Changes of Hemodynamic Parameters at the Preparatory Stage of Periodization Training among the Male and Female Athletes Involved in Different Running Events

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Abstract

The present study was conducted to determine the changes occurs in hemodynamic variables of (HR, LVSD, LVESD, Stroke volume, Cardiac output) at different training phases of periodization in athletic events such as, middle distance and long-distance running between the male and female novice athletes in athletic training center at maychew, Ethiopia.

Materials and Method: In this qazi-experimental study, 18 athletes selected from different phases of training at maychew athletic training center in Ethiopia. The novice athletes of male and female were selected by their performance in the regional wise, as they are novice athletes in the training center they used to go for more than a year training however the researcher wanted to know the hemodynamic parameters changes occurs before the athletes used to engage in specific period of training. To analyze the hemodynamic parameter the subjects were taken to the comprehensive specialized regional hospital then, "Echocardiography was performed by VIVID E-19 (General Electric) undertaken using a 2.5MHz probe"are used to calculate several hemodynamic parameters the values of hemodynamic parameters were recorded at intervals. The recorded data were analyzed by SPSS 21 software, using independent t-test, it is concluded that while comparing the male and female novice athletes male athletes are dominating in long-distance then female athletes are dominating in middle distance running events.

Keywords: *Hemodynamic, athletes, events, echocardiograph.*

Introduction

A training session includes general and specific exercises related to their events performed in a given period. A recommended training session consists of different exercises, which increase the strength of large muscle groups that are important in everyday activities (arms, shoulders, spine, hips, and legs). An intensity equal to 80% 1-RM (i.e. 10-15 repetitions per set) seems to be the recommended amount of load necessary to produce significant changes. At the beginning of a training program, it is suggested to perform only one set of each exercise with 2-3 min rest periods between sets. Progression can go from 1 to 3 sets over training time for each type of exercise.[1] The training consisting of 2-3 sessions per week is recognized as sufficient for gaining health benefits, each session consisting of single sets of 8- 10 exercises.[2] Similar recommendations can also be found in Endurance running capacity may have initially arisen in the genus Homo. For evolution, human physiology has been optimized for covering large distances every day, to find enough food to sustain the brain's metabolism. Indeed, [3]the increasing popularity of marathon running in modern humans of all ages and abilities can be viewed as a legacy of our species' evolutionary capacity to run long distances (>5 km) using aerobic metabolism. Indeed, the number of starters in the London Marathon has risen from 7,000 to 35,000 over the last 30 years and participation in road racing, in general, has increased by more than 50% over the

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last decade. The increasing popularity of road running is typified by the emergence of recreational marathon runners who complete the 42.195 km event in a time of between 2hr 40min and 4hr 40min. [4] The marathon's potentially negative impact on the cardiac status and the occurrence of sudden cardiac deaths during this type of event have prompted much debate

The study of hemodynamic of athletes is one of the important areas of sports medicine, aimed at identifying the characteristics of the body that trains and diagnosis of preparedness. Body preparedness determines the level of fitness and characterizes the readiness of an athlete to achieve high sports results. [5]It develops under the influence of systematic and targeted training phases and its level depends on the balanced interaction of many functional systems that determine the nature of adaptive capacity, hemodynamic being among the most important ones. [6]To determine the functional condition and adaptive capacities, heart rate variability, blood pressure, and central hemodynamic of athletes are recently taken into consideration Such techniques are applied in sports medicine practice. [7]when it is primarily necessary to identify pre-pathological changes in the body of athletes, to predict athletic performance, which is only possible with a clear understanding of applied and adaptive mechanisms that develop in the body under the influence of training activity Recognition of these mechanisms can not only determine the tolerance towards physical exercises but also adjust training process purposefully with the use of various kinds of exercises

Materials and Method

Study area and study design: This study was conducted in Maychew athletic training center, Maychew town located in the tigray regional state, Ethiopia. The study design was qazi experimental. The athlete trainees used to go for one-year athletic training which includes different phases of training, but currently, the athletes are at the Preparatory stage of periodization.

