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IMPACT OF HIGH-INTENSITY INTERVAL TRAINING ON CARDIAC HEALTH IN MIDDLE-AGED ADULTS

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ABSTRACT

The purpose of the study is to ascertain how high-intensity exercise affects heart health. The study's foundation was an investigation of middle-aged persons' main data. These data were gathered using specific questions on high-intensity interval training. Studies on the effects of high-intensity interval training (HIIT) on older adults are necessary since exercise is a potent inducer of mitochondrial biogenesis. Examined and summarized using smart PLS software, the study measures the effect of HIIT on mitochondria and various cardio-metabolic health outcomes in older adults, both in good health and with co-occurring conditions. The results produced include descriptive statistics, correlation coefficients, and a smart PLS algorithm model between them. Electronic databases were searched for pertinent studies using variants of keywords related to the cardiac health, the HIIT, mitochondria, cell organelles, and cardio-metabolic health outcomes. This review contains twenty-one papers that satisfied the inclusion criteria. HIIT is an original treatment approach that helps maintain mitochondrial integrity as people age and is a good, safe, and effective substitute for exercise for older persons who are well or sick. Overall, the result found a direct and significant impact of high-intensity training on cardiac health in middle-aged adults.

KEYWORDS: High-intensity Interval Training (HIIT), Cardiac Health (CH), Middle-Aged Adults (MAA)

1. INTRODUCTION

High-intensity interval training has been gaining popularity among middle-aged adults because of its efficiency in regulating heart health. The age range of 35 to 58 years old is termed middle age and is the period during which

the aerobic capacity of humans starts reducing by 8% every ten years. Similarly, human functionality also faces a reduction by a factor of 15% as people transition from young adulthood to middle age. The major reason for deteriorating functionality, endurance, and skeletal muscle is because of lessened protein synthesis by mitochondria. Moreover, insulin production also faces sensitivity issues in both men and women. These two significant factors add up to a combined reduction in heart activity. Modern studies are putting too much emphasis on the exercises to deal with such issues, as they serve as a potential measure to work against the deterioration of heart muscles. Studies have revealed that high-intensity interval training can reduce cardiovascular issues by up to 50%. The training promoting endurance activities and high-intensity exercises have been linked to improved cardiovascular fitness and insulin production (Silva et al., 2019). According to surveys, only 28% of women and 40% of men in the UK follow fitness exercises for half an hour, five days a week. The primary reason for these exercise reductions is their lack of time in their daily commitments. This suggests that high-intensity training that is also efficient can help improve middle-aged people's cardiovascular health. The studies also suggest improving the lipid profile of middle-aged people, reducing the chances of growing bad cholesterol in middle-aged groups (Abadia-Naudí et al., 2021; Marriott, Petrella, Marriott, Boa Sorte Silva, & Petrella, 2021).

High-intensity Interval Training has been rising as a time-efficient type of exercise method suitable for the busy daily lives of middle-aged people, compared to traditional exercises that involve endurance activities only. There are several advantages of these types of exercises, one of which is that the production of GLUT4 in skeletal muscles is the most important one as GLUT4 helps in enhanced glucose uptake for middle-aged people. However, these types of exercises can be gender-specific and might work differently for both men and women. For instance, a study has found that six weeks of high-intensity interval training caused a massive increase in insulin maintenance in males. The same study showed no significant impact on female insulin sensitivity (Hwang et al., 2016). For this, a whole-body style of intensity training is required to benefit the women's cardiovascular system and body's endurance capacity. The total intensity and level of weight or sprinting need to be modified for every person according to their body strengths. Similarly, short-duration high-intensity interval training in middle-aged people has also gained attention because of its effectiveness in heart issues. These types of exercises mostly deal with the 60 seconds of intense exercise per day for two weeks. Other types of training, like concurrent training exercises, have been found efficient for maintaining cardiovascular health, except the middle-aged people (Poon, Little, Sit, & Wong, 2020). This is because of diseases at this age, such as diabetes and lack of skeletal well-being. The increase in cardiovascular health is due to the many factors that are enhanced by intense training. First of all, the ejection fraction of the heart's ventricles increases, which means the efficiency of the ventricles in throwing blood out increases. Secondly, the stroke volume is

increased by pumping more blood to the left ventricle, i.e., increasing cardiac output. The factors, like atherosclerosis, are also lessened because of the improved functioning of endothelial tissues of the vessels, which result in better blood flow and exchange of materials (Wu, Wang, Gao, Zhou, & Li, 2021).

