

## Hypertension Today: Role of Sports and Exercise Medicine

Laura Stefani<sup>1,\*</sup>, Gabriele Mascherini<sup>1</sup>, Benedetta Tosi<sup>1</sup>, Giorgio Galanti<sup>1</sup>

<sup>1</sup>Sports and Exercise Medicine Unit-Department of Experimental and Clinical Medicine University of Florence –Italy.

### Abstract

Progressive increase of cardiovascular disease (CVD), with a rising costs for the society, is driving to focus on risk's factors reduction. The importance to prevent acute events and to reduce mortality and morbidity have risen the sound of the correct life style indications as the primary approach for hypertension. The new classification of hypertension has amplified an high-value of the role of the physical activity especially in the initial phase of the disease when the potential positive impact of the regular physical activity can permit to avoid the use of the pharmacological treatment. The numbers of the hypertensive subjects is increasing everywhere; however the awareness of the presence of the disease is not so frequent. Although some risk factors, such as age and hereditary factors cannot be changed, on the contrary lifestyle's modification can prevent the CVD and hypertension.

Sports Medicine physicians agree that healthcare providers need to focus on preventive and lifestyle aspects of cardiovascular care to promote individual and population health. A dedicated approach to prescribe the amount of weekly physical activity at moderate intensity can allow to control the blood pressure values avoiding the assumption of antihypertensive drugs. Aerobic and resistance exercises need to be individually established by dedicated models tailored on the basis of the specific characteristics of the people involved. Sports and Exercise Medicine can contributes to manage and to tailor the amount of programmed physical activity starting from the "exercise prescription" guidelines.

**Corresponding author:** Laura Stefani, Sports and Exercise Medicine Unit-Department of Experimental and Clinical Medicine University of Florence –Italy, Tel.: +30-3477689030, Email: [laura.stefani@unifi.it](mailto:laura.stefani@unifi.it)

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*The Correct Diagnosis of the "Hypertension Disease"*

The first step is the correct diagnosis of hypertension that should be based on an average of repeated carefully recorded readings obtained on repeated visits, unless blood pressure (BP) is substantially and there is clear evidence of hypertension mediated organ damage. The out-of-office and self-monitoring of BP measurements are currently recommended to confirm the diagnosis and to decide the primary role of the eventual health counselling. The number of visits may vary according to the severity of hypertension. This approach can provide supplementary information for detecting white coat and/or masked hypertension. The "white coat hypertension" and masked hypertension are found in about 15-25 % of the population. Despite they are not often considered for a treatment, literature has demonstrated that for patients with white coat hypertension or masked hypertension the risk for cardiovascular disease is lower than those with normotensive values [1,2] and they cannot be excluded from the current treatment, especially non pharmacological one. In addition, the eventual comorbidities, often found in presence of hypertension, should be also evaluated and the management adjusted accordingly [3]. This specific assessment for comorbidities includes the evaluation of the eventual

presence of the ischemic heart disease, heart failure, heart valves or aortic disease, chronic kidney disease, peripheral vascular disease, diabetes, metabolic syndrome, atrial fibrillation etc. that are determinant to decide the different kind of approach and are fundamental to adapt the intensity of the exercise prescription program. The recent and innovative aspect is that two different ranges of the BP values, the normal or elevated level, separated and distinguished from the hypertension category, are also reported [4]. The inclusion of the "normal and/or elevated" range as a measure of the high level of attention in the management of hypertension, has given more strength to the role of the physical exercise program in this context (tab 1).

*The Indication to Physical Activity in Hypertension.*

The new European hypertension guidelines (ESC) has recently highlight the "physical exercise" as the principal therapeutic approach for all the levels of BP on the basis of the BP classification [4].

