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Effect of Nordic walking in overweight individuals

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Abstract
Background: Obesity - A disorder involving excessive body fat that increases the risk of health problems. Modern lifestyle, with its lack of everyday physical activity, predisposes a person to chronic diseases increasing the morbidity and mortality rate. Nordic walking proved to be a feasible form of physical activity that can be done by nearly everybody to improve health related quality of life.
Materials and Methods: 30 participants were included in this study. Their BMI, Heart rate, Blood pressure and VO_{2max} were assessed. Nordic walking training was given for 4weeks, 5 times a week each session of 50 minutes. After 4 weeks, the parameters were re-assessed.
Result: There was significant reduction in BMI, HR, BP and increase in VO_{2max}after 4 weeks. *Conclusion:* Study concluded that, Nordic walking, less popular form of activity in India, is one of the innovative styles of walking which helps in improving the physical activity and vitals.

Keywords: nordic walking, BMI, heart rate, blood pressure, VO_{2max}

1. Introduction

"Obesity Is The High-Weigh To Hell!"

One of the most common problems related to lifestyle today is being overweight. Obesity is often defined simply as a condition of abnormal or excessive fat accumulation in the fat tissues (adipose tissue) of the body leading to health hazards. The basal cause is a positive energy balance leading to weight gain i.e. when the calories consumed exceeds the calories expended. Overweight and obesity are leveraged by many factors including hereditary tendencies, environmental and behavioral factors, ageing and pregnancies [1]. Obesity is a pathological condition in with excess body fat. It is a chronic disorder with complex dealings between genetic and environmental factors [2]. Obesity is imminence to many secondary conditions like cardiovascular disorder, insulin pathological resistance, retinopathy, neuropathy and cancer.

The substantial health problems consociated with obesity and overweight are: Type 2 diabetes, Cardiovascular diseases (hypertension), Respiratory diseases (sleep apnea syndrome), Musculoskeletal disorders (Osteoarthritis), Psychological problems, Alteration of the quality of life[2] [2].

In order to abet people determine their healthy weight, a simple measure of the relationship between weight and height called the Body Mass Index (BMI) is used. Body mass index (BMI) is a simple index of weight-for-height that is ubiquitously used to classify overweight and obesity in adults.[1] According to WHO, it is defined as a person's weight in kilograms divided by the square of his height in meters (kg/m^2).

Lifestyle changes involving exercise and food intake comprise of the conventional treatment of overweight individuals, eating several balanced meals dispersed through the day, with admixture of progressive, primarily aerobic, physical exercise. Although it is well established that exercise is an important building block in improving fitness and health, the cogitation of sore muscles and voyages to a crowded gym discourages many individuals to bolt an exercise program [3].

In the past, it was mandatory for the man to look for food, travel and exhibit stamina and other skills consociated with movement in order to survive. The advancement of civilization in paramount societies of the world has led to elimination of physical effort. Nowadays, there is no need to disburse large quantum of energy to get nutrition. We belittle the amount of energy spent on a physical activity, which results in an energy imbalance. Health challenges of industrialized countries stem from swaying from an energy regime set by our ancestors. Restoring energy balance is an oppugn for modern societies and may be achieved by maintaining a copacetic level of physical activity throughout life. Developing the habit of an active lifestyle during childhood, adolescence as well as among adults and senior citizens seems to be dynamic. Research shows that adults who have been more functional in childhood demonstrate better parameters for the cubage of the cardiovascular, respiratory and skeletal systems. It is, therefore, momentous to develop a liking for motor activities from an early age. It is necessary to dig out ways to engage various social groups in physical activities. One of the possibilities is to showcase a disparate choice of sport activities available for different age groups. The wider the preference, the greater the chance of finding a perfect sport activity for life. The dynamic elaboration of various forms of sport activities bewitching more and more people only supports the statement. The expansion of Nordic walking is an impeccable example of this phenomenon [4].