The impact of high-intensity interval training on aerobic fitness is massive as it helps maximize the peak of oxygen consumption during intense training, measured as VO2 peaks. Training of this type has been found to have broad applicability as it helps promote aerobic fitness in healthy and diseased middle-aged people. Studies have shown comparable results with common endurance training and even some show better results of high-intensity interval training as it can increase the VO2 peak more than the common endurance training. Its efficiency is also more because of less time consumption than traditional training (Kessler, Sisson, & Short, 2012). Different studies have suggested different results regarding the impact of high-intensity interval training on vascular systems. According to some, arteries have enhanced stiffness for middle-aged people who perform high-intensity interval training. This stiffness is measured for the vascular system's health, i.e., blood flow and exchange of materials and fluid through vessels. The effect of high-intensity interval training on the heart is massive, as this training helps increase the diastolic diameter of the left ventricular (Ito, 2019). Other than these advantages, reducing the neurocognitive decline is also important. The major issue in an increase of disease factors in middle-aged people is the decline in neurocognition. Therefore, the training of high-intensity levels is effective against Parkinson's disease and Alzheimer's disease, which are related to psychological disorders that rise in middle-aged people after hitting a certain time of age. Moreover, people with high-intensity interval training have also increased their bones' health, thereby reducing osteoarthritis disorders (Adamson, Lorimer, Cobley, Lloyd, & Babraj, 2014; Zhang et al., 2023).

Increased high-intensity training also helps lower body fat, which in turn helps decrease blood pressure and bad cholesterol in the body. All of these factors collectively collaborate to make cardiovascular fitness available to middle-aged men and women for a better, enhanced, and fitness-approved life which makes them less dependent and away from infection, medicines, and health-bound issues (Ballesta-García, Martínez-González-Moro, Ramos-Campo, & Carrasco-Poyatos, 2020; Holloway, Roche, & Angell, 2018).The research determines the impact between intensity training intervals and affects cardiac health. The research paper is divided into five sections. The first portion describes the introduction and objective of the research, and the second section demonstrates the literature review. The third portion represents that methodology, and the fourth section describes results and descriptions, including correlation coefficient and descriptive statistics. The last portion summarized overall research study and present the recommendations about topic.

2. Literature Review

Studies assess the extreme focus practice on wellbeing related personal satisfaction in moderately aged and older individuals with analyzed cardiovascular gamble. The intense cardio exercise was the best to further develop HRQoL, albeit some positive changes noticed additionally after the persistent preparation, in moderately aged and older grown-ups with analyzed cardiovascular gamble(Silva et al., 2019). Researchers reveal that high-intensity interval training is successful at further developing wellbeing; in any case, it is obscure whether HIT likewise works on actual capability. This study planned to decide if HIT works on metabolic wellbeing and actual capability in undeveloped moderately aged people(Adamson et al., 2014). Studies suggest that Maturing and diabetes are related with diminished oxygen consuming wellness, an autonomous indicator of mortality. All in all, all-limit HIIT and MICT are doable, all around endured and safe and result in comparable upgrades in oxygen consuming wellness in moderately aged/more seasoned people. This study discoveries have significant ramifications for practice remedy for people with diabetes; researchers demonstrate that practice is a plausible choice to fat-loaded activity & the people who reluctant to participate in Stop and go aerobic exercise might get comparative advantages from MICT(Hwang et al., 2019). Studies inspect whether focused energy stretch strolling preparing expanded thigh muscle strength and pinnacle oxygen consuming limit and diminished pulse more than moderate-power consistent strolling preparing. Focused energy span strolling may safeguard against age-related expansions in circulatory strain and diminishes in thigh muscle strength and pinnacle high-impact limit(Nemoto, Gen-No, Masuki, Okazaki, & Nose, 2007). This study expected to assess the movement of vascular and cardiovascular changes north of a 6-week preparing period.

