endothelial function. Furthermore, physical exercise develops improvements in arterial compliance, lowering, therefore, cardiovascular risk factors, such as arterial blood pressure and total cholesterol levels, as well as reducing circulating levels of iterleucin-6, leptin and resistin. These molecules, when in high circulating concentrations, may induce or facilitate chronic inflammation, resulting in the development of neurodegenerative diseases, osteoporosis and atherosclerosis; evidently having a profound impact in women's quality of life[21].

It is well known that physical exercise has an important role in both prevention and treatment of hypertension[11], as well as having a role in reducing cardiovascular risk through the improvement of lipid profile in the general population. When noting post-menopause women, it is observed that aerobic exercise reduces BP significantly[11], as well as combined exercise[22], which is something that was observed in this study: the women from the AG had an average SBP 5,08% lower in comparison to the CG; and an average DBP 13,4% lower than the CG. The averages differ from the literature, since it is reported an average reduction of 3,8% of the SBP and a 5,9% reduction in DBP after aerobic training[11]. When investigating the general population of 69 participants, 83% of which were women on postmenopause, a randomised controlled trial[23] comparing aerobic, resistance, and combined exercise, showed significant reduction only in peripheral DBP, central DBP, and resting heart rate; and only in the group submitted to the combined exercise training; trial which was conducted in an 8-week exercise regimen. However, it is important to note that the methodology of these studies differ significantly from this one.

Furthermore, although the associations between hormonal changes in the postmenopausal period and CVD risk are not entirely understood, out study strengthens the argument for the recommendation of physical exercise in this population, even though further investigations are needed regarding the hormonal adaptations that occur in these women[24].

Even though our study did not analyze other CVD risks, it was shown[22] that combined physical exercise has a positive effect in postmenopausal women with hypertension, with reduction in many CVD risk markers, most notably the pulse wave velocity (PWV), an important arterial compliance marker and independent CVD risk predictor.

4.2 BODY COMPOSITION

Relating to the BMI, the results showed that in the AG 40% of participants had a BMI considered overweight (between 25 and 30kg/m^2); in the CG, however, 72% of women had a BMI considered normal (between 18,5 and 25kg/m^2). In light of these results, the following questions emerged: do overweight women have an increased interest in physical exercises? Are the post-menopausal women that had a normal BMI aware of the importance of physical exercise in the reduction of symptoms and health issues in the post-menopause period?

A study in 2014 showed that the main reasons for the practice of physical exercise were aesthetic, health, physical aptitude and quality of life improvement[25]. Furthermore, a different study showed that adult men are motivated to the practice of physical exercise due to social reasons, while women were motivated due to aesthetic and body mass aspects[26]. There is solid evidence that physical exercise promotes improvement in psychological well-being, self-esteem and corporal image.

However, even more than aesthetics, the regular practice of physical exercise is essential for increasing the daily energy expenditure, controlling the standard metabolic rate, contributing therefore to the improvement in physical capacity e maintenance of lean mass[27]; being its effects in post-menopause women a non-pharmacological approach within primary health care with significant evidence of its benefits on cardiovascular and metabolic diseases. In this context, health care professionals have a relevant role in informing the importance of regular physical exercise practice for women in all stages of life, specially for those in the post-menopause period. The professional should use tools and strategies in order to bring women to health services through constant health

education, identifying as well the vulnerabilities and potentials of theses individuals, therefore causing the user to have self-judgment regarding the practice of healthy diets, the practice of physical exercise in tandem with her own reality and social limitations, as well as her own social and psychological context.

It is also reported a reduction of the BMI of 6% in a subset of obese, hypertensive, post menopause women who underwent 8-week moderate aerobic training[21]; and a reduction of 1,5% in hypertensive post menopause women in 8-week 3 times/week treadmill training at maximum lactate steady-state (MLSS)[11];

Even though the present study has improved our comprehension about the impact of physical exercise in post-menopause women, the literature lacks studies regarding this theme. So, it is clear the need of studies that demonstrate the benefit of physical exercises in post-menopause women and the role of the healthcare professional, having in mind that this period comes with numerous psychological and physical transformations in women, more often than not viewed as negative, but also with the change in social role within the familiar circle and the professional life[28].

In addition, though this research's results it was possible to note that the social and economic context of the woman may be directly correlated to their availability to the practice of physical exercises. Therefore it is essential the development of social policies that enable professionals to appropriately help women that are going through menopause in their different realities, envisioning the promotion of health and well-being actions.

5 CONCLUSION

The regular practice of physical exercise, even in mild intensity, contribute to an improvement in quality of life and health conditions. This study demonstrated that formal years of education may be involved in women's perception of the importance of the practice of physical exercise. Furthermore, the women with formal employment seem to be less likely to practice physical exercise when compared with those who are domestic workers; being the lack of available time the main reason to not practice physical exercise.

Even though the results shown here can't be applied to the general population, they deserve attention in order to enable public policies to be created and contribute to improving women's health and cardiovascular and metabolic parameters.

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