Nordic walking (originally Finnish sauvakävely) is a form of physical activity, where regular, natural walking is enhanced by the addition of the active use of a pair of specially-designed Nordic walking poles. Nordic walking (NW) was first

discovered by cross-country skiers in Finland, who started using cross-country ski poles for off-season training. The cross-country ski poles, however, broke facilely and were too long. Unique walking poles that were more durable and flexible were developed in the 1970s and became a nationally approved training method in Finland. It is estimated guesstimated that around 8 million people practice NW, mostly in Europe, and NW is quickly gaining popularity in Canada [5]. The popularity of NW should not be surprising as it is archetypal way of human locomotion and one of the most common forms of everyday physical activity. The undoubted advantage of NW is its natural and simple movement. In addition, it is an automated activity which under normal conditions does not necessitate lot of concentration during its execution. However, the characteristics of natural, biomechanically-correct walking and appropriate posture are maintained in all aspects [6]. However, the actual poles and techniques used in Nordic walking seem to bring together a unique combination of benefits, and act as a prism magnifying the overall health benefits. People of all ages quickly were attracted by it [7]. Nordic walking has proved to be a simple and feasible form of physical activity that can be done by closely everybody, everywhere, and at almost any time. It is the same as brisk walking except for the additional use of specially designed poles that provide the advantage of actively involving the upper body and arms [8].

Compared to regular walking, Nordic pole walking involves applying force to the poles with each stride. Nordic walkers use more of their entire body (with greater intensity) and receive fitness building biceps, shoulder, abdominals, and spinal and other core muscles. Nordic walking has been estimated as producing up to a 46% increase in energy consumption, compared to walking without poles, Nordic walking provides additional benefits in muscular strength compared to conventional walking, making it suitable for improving aerobic capacity and muscular strength as well as other ingredients of functional fitness in a short period of time [9]. Nordic walking has also been used for rehabilitation in individuals with intermittent claudication, Parkinson's disease, depression, athletic injuries and chronic low back pain. Moreover, in obese women, it elevated exercise intensity and cling to the training program without increasing the perception of effort, enhancing aerobic capacity [10].

Aerobic and anaerobic conditioning is at the core of the Nordic walking. Aerobic exercise utilizes fain acquirable oxygen, glycogen, and fat stores to sustain movement and pace, most often at a concordant moderate heart rate, and it is performed for longer durations of time. Aerobic conditioning is the backbone of training program, not just because it is immanent in a Nordic walking experience, rather because it preps the body for more intense anaerobic conditioning later on. Anaerobic activity demands a quicker source for energy; therefore instead of using fat stores, the main source of fuel is what is stored in the muscles. It is an ideal activity for cardio respiratory fitness because it can be performed at any intensity [11].

2. Materials and Methodology

2.1 Materials

Data was collected from the male and female students (age=18-25) with BMI between 25-30kgandm2 from Dr. A.P. J. Abdul Kalam, College of Physiotherapy, Loni. The Experimental Pretest and Post Test Study included thirty participants on the basis of convenient sampling for Duration of 4 months with intervention (using Nordic poles) for 4 weeks.(Length: 115cm, variable adjustment possible, Shaft (lower part): aluminum, Grip: ergonomically designed, powerful band, Tip: metal caride, Shaft (upper part): long lasting plastic, Rubber foot: natural rubber). Subjects with cognitive disorders, cardio-respiratory diseases, known neuro-muscular disorders, orthopedic disorders and fractures were excluded from the study. Evaluation was done using heart rate, Blood pressure, BMI, VO_{2max}