A month and a half of focused energy preparing increments vigorous wellness and is sufficient to invigorate beginning decreases in fringe pressure, yet not adequate to evoke underlying and utilitarian cardiovascular changes, diminish blood vessel firmness or lower CV gamble(Holloway et al., 2018). Scholars reveal that the reason for the ongoing review was to look at the impacts of Stop and go aerobic exercise or moderate-power nonstop preparation alone or exchanging Stop and go aerobic exercise-moderate-power nonstop preparation on cardio reactions in idle hefty moderately matured male. Stop and go aerobic exercise or moderate-power nonstop preparation alone or substituting likewise work on cardi wellness & torso creation in fat moderately matured male regardless of contrasts in complete preparation volume and time responsibility(Poon, Siu, Wongpipit, Gibala, & Wong, 2022). Scholars Suggest that HIIT has comparable or improved impacts than moderate-power nonstop preparation in expanding maximum oxygen utilization. Researchers looks at the impacts of a Stop and go aerobic exercise against moderate-power nonstop preparation on maximal oxygen consumption & blood

pressure of moderately matured & more seasoned ladies. All in all, the two Stop and go aerobic exercise & moderate-power nonstop preparation produced variations in maximal oxygen consumption. Besides, just Stop and go aerobic exercise produced beneficial outcomes on the systolic blood pressure during exercise. Thusly, the two preparation techniques are contemplate for apply in practice projects including moderately matured & more seasoned ladies(Ballesta-García et al., 2020). This study evaluated the adequacy of span preparing contrasted and that of MICT for working on cardiorespiratory wellness in moderately aged and more seasoned grown-ups. This study gives proof combination to stretch preparation as a feasible activity procedure to work on cardiorespiratory capability in sound maturing(Poon, Wongpipit, Ho, & Wong, 2021). Studies elaborate that the impacts of activity based cardiovascular recovery (CR) on actual wellbeing in coronary corridor disease (computer aided design) patients has for quite some time been laid out, while the ideal activity mode still needs not set in stone. This meta-examination recommended that HIIT is better than MICT in expanding VO2peak, anaerobic limit, top power in computer aided design patients. Furthermore, the adequacy of Stop and go aerobic exercise above moderate-power nonstop preparation in further developing VO2peaks affected by High intensity training stretches.

The two Stop and go aerobic exercise & moderate-power nonstop preparation didn't altogether impact blood pressure, notwithstanding, moderate continuous training appeared deeper compelling in lessening blood pressure relative to Stop and go aerobic exercise(Du et al., 2021). This orderly audit features the advantages of various kinds of actual preparation mediations on autonomic capability and wellbeing boundaries in youthful and moderately aged, sound grown-ups. Taking everything into account, higher preparation forces and frequencies are bound to further develop HRV. For future investigations, we prescribe sticking to the models of systemic guidelines of activity mediations and HRV estimations and empower the utilization of non-direct HRV boundaries(Graessler, Thielmann, Boeckelmann, & Hoekelmann, 2021). Studies claim that Maturing is related with diminished oxygen consuming wellness and heart redesigning prompting expanded chance for cardio infection. Stop and go aerobic exercise on exercise machine for running accounted for increasingly viable in enhancing gamble components contrasted and moderate-power constant preparation in sick person. Hence, all-furthest point HIIT is plausible and protected in more seasoned grown-ups. HIIT, however not MICT, worked on high-impact wellness, launch division, and insulin obstruction(Hwang et al., 2016). Scholars explain that Stop and go aerobic exercise is inexorably famous type of oxygen consuming activity which incorporates episodes of extreme focus practice sprinkled with times of rest. HIIT conventions were different yet were for the most part very much endured and may present numerous wellbeing benefits to more seasoned grown-ups. Bigger examinations and more exploration in clinical populaces generally illustrative of more established grown-ups are expected to additionally assess

