Abstract

Women enter the menopausal transition on average around the age of 50 years. This natural process leads to the termination of menstruation and a drastic decrease in the ovarian production of female sex hormones. The menopausal transition is associated with several physiological changes in the body and increased risk for metabolic and cardiovascular disease (CVD). The underlying cause of the increased risk of CVD is thought to largely be the consequence of the reduced estrogen levels as estrogen is known to have several protective effects in the cardiovascular system. Nevertheless, the risk of developing CVD after menopause is likely to be reduced with an appropriate lifestyle where physical activity may be the most efficient intervention. Physical activity is known to have potent health promoting effects associated with the cardiovascular system and whole body metabolism. It is clear that physical activity reduces the likelihood of CVD and known cardiometabolic risk factors in different populations, however, so far this has been sparsely examined in recent postmenopausal and late premenopausal women. The purpose of this PhD project was to examine the effect of the menopausal transition and of an intervention period with intense aerobic cycle training on cardiometabolic risk factors as well as cardiac morphology and function. The participating women were divided in two groups depending on their menopausal status, one group of late premenopausal (n=43) and one group of recent postmenopausal women (n=40). The age difference was minimal (4.2 years) to limit the influence of aging on the results. All women were healthy, sedentary (physical activity < 2 hours/week) and with similar body composition. Before and after a 12-week training period, the women underwent examinations for cardiometabolic risk factors, e.g. blood pressure, glucose tolerance, body composition and total blood lipids. Cardiac examination was performed with echocardiography and cardiac magnetic resonance imaging (cMRI). At baseline, before the initiation of the training intervention, the postmenopausal women had higher levels total cholesterol, LDL and HDL, but all other measured cardiometabolic risk factors and variables were similar, including blood pressure, resting HR, aerobic fitness (VO₂max) and fasting blood glucose. After the training period, the cardiometabolic risk profile was improved in both groups. The women had more lean body mass, lower diastolic blood pressure and resting heart rate, their sugar metabolism was improved and total cholesterol and LDL was reduced after training. Cardiac morphological assessment with echocardiography (n=73) and cMRI (n=28) showed similar size, volume and wall thickness of the left ventricle in the pre- and postmenopausal groups. There were only minor differences in systolic and diastolic function between the two groups of women. After the training period, both groups had increased left ventricle mass (echocardiography and cMRI) and had improved on several parameters related to systolic and...
diastolic function, with only minor differences between groups. The perfusion of the heart (myocardial perfusion) was measured at rest and during stress with a pharmacological agent (adenosine) which was infused in the antecubital vein of the arm. At rest the myocardial perfusion was lower in the postmenopausal women compared to the premenopausal women, this difference persisted after the intervention where both groups of women displayed lower perfusion than before the training. Under stress induced myocardial perfusion no difference between the groups was detected before or after the training. However collectively, the women showed a lower perfusion after the training period, although this was not significant when the women were divided into groups.

The Copenhagen women Study – menopause and this PhD thesis have provided new knowledge related to cardiometabolic risk factors and cardiac health in relation to the menopausal transition. Importantly, the project demonstrates that regular physical activity can partly oppose the detrimental effects of menopause on cardiometabolic health. The results of the project, underlines the importance of physical activity for health, especially for recently postmenopausal women who are known to have an increased risk of CVD. Future studies should examine effects of training in postmenopausal and the importance of years since the menopausal transition.