2.2 Methodology

The study received ethical approval from the institutional ethical committee. 30 participants from Dr. A.P.J. Abdul Kalam College of Physiotherapy, and was conducted on the ground in the campus of Pravara Institute of Medical Sciences, Loni. Participants were included in this study based on the inclusion and exclusion criteria. Written informed consent was signed from all participants. The procedure was explained to all the participants. Before proceeding for the procedure Rate of Perceived Exertion (RPE) scale was explained to the participants. Participants were evaluated for the baseline measurements of all outcome measures such as BMI, HR, BP, and VO2max. Their BMI was measured by calculating weight upon height in meter square, Heart Rate was obtained by calculating the pulse rate, VO_{2max} was measured by using the formula 15.3 multiplied by (maximum heart rate/ resting heart rate), Maximum heart rate was calculated by using the formula- 206.9-(age multiplied by 0.67), BP was measured by using a sphygmomanometer before starting their training with Nordic poles. Nordic walking exercise program consisted of warm-up exercise, main exercise, and cool-down exercise for 4weeks, 5 times a week, and 50 minutes each time. The participants were trained to use the Nordic poles and then the intervention was started. During the warm-up exercise period, the participants did isometric exercises with poles. The warm-up exercise period lasted for 10 minutes. Using the perceived exertion rating, we gradually increased the subjects exercise intensity. The intensity was 11 to12 (easy) during the 1st week as the adaption period, 13 to 14 (a little hard) for the 2nd and 3rd week, and 15 to16 (hard) for the 4th week. The cool-down exercises involved dynamic stretching for 10 minutes. Participants used Nordic poles and we set the length of each pole to reach the participant's umbilical level when standing and with the rubber at the bottom of the poles. After their training was completed their post pole walking BMI, HR, BP, VO2max was recorded as mentioned above for the outcome.