the clinical impacts of HIIT in these gatherings(Marriott et al., 2021). Studies show that Stop and go aerobic exercise can successfully increment top oxygen utilization, actual wellness, & wellbeing qualities of grown-ups; be that as it may, its effect in the more seasoned populace remains exceptionally discussed. This methodical survey describe that Stop and go aerobic exercise prompts good affection in actual wellness, muscle strength, heart capability and diminished blood fatty oil & dextrose intensity in more established people, that might assist with keeping up with high-impact wellness and dial back the course of sarcopenia(Wu et al., 2021). Researchers examined the effect of Stop and go aerobic exercise & moderate-power nonstop preparation on RV glucose & flabby digestion. Just 2 week of actual preparation in already stationary subjects prompt swap in Right Ventricular digestion, capacity & launch part, that go before work out actuated hypertrophy of RV(Heiskanen et al., 2016). Scholar Studies reveal that the impact of actual work mediations and, explicitly, on the possible advantages of consolidating higher power work out. All in all, HIT seems to advance unrivaled enhancements in oxygen consuming wellness and comparative upgrades in few cardio probability components in contrast with continuing medical education, as executed solid themes for no less than eight to twelve weeks(Kessler et al., 2012). This survey portrays the groupings of high-impact HIIT and SIT, and their disparities as far as impacts, target subjects, flexibility, working components, and security. Figuring out the HIIT conventions and taking on the right sort one and all topic might prompt higher quality upgrades in volume of oxygen uptake during peak exercise with greater conformity & smaller gamble(Ito, 2019). Researchers investigated that Stop and go aerobic exercise might influence cardio & solid wellness all the while, yet conventions ordinarily center around lower-body work out. For more established grown-ups in any case, performing exercises of everyday living requires overall human body wellness.

Consolidated overall body HIT affects strong & cardiorespiratory wellness in more seasoned grown-ups(Hurst, Weston, & Weston, 2019). Studies explain that Support in vigorous activity produces expanded cardiorespiratory wellness, which brings about a defensive element toward cardio disease. HIIT could prompt greater expansions with cardio wellness in examination with moderate-power nonstop preparation; all things considered, ongoing proof isn't convincing(Arboleda Serna, Arango Vélez, Gómez Arias, & Feito, 2016). Researchers determine that a program of necessary physical activity along Stop and go aerobic exercise prompts medically pertinent upgrades with pulse, rate power item and supports recuperation of pulse save with erythrocyte sedimentation rate, although working on greater metabolic equivalent limit with the two erythrocyte sedimentation rate & liver extract devoid of actuating each neurotic cardio redesigning(Grace et al., 2018). Researchers explain that contrasted with different gatherings, Stop and go aerobic exercise reveal fundamentally greater decreases in fetal movement, diastolic blood pressure, triglycerides, apolipoprotein B-100 & altogether more

noteworthy expansions with greater thickness. Low intensity continuous training brought about the best decrease in Spontaneous Bacterial Peritonitis. Whole gatherings display huge betterment of blood work with no tremendous contrasts between gatherings. Our discoveries show that extreme focus high-intensity exercise is more powerful in further developing circulatory strain, lipoproteins and fatty oils than aerobic exercise alone or lower force high-intensity exercise(Paoli et al., 2013). This deliberate survey is directed to assess the effect of Stop and go aerobic exercise & moderate-power nonstop preparation on body arrangement & cardio wellness in the youthful & moderately elder. Regardless of the medical meaning of the betterment actuality restricted, Stop and go aerobic exercise seems, by all accounts, to be additional efficient and agreeable than MICT(Guo et al., 2023). Researchers inspects the effect of Stop and go aerobic exercise on cardio wellbeing amid the moderately elder Chinese populace, in midst of the nation's developing weight of CVDs.