Selection of Subject and Study Design: All subjects fulfilling selection c riteria w ere p rovided informed consent for participating in the research The population defined in the research has included by novice athletes in, middle distance and long-distance running The sample included a total of 18 from 9 male and 9female athletes, who have selected from the different districts & woredas of Tigray region, Ethiopia and the selected athletes will undergo for a yearly advance training program to improve the top performance in athletics and participate in the national and international competitions. The variables of hemodynamic parameters are (HR-Hear rate, LVSD-Left ventricular systolic dysfunction, LVESD- left ventricular end-diastolic dimension, Stroke volume, Cardiac output)

Tools used for the study: Echocardiography and 2D imaging are used to calculate several hemodynamic parameters such as stroke volume, cardiac output, and cardiac index. These parameters are important for LVF. They can be derived from two measurements: The velocity-time integral (VTI) and the cross-section of the Left ventricular outflow tract (LVOT). The VTI represents the total flow across the area of the sample volume in systole. Therefore a PW Doppler is placed in the LVOT. The diameter of the LVOT = the cross-section of the LVOT. Stroke volume is the result of VTI multiplied with a diameter of LVOT.

Echocardiography was performed by VIVID E-19 (General Electric) undertaken using a 2.5MHz probe" . Echocardiography was performed in the standard way, with the male and female athletes placed in the left lateral decubitus position and 2D, M Mode and color Doppler techniques used. A fractional shortening, using M Mode echocardiography, of less than 25% or ejection fraction, using Simpson's method, of less than 50% was used as the cut-off for the presence of LVSD

Results and Discussions

Table: 1: The Initial stage Hemodynamic parameters of male and female athletes in middle distance running

Hemo dynamic	HR	LVSD	LVESD	SV	CO
Male	70±5.19	9±1	32.33333±2.30	40.66667±3.21	2.83±0.19
Female	66.33333±4.04	9±1	27.33333±0.57	36.66667±5.68	2.426±0.354
T-Value	0.950724	0.754404	0.046205	0.24558	0.173
p-value	0.3955	0.492589	0.965365	0.8181	0.871053

DF =4at level α=0.05, Abbreviations :(HR- Heart rate, LVSD- Left ventricular systolic dysfunction LVESD- left ventricular end-diastolic dimension, SV- Stroke volume, CO- Cardiac output)

The hemodynamic parameters by impedance cardiograph of all subjects in middle distance running the HR (M=45.21% & F=45.20%) LVSD (M=5.81% & F=5.56%) LVESD (M=20.88% & F=21.09%) SV (M=26.27% & F=26.42%) and CO(M=1.83% & F=1.72%) association of mean and standard deviation values the obtain t-values are HR (0.950724) LVSD (0.754404) LVESD (0.046205) SV (0.24558) and CO(0.173) but based on the p-values of the hemodynamic variables such as HR (0.3955) LVSD (0.492589) LVESD (0.965365) SV (0.8181) and CO(0.871053) while compared to male and female athletes of hemodynamic variables at the initial stage of novice athletes as df=4, the obtained p-value is greater than the set value P<0.005, therefore, there is no significant difference in all the hemodynamic variables among the male and female novice athletes in middle distance running.

Table: 2: The Initial stage Hemodynamic parameters of male and female athletes in long-distance running

Hemo dynamic	HR	LVSD	LVESD	SV	CO
Male	62.66667±6.02	9.333333±1.15	32.33333±2.51	40.33333±4.72	2.135±2.56
Female	72±9.84	8±1	31.33333±4.16	38.66667±6.65	2.813±0.86431
T-Value	0.247841	0.206526	0.743442	0.743355	0.668
p-value	0.81649	0.8464	0.49853	0.49846	0.54070

DF =4at level α=0.05, Abbreviations :(HR- Heart rate, LVSD- Left ventricular systolic dysfunction LVESD- left ventricular end-diastolic dimension, SV- Stroke volume, CO- Cardiac output)

The hemodynamic parameters by impedance cardiograph of all subjects in long-distance running the HR (M=45.20% & F=47.12%) LVSD (M=5.56% & F=5.24%) LVESD (M=21.09% & F=20.50%) SV (M=26.42% & F=25.30%) and CO(M=1.72% & F=1.84%) association of mean and standard deviation values the obtain t-values are HR (0.247841) LVSD (0.206526) LVESD (0.743442) SV (0.743355) and CO(0.668) but based on the p-values of the hemodynamic variables such as HR (0.81649) LVSD (0.8464) LVESD (0.49853) SV (0.49846) and CO(0.54070) while compared to male and female athletes of hemodynamic variables at the initial stage of novice athletes as df=4, the obtained p-value is greater than the set value P<0.005, therefore, there is no significant difference in all the hemodynamic variables among the male and female novice athletes in long-distance running.