Warm up exercises

Fig 1: Mobility sequence with poles

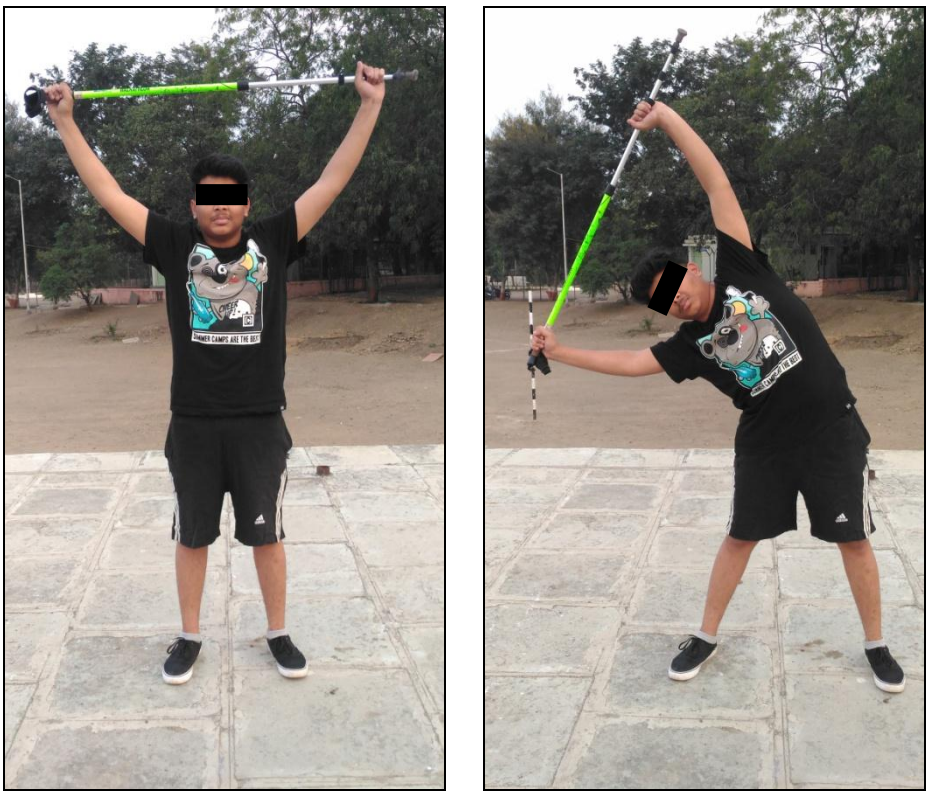

Fig 2: Active sides bend with poles

Fig 3: Standing torso rotation with poles-golf rotation

Fig 4: Participant walking using Nordic pole

Cool Down

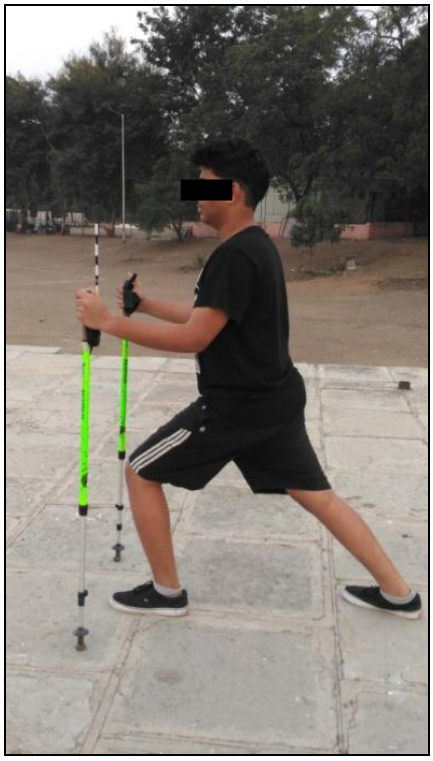

Fig 5: Calf muscle stretch

Fig 6: Hip stretch/ Front thigh stretch

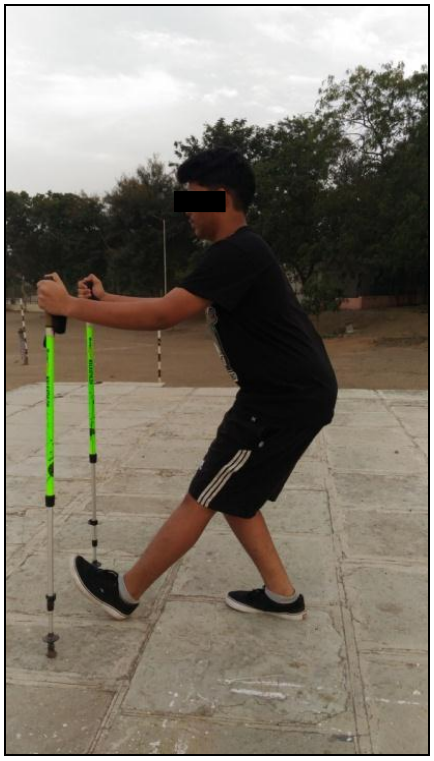

Fig 7: Hamstrings stretch

3. Result and Discussion

Data Analysis

Table 1: Demographic representation of the participants

Gender	No of participants
Female	22
Male	8

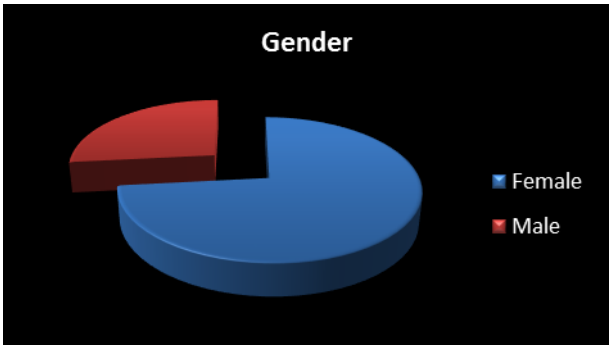

Fig 8: Represents no of participants

Result No 1: Demographic representation of data in which 22 were females and 8 were males

Table 2: Comparison between weight of pre and post Nordic walking

Weight	Mean+-SD	p value	t value
Pre	74.66+-8.087	<0.0001,considered extremely significant	11.937
Post	72.3+-8.302		