The ends drawn accentuate Stop and go aerobic exercise huge latent in alleviating cardio gamble amid moderately elderly Chinese, pushing for its coordination among public wellbeing advancement endeavors(Chen, Xu, & Wang, 2024). Researcher studies reveal that high intensity training has arisen as a optimistic activity mediation improving medical results in heart sick people. Stop and go aerobic exercise & moderate-power nonstop preparation arose while compelling methodology toward upgrading pulse & the time of heart relaxation capability, soma piece, and blood molecular marker in computer aided design sick people, along Stop and go aerobic exercise exhibiting steady enhancements above moderate-power nonstop preparation(Gonçalves, Raimundo, Abreu, Pais, & Bravo, 2024). Studies reveal that high intensity training working on various cardio wellbeing results & routine physician assistant. Researchers additionally examined swap in constant physician assistant beyond mediation duration affected work out actuated wellbeing results. Researchers summarize that high intensity training was exceptionally practical for college woman understudies to work on cardio wellness, muscle versus overweight & routine physician assistant(Lu, Wiltshire, Baker, Wang, & Ying, 2023). Researchers elaborate that Sarcopenia is a huge wellbeing concern fundamentally influencing old grown-up people, portrayed diminished solidity, influence, & perseverance. This significantly affects in general wellbeing and personal satisfaction, including decreased freedom, versatility, and everyday movement execution, osteoporosis, expanded fall and break gambles, metabolic issues, and constant disease like diabetes and cardiovascular circumstances(Morcillo-Losa et al., 2024).

3. Methodology:

The research determines the impact in between high-intensity interval training on cardiac health. The research study is based on middle-aged adults.

Research also based on primary data analysis to determine the research study used smart PLS software and present numerical results including descriptive statistics and correlation that present smart PLS Algorithm model between them. Epidemiological studies showed that CRF (cardiorespiratory fitness) have an inverse relation with coronary heart diseases. Additionally, it was revealed that loss of CRF activity contributed to the decline in exercise ability and Sarcopenia, which limits oxygen diffusion in middle-aged adults. These conditions create oxidative stress and fibre loss in skeletal muscles. Thus, these two factors, CRF and skeletal muscle performances, play important roles in maintaining the health of aged people (Wu et al., 2021). Using strategies like HIIT improves CRF and skeletal muscle activity and improves the health of the heart. HIIT training exercise improves CRF activity, skeletal muscle ability, oxidative pressure, insulin strength and tenderness in healthy middle-aged adults. The impact of HIIT in improving heart health and CRF activity needs more research and clarity for its understanding (Wu et al., 2021). Studies have shown that HIIT requires less time and improves ventilation compared to other training exercises.

HIIT improves cardiovascular activity in obese patients, has better efficiency in promoting cardiovascular health, and reduces the risk of heart disease in patients (Yue, Wang, Liu, Kong, & Qi, 2022). The HIIT exercise model is divided into three types. The high-intensity model is comprised of 15-20 sec, and it is known to be the most effective model in maintaining the cardiovascular health of aged people. Some research revealed that HIIT exercise twice a week improves cardiovascular health, while other research demonstrated that HIIT once a week improves cardiovascular health (Chin et al., 2020). Though guild lines from the American College of Sports Medicine (ACSM) demonstrated that merely average to high intensity of HIIT thrice a week is effective for CRF activity, using it twice a week will not give promising results (Garber et al., 2011). Furthermore, studies also verified that using the HIIT exercise twice a week increases the VO2peak by 10.8%, while three a week by 13.6% (Stavrinou, Bogdanis, Giannaki, Terzis, & Hadjicharalambous, 2018). HIIT model not only improves cardiovascular health but also enhances muscle structure and reduces inflammation. In the pre-training process of HIIT, outcomes showed that there is a reduction in depression and anxiety in aged people. There are various other benefits of using the HIIT exercise model in terms of its safety, as no accidents related to cardiovascular activities have been seen (Martland, Mondelli, Gaughran, & Stubbs, 2020). Moreover, HIIT has proved to be the safest and most user-friendly exercise, and it provides many health benefits to several populations.