Table 3: Percentage differences of Hemodynamic parameters of male and females athletes in middle distance and long-distance running events.

Events		Hemodynamic parameters				
		HR	LVSD	LVESD	SV	CO
Middle distance running	Male	45.21	5.81	20.88	26.27	1.83
	Female	45.20	5.56	21.09	26.42	1.72
Percentage Difference		0.02%	4.39%	1.00%	0.56%	6.19%
Long-distance running	Male	45.20	5.56	21.09	26.42	1.72
	Female	72.00	8.00	31.33	38.67	2.81
Percentage Difference		4.15%	5.92%	2.83%	4.33%	6.79%

Discussion

The aim of this study was to evaluate and observe the changes occurs at the initial stage of male and female athletes involved in, middle distance and long distance running events while testing the hemodynamic variables such (HR- Heart rate, LVSD- Left ventricular systolic dysfunction LVESD- left ventricular end diastolic dimension, SV-Stroke volume, CO- Cardiac output))the male and female athletes participate in different athletes events may not have a significance difference in hemodynamic parameters hence the obtain p values are greater than the set value P<0.005 though statistically there is no significance difference while observing the data shows there could be some difference in certain hemodynamic parameters therefore, the researcher converted the values in percentage mode as mentioned (table 4) further the researcher observed the changes happens at the different percentage levels of hemodynamic variables such the difference in percentage levels of the HR(2.18%) LVSD (1.07%) LVESD (0.52%) SV(5.16%) CO (4.54%) Similarly in middle distance running HR (0.02%) LVSD (4.39%) LVESD (1.00%) SV(0.56%) CO (6.19%) and in long distance running HR (4.15%) LVSD (5.92%) LVESD (2.83%) SV (04.33%) CO (6.79%). In middle-distance running the difference in percentage level of Female athletes are **higher** in LVESD and SV and **lower** in HR, LVSD, and CO than male athletes and in long-distance running the percentage difference in females athletes are **higher** in all hemodynamic variables such as HR, LVSD, LVESD, SV, CO than the males athletes. In trained athletes, physiologic cardiac adaptations occur to the hemodynamic load with chronic exercise training. LV volume overload might induce greater LV end-diastolic diameter and earlier and better early diastolic stretching of myocardial fibers, which in turn could be able to induce an enhanced SV through better use of the Frank-Starling mechanism (Warburton DE,2002). Endurance trained female athletes had lower SV and SI than males but the latter difference was no longer significant. [8]Because of the smaller body mass, female athletes have smaller heart volumes which may reduce LV end-diastolic volume that compared to male athletes, female athletes had lower SV values but when expressed relative to body mass, there was no gender difference.

Conclusion and Recommendation

To conclude we observed that male and female athletes will have unique differences in genetically considering the hemodynamic variables the results indicate though statistically there are no significant differences a percentage difference observation pointed that females have higher percentage levels in long-distance running than the male athletes. The males' athletes have a higher percentage level of hemodynamic parameters in middle distance running than the female athletes. The data obtained can be considered as baseline data athletes undergoing serious training in different phases. [9]All these changes can be accepted as a physiological adaptation for systematic intense activity and to a lesser degree in other factors like genetic factors which are a subject of controversy. This conclusion is confirmed by [10] the result of a longitudinal study, which provided convincing evidence of the causal role between specific sport activity and cardiac structure and function.

Acknowledgment: We would like to thank the staff of Mekelle University, Ayder health referral hospital, Mekelle, Tigray region, Ethiopia and laboratory officials in providing available materials as well as providing the instructions and encourage the subjects at the time of Examining. We extend our thanks to maychew athletic training center directors, coaches & athletes

Ethical Consideration: Approval and ethical clearance of the protocol were sought for Health Research and Ethical Review Committee of Mekelle University registration No ERC1235/2019 dated 07.03.2019.

Source of Funding: Self

Conflict of Interest: Nil

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