Regular physical exercise is promoted as the main part of the lifestyle interventions for hypertensive patients and/or with high-normal BP. Authors underline as the aerobic endurance training, dynamic resistance training, and isometric training reduce resting systolic blood pressure (SBP) and diastolic blood pressure in general population, while more advantage is

Table 1. categories of BP range as reported in the ESC (European Society of Cardiology) (European Heart Journal (2018) 39, 3021–3104)

Blood Pressure Category	SBP		DBP
Optimal	< 120 mm Hg	and	< 80 mm Hg
Normal	120–129 mm Hg	and	< 80 mm Hg
Hypertension			
High Normal	130–139 mm Hg	and/or	80–89 mm Hg
Grade 1	140 -149mm Hg	and/or	90-99 mm Hg
Grade 2	160–179	and/or	100-109 mmHg
Grade 3	≥ 180	and/or	≥ 110
Isolated systolic hypertension	≥ 140	and	< 90

Legend: SBP = Systolic Blood Pressure, DPB = Diastolic Blood Pressure

obtained in hypertensive subjects by endurance training, where the reduction is allocated around 8.3/5.2 mmHg [5].

Recently a review has highlighted the role of exercise interventions as effective in lowering systolic blood pressure, despite individuals receiving medications generally achieved greater reductions than those following structured exercise regimens [6]. Especially for the intensity of exercise, literature reports as "lower intensity of physical activity", if regularly practiced, is very effective, even if the expected reduction of BP is less than moderate or high-intensity training.

In the scale of the intensity of "physical activity as therapy" some low ranges are investigated. For example the positive impact of "leisure activity" lower than "moderate level" (that is around 3-4 METs of intensity individually established) seems to be very fascinating. Men and women with high levels of "leisure time physical activity" had a 24% and 27% lower risk of cardiovascular disease, respectively, than men and women with low levels of physical activity [7].

The role of "moderate intensity" of physical activity as therapeutic intervention in hypertension is largely supported to.

Moderate intensity of exercise is associated with at least a 15% decrease in mortality [8, 9]. This evidence suggests that hypertensive patients should be advised to participate in at least 30 min of moderate intensity dynamic aerobic exercise (walking, jogging, cycling or swimming) on 5-7 days per week. Performance of resistance exercises on 2 - 3 days per week can also be advised with potential effects in lowering SBP effects of exercise compare to medication interventions [10]. For additional benefit in healthy adults, a gradual increase in aerobic physical activity to 300 min a week of moderate intensity or 150 min a week of vigorous intensity aerobic physical activity, or an equivalent combination is therefore recommended [11]. The impact of isometric exercises on BP and CV risk is less well established [12]. Some evidence of positive effect in reducing BP are found, however they are not completely confirmed by other studies [13].

In conclusion from the ESC guidelines the

aerobic, resistance, isometric exercises are all included into the specific program for their potential positive impact in subjects with high values of BP [4]. ESC guidelines underline as either in the normal, elevated, or in the stages 1 or 2 hypertension, it is possible to prevent and treat high values by non-pharmacological therapy. On the contrary, the term "prehypertension" and "high normal" are not contemplated in the ESC guideline [4].

This approach seems to be correct, because this definition could create a confusion especially for the indications regarding how to start with an adequate therapy.

It is important to consider that among the patients with a BP in the range of 130-139 mm Hg systolic or 80-89 mm Hg diastolic, as well in the first level of hypertension, the cardiovascular risk is estimated to be twice of the risk of their counterparts with a normal level of BP. In this case, this aspect seems to address toward the tailored exercise programs where the exercises are not avoided, on the contrary are suggested before to start with regular drugs.

Some specific "Sports Medicine" indications regarding specifically the "tailored physical exercise" to maintain the BP range within the normal value, are not today jet detailed into the ESC guidelines. This should be, on the contrary, the principal message for a complete and correct "therapeutic approach regarding" the healthy and potentially hypertensive subjects [14] to emphasizes the combination of moderate and vigorous-intensity aerobic activity.

Starting from these considerations, an other important aspect to reinforce the role of regular exercise in this context is that many people does not know to have hypertension and therefore many subjects are exposed to an acute cardio vascular (CV) event.