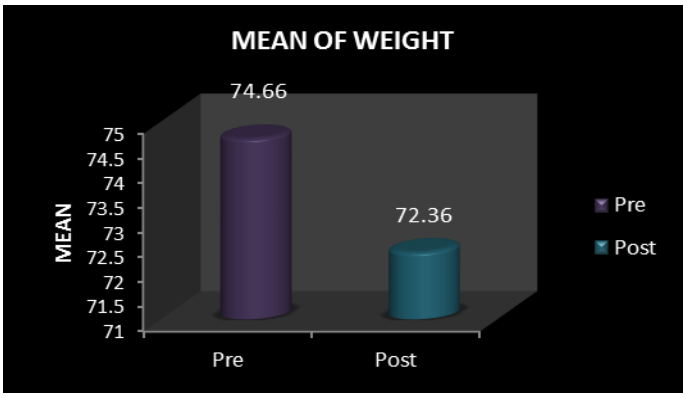

Fig 9: Represents comparison of mean of weight.

Result no2: The result shows that, the mean of pre Nordic walking is 74.66 while it is reduced to 72.36 after 4 weeks of Nordic walking. The interpretations of student paired' test with t value is 11.937, DF =29 and p value<0.0001, which is considered extremely significant.

Table 3: Comparison between mean of BMI

BMI	Mean+-SD	p value	t value
Pre	28.78+-3.58	<0.0001,considered extremely significant	10.014
Post	27.84+-3.52		

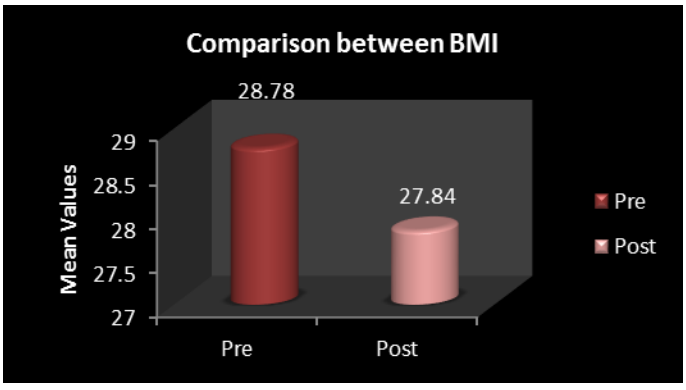

Fig 10: The above graph represents the comparison between the BMI.

Result No. 3: The results of the above study shows a slight reduction in the BMI, the pre mean value was 28.78 while the post mean value is 27.84. The t value is 10.014 and p value is <0.0001, which is considered extremely significant.

Table 4: Comparison between mean of HR

Heart rate	Mean +-SD	p value	t value
Pre	75.06+-8.030	0.0004, considered extremely significant.	3.976.
Post	73.16+-7.212		

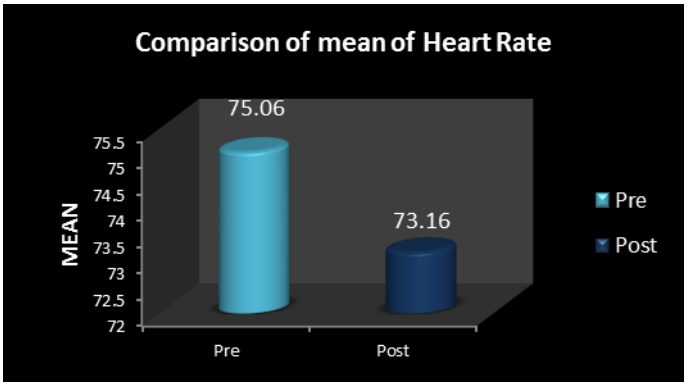

Fig 11: The above graph represents the comparison between Heart Rate

Result No 4: The results of the above study shows a slight decrease in the HR, the pre mean value was 75.06 while the post mean value is 73.16. The t value is 3.976 and p value is <0.0004, which is considered extremely significant.