High-intensity interval training is a type of model or exercise that includes intermittent intervals of high intensity and low intensity of the resting and recovering phase. HIIT is considered to be the most efficient method compared to the traditional methods that are used to improve aerobic fitness, usually

called endurance training (ET). Recent studies demonstrated that the use of HIIT or ET improves the VO2 peak in youth, middle age and older people (Bouaziz et al., 2020). There is much evidence that high-intensity interval training is more efficient than low or modest-intensity interval training in terms of improving cardiovascular health.

HIIT improves the biogenesis in mitochondria, protein synthesis, and molecular version in Krebs's cycle, as well as the oxidation of cytochromes fatty acid binding protein activity. Additionally, HIIT also improves hormonal activity in middle-aged people (Delgado-Floody et al., 2020). HIIT exercises were verified as the most effective exercise compared to moderate intensity to improve CRF activity. The duration of HIIT exercise duration ranges from 30s to numerous minutes, usually for people suffering from cardiovascular diseases.

3.1 Smart PLS Algorithm Model

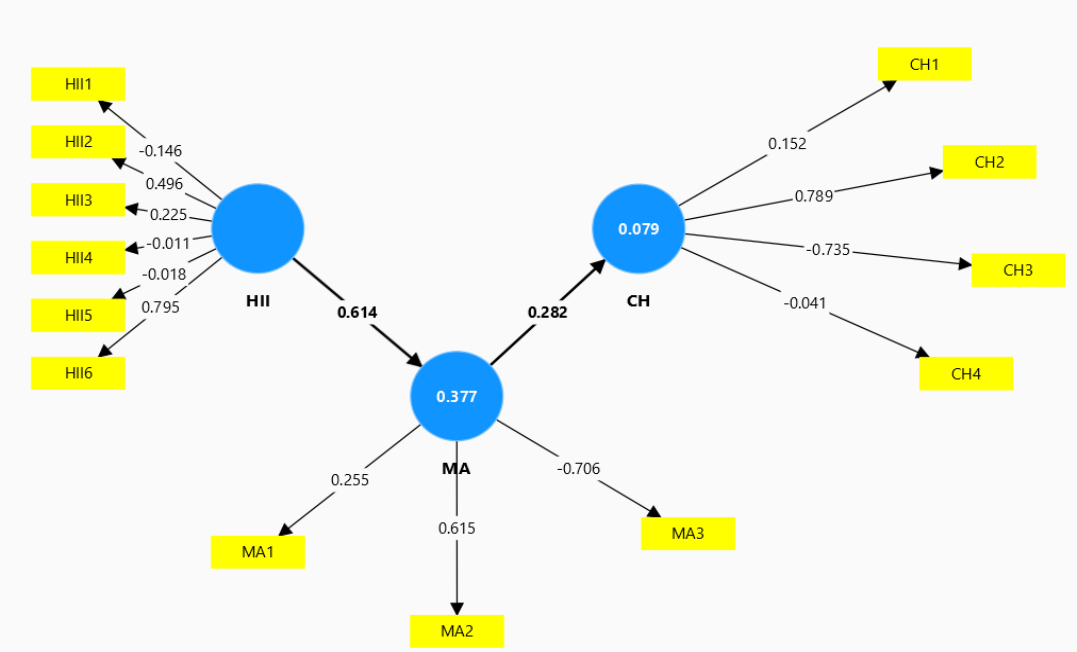

Figure 1: Smart PLS Algorithm Model

The above model of figure 1 represents the smart PLS Algorithm model in between HII, CH and MA. The result shows that HII is an independent variable according to the above model. Its rate is -0.146, 0.496, 0.225, 0.011, -0.018, and 0.795. It shows that positive and some negative but significant value between them. The MA is a mediator variable according to the smart PLS Algorithm model. Its rate is 0.255, 0.615, and -0.706, showing that 25%, 61% and 70% are significant values between MA1,2 and 3. The CH is a dependent variable according to the result; it shows that the levels of 15%, 78%, 73%, and 4% are significantly different between them. The overall model shows a 61% positive and significant link with MA and a 28% positive and significant link between MA and CH, respectively.