#### *Exaggerated BP Response to Exercise*

A special category of particular interest in sports Medicine is the exaggerated blood pressure response in the early stage of the exercise test [15]. This particular behavior seems to be associated with presence of an effective hypertension. It could be a warning signal to health/exercise professionals on the presence of hypertension and the

need to provide follow up care to reduce cardiovascular risk, is fundamental.

Exaggerated response to the ergometric test (EMT following Bruce protocol) is therefore taken into account in Sports Medicine and recent data suggest that the BP response to submaximal intensity exercise should be a marker of potential underlying cardiovascular disease (CVD) [16]

This specific category highlights and takes benefit from an early discovery of this eventual abnormal behavior of BP and therefore in this specific context Sports Medicine and exercise specialists, play a determinant role in the intervention to modify "incorrect" lifestyle habits. As reported in the PURE study [17] just 30 minutes of physical activity 5 days a week could prevent 1 in 12 deaths and 1 in 20 cases of CVD worldwide. A higher reduction was observed in those who were highly active (750 minutes weekly). The PURE study has also demonstrated as daily physical activity provided the same satisfaction as "leisure activities". Although it has been demonstrated as walking at a brisk pace for as little as 10 minutes a day or at a slower pace for 15-20 minutes can reduce all-cause mortality by 33% in patients with stable coronary heart disease [17], some obstacles and barriers are in any case found to achieving healthy lifestyle. Some of them include limited healthcare provider training, the lack of access to adequate healthcare, the high cost of healthcare, prior authorization of medications, and limited time with patients etc. [18]

More effort and feeling on behalf of sports medicine physician are determinant to support the Sports Medicine Center to improve cardiovascular health and to share the importance of a CVD prevention and promotion of individualized exercise prescription in them.

#### *Program of Exercise Prescription in Hypertension*

Lifestyle changes is the specific treatment for most patients who are considered to have elevated level of pressure or stage 1 hypertension. These changes includes weight loss, consuming a healthy diet, sodium reduction, potassium supplementation, increased physical activity and limiting alcoholic drinks [5]. For physical activity Frequency, Intensity, Time, and Type

(FITT) are the principle to plan the programmed exercise called "exercise prescription". Numerous studies and many meta-analyses have demonstrated the antihypertensive effects of exercise [19]. Especially for frequency the recommended exercising are 3-4 days per week for at least 12 weeks among adults with hypertension. The exercise is preferably all days of the week as consequence of the fact that BP is lower during the days people exercise if compared to the days they do not exercise. The idea is to use physical exercise as a drug, and therefore the daily assumption is associated to the best efficacy. The global duration of exercise should be total 150 min or more per week, while the aerobic exercise only should reach at least 30 to 60 min per day that can be continuous or accumulated. Many aerobic activities can be included in the exercise therapy as walking, jogging, cycling, and swimming.

Dynamic resistance exercise should be performed 2-3 times per week with at least 48 hours of rest between each training session. There are recommended two/three sets of 10 to 12 repetitions for 8 to 10 exercises that target the major muscle groups of the upper and lower body. Some dynamic resistance training equipment may include machine weights, free weights, and resistance bands, as well as functional body weight exercises. Evidences support the positive effects of both the aerobic and resistance exercises in the exercise training in hypertension [20] with major reduction of blood pressure around 4- 5 mmHg in hypertensive patients and around 2- 3 mmHg in general population. This highlights the importance of this therapy before the diagnosis and in clearly established hypertension.

The role of isometric exercise has been also investigated in this field, despite not in deep. Some authors support the impact of isometric training in reducing resting SBP and DBP by 3.5/2.5, 1.8/3.2, and 10.9/6.2 mmHg, in general populations [5]. Some mechanisms of the isometric exercise can be considered as principal causes to influence resting blood pressure in hypertension [21]. The isometric exercise consists on isometric handgrip (IHG) or isometric bilateral leg (IBL) training and 4 × 2-min contractions at ~ 20-50 % maximal voluntary contraction with 1-5-min rest between. Improvements in conduit and resistance

vessel endothelium-dependent dilation, oxidative stress, and autonomic regulation of heart rate and BP have been reported as the major physiological components involved in the positive effects [22].