3.2 Descriptive statistical analysis:

Table 1: Result of Descriptive statistical analysis

NAME	NO.	MEAN	MEDIAN	SCALE MIN	SCALE MAX	STANDARD DEVIATION	EXCESS KURTOSIS	SKEWNESS	CRAMER-VON MISES P VALUE
HII1	1	1.633	2.000	1.000	3.000	0.629	-0.603	0.490	0.000
HII2	2	1.510	1.000	1.000	3.000	0.576	-0.554	0.621	0.000
HII3	3	1.531	1.000	1.000	3.000	0.575	-0.634	0.541	0.000
HII4	4	1.449	1.000	1.000	3.000	0.537	-0.806	0.618	0.000
HII5	5	1.633	2.000	1.000	3.000	0.596	-0.623	0.358	0.000
HII6	6	1.490	1.000	1.000	3.000	0.539	-1.002	0.445	0.000
CH1	7	1.469	1.000	1.000	3.000	0.575	-0.329	0.788	0.000
CH2	8	1.327	1.000	1.000	3.000	0.511	0.505	1.231	0.000
CH3	9	1.510	1.000	1.000	3.000	0.576	-0.554	0.621	0.000
CH4	10	1.673	2.000	1.000	4.000	0.651	1.831	0.920	0.000
MA1	11	1.755	2.000	1.000	3.000	0.686	-0.837	0.369	0.000
MA2	12	1.490	1.000	1.000	3.000	0.539	-1.002	0.445	0.000
MA3	13	1.571	2.000	1.000	3.000	0.606	-0.545	0.567	0.000

The above results of table 1 represents the descriptive statistical analysis related to variables. The overall result demonstrates that mean values, median rate, standard deviation value, skewness rate and probability value of each factor are related to the independent and dependent. The HII is the main independent variable, according to the result. Its mean values are 1.633, 1.510, and 1.531, showing positive average values of the mean. The standard deviation rates are 62%, 57%, 53%, and 59% deviate from the mean value. According to the result, the overall minimum value is 1.000, the maximum value is 4.00, and the overall significant value is 0.000, showing that there is a 100% significant level between them. The CH1,2,3 and 4 are considered as dependent variables. The result shows that mean values are 1.469, 1.327, 1.510, 1.673. These are all values that present positive average rates. The standard deviation values are 92%, 78%, and 62%, deviating from the mean values of MA1,2 and 3. These factors are considered mediator variables. According to the result, their mean values are 1.755, 1.490,

1.571. All of them show the positive average rates. The standard deviation rate is 36%, 44%, and 56% deviates from the mean value.

3.3 Correlation coefficient:

Table 2: Result of Correlation coefficient

	HII1	HII2	HII3	HII4	HII5	HII6	CH1	CH2	CH3	CH4	MA1	MA2	MA3
HII1	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
HII2	0.067	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
HII3	0.257	0.045	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
HII4	-0.056	-0.015	-0.375	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
HII5	-0.197	0.011	-0.027	-0.186	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
HII6	-0.011	0.115	-0.180	0.227	-0.202	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CH1	0.082	-0.045	-0.074	0.045	-0.212	0.114	1.000	0.000	0.000	0.000	0.000	0.000	0.000
CH2	0.119	-0.011	0.035	0.135	-0.277	0.309	0.104	1.000	0.000	0.000	0.000	0.000	0.000
CH3	-0.046	0.077	-0.078	0.117	0.070	-0.476	0.140	-0.220	1.000	0.000	0.000	0.000	0.000
CH4	-0.044	-0.100	-0.082	0.478	-0.362	0.107	0.082	0.075	-0.046	1.000	0.000	0.000	0.000
MA1	0.217	-0.045	0.381	-0.034	-0.020	-0.007	0.291	0.228	0.058	0.004	1.000	0.000	0.000
MA2	-0.252	0.247	0.215	-0.125	-0.075	0.228	0.048	0.012	-0.148	0.165	-0.062	1.000	0.000
MA3	0.015	-0.075	0.008	-0.099	-0.153	-0.419	0.050	-0.207	0.159	0.214	-0.105	0.080	1.000

The above results of table 2 demonstrates that the correlation coefficient analysis overall result shows negative and some positive correlations between one variable and another. Globally, mortality is caused by physical inactivity, which leads to many cardiovascular diseases. Physical inactivity, together with ageing, contributed to the weakening of cardiorespiratory capabilities (Poon et al., 2021). It is demonstrated that older people experienced 23% of the disease burden globally. People aged (35-58) years old are linked with declining aerobic ability and VO2max ability. This decline is associated with the activity of mitochondrial enzymes and weakened protein synthesis in skeletal muscles when at rest phase. Additionally, loss of insulin activity was also observed in both males and females of that age group.

These conditions increase the risk of many cardiovascular diseases (Adamson et al., 2014). The majority of the disease burden comes from chronic non-communicable diseases. For healthy ageing, exercises play a crucial role in preventing middle-aged people from different chronic diseases. The guidelines for physical activity for Americans suggest that people above the age of 65 years should have a moderate activity of 150 min vigorous physical activities of 75 min per week. The aim of the exercise is to improve functional and fitness capabilities in aged people. It is important to identify the types of exercise that help aged people achieve these goals and improve their health (Marriott et al., 2021). Cardiovascular diseases are usually contributed to increasing the mortality rate worldwide. Studies revealed that aerobic exercises play an important role in improving the health of the heart (Du et al., 2021). High-intensity training (HIIT) is known to be the most popular form of exercise. It is comprised of high-intensity aerobic exercise, which lasts from seconds to minutes and is intermingled with intervals of rest. It is demonstrated that HIIT is beneficial in two ways: in contexts related to physiological and entertainment parameters (Karlsen, Aamot, Haykowsky, & Rognmo, 2017).HIIT improves the activity of skeletal muscle. Some studies showed that utilizing HIIT training progressively improves cardiac health and insulin insensitivity in males. Moreover, studies also showed that HIIT training improves cardiovascular activities in females (Burgomaster, Hughes, Heigenhauser, Bradwell, & Gibala, 2005).

4 Conclusion

HIIT's impacts on mitochondrial biogenesis and its consequences for older individuals' cardio-metabolic health outcomes are discussed from a variety of angles in this study. Additionally, new ideas, research, and developments in this field of study are sparked by this examination. As such, we add to the increasing corpus of research demonstrating that HIIT is a viable, safe, and time-efficient training approach that may be used to improve cardio-metabolic risk factors in the elderly. Additionally, it has demonstrated the ability to successfully postpone or prevent the emergence of comorbidities, effectively aiding in the reversal of the ageing-related reduction in functional abilities. In summary, studies have shown that high-intensity interval training is superior to traditional endurance training for individuals whose bodies are transitioning from early adulthood to middle age. Even with certain health concerns, most middle-aged persons have an overall positive assessment for the tolerance aspect. Smart PLS software was employed in the research study, which measured the research using primary data analysis. This guarantees that middle-aged individuals can benefit from this high-intensity training for improved cardiovascular health. Therefore, it can be inferred that both middle-aged and older individuals benefit suggestively from high-intensity interval training (HIIT) in terms of their cardiovascular health and fitness. This kind of

exercise incorporates the alternate cycles of rest and recovery, which enhance metabolism and heart health. It is also clear from the explanation above that HIIT enhances the VO2 max cycle, a crucial component of cardiovascular fitness exercises. Overall, the research concluded that there are positive and significant impacts between them. High-intensity training is believed to be more effective than moderate-intensity training in improving cardiovascular health. Still, more research is needed to discuss its other beneficial effects.

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