Possible other influential factors and mechanisms among the positive effects of isometric physical activity are recognized in the age, sex, pre-existing disease and medication [23].

However no sufficient evidences are found in literature for a larger application of isometric exercise program in hypertension and more studies will be necessary in this context to confirm this hypothesis.

A special attention has been reported to a novel approach and modality to plan and to prescribe physical exercise on the basis of an emerging evidence that acute aerobic exercise performed continuously in a single bout or accumulated in shorter bouts, throughout the day, can reduce BP to similar levels and durations among adults with hypertension [24]. A sort of "interval training" where a short (15 min) of intense exercise and long (30 min) acute aerobic exercise bout performed at light (40 % VO<sub>2</sub>max) or moderate (60 % VO<sub>2</sub>max) intensity is proposed [25]. An other experience reports similar positive effects in a group of subjects on

antihypertensive medication to either 40 min of acute aerobic exercise performed continuously at 60 % HR reserve or an interval aerobic exercise session that alternated between 2 min at 50 % HR reserve and 1 min at 80 % HR reserve to total 40 min [26].

In any case the capacity to modulate and to manage the intensity, rate and kind of exercise (Table 2) with different planning on the basis of the subject's characteristics, is the peculiar role of the Sports Medicine for the therapeutic indications.

### Conclusion

Approaches that focus on lifestyle reconditioning toward a correct lifestyle and to prevent the eventual initial pharmacological treatment is recently largely appreciated and encouraged everywhere. Individual healthcare system is addressed to facilitate, and reward efforts by patients and providers to improve health behaviors and factors as well as population-level tactics that target lifestyle in schools and workplaces, local communities, states, and the nation. The principals of exercise prescription have create the evidence of this importance and necessity and many randomized controlled trial have demonstrated the efficacy of the moderate level of the exercise [27] where the cardiac

Table 2. The table shows the "exercise on prescription programm" used in sequence or/and in combination.

Type of Exercise	Time of Exercise	Expected BP reduction in Hypertension	BP reduction in healthy
Aerobic	90-150min/wk 65%-75% HRR	-5/8 mmHg	-2 mmHg
Dynamic Resistance	90-150 min/wk 50%80% 1 rep max 6 exercises, 3sets/exercise, 10rep/set	-4 mmHg	-2 mmHg
Isometric resistance	4x2 min (hand grip and 1 min rest) 30%- 40% max, 3 sessions/wk 8-10/wk	-5 mmHg	-4 mHg

and skeletal muscle adaptation cardiac are determinant to reach the goal.

Even if the reduction in blood pressure values seems small, it may be enough to translate into a significant reduction in the incidence of strokes and myocardial infarctions. This aspect plays the most important role to induce the patients to making the decision to feel progressively healthier and in better physical shape, since it also helps maintain body weight and prevents obesity that allows us to control blood pressure, cholesterol and glucose levels. Perhaps these well-recognized aspects should be accompanied by systems that guarantee the therapeutic compliance of Hypertensive patients who are practically high non-compliers

For this reason the Exercise program for hypertension needs to be particularly detailed and "individualized" in terms of exercise in this field to take care on the progression of the charge of exercise, to combine different schedules of exercise in order to integrate the existing recommendations and guidelines for hypertension. Starting from the evidence of the literature, it seems particularly important, in addition to the indications, to manage constantly the assumption of the physical exercise like a drug to optimize the blood pressure level. Few data are available in terms of differences in gender for their more appropriate level. This aspect could be particularly important in case of associated diseases or in case of particular conditions like pregnancy where comorbidities are often found. More effort will be necessary if eventual different indications will be requested in case of diverse ethnicity. Exercise prescription means to have a specific knowledge and experience as the Sports Medicine discipline now suggests.

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