Table 5: comparison of mean of VO_2 max

$VO_{2\ max}$	Mean+ SD	p value	t value
Pre	39.841+-4.580	<0.0049, considered very significant	3.050
Post	40.629+-4.403		

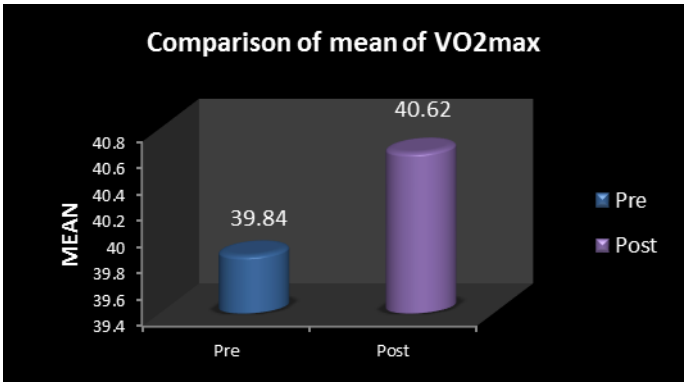

Fig 12: The above graph shows the comparison between VO_{2max}

Result No 5: The results of the above study shows a slight increase in the VO_{2max}, the pre mean value was 39.84 while the post mean value is 40.62 The t value is 3.050 and p value is <0.0049, which is considered very significant

Table 6: Comparison of mean of Systolic BP

Systolic BP	Mean+ SD	p value	t value
Pre	124+-6.787	<0.0001 considered extremely significant	7.316
Post	118.2+-6.692		

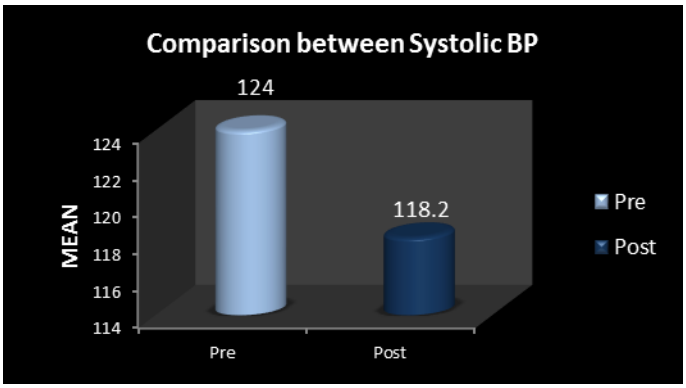

Fig 13: The above graph represents the comparison between Systolic BP

Result No 6: The results of the above study shows a slight reduction in Systolic BP, the pre mean value was 124 while the post mean value is 118.2. The t value is 7.316 and p value is <0.0001, which is considered extremely significant

Table 7: Comparison of diastolic BP

Diastolic BP	Mean+ SD	p value	t value
Pre	82.2+-1.095	<0.0001, considered significant	2.484
Post	78.46+-8.199		

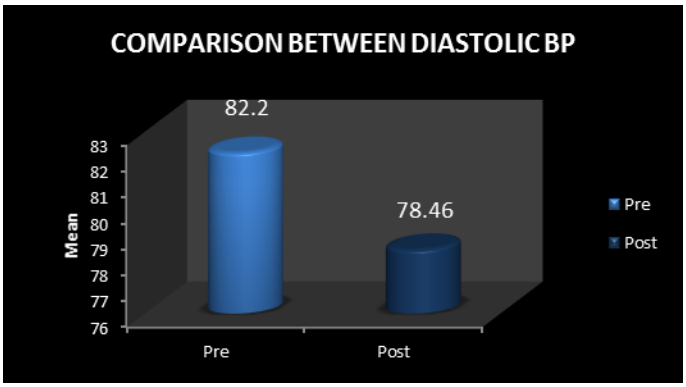

Fig 14: The above graph represents comparison between Diastolic BP

Result No 7: The results of the above study shows a slight increase in the HR, the pre mean value was 82.2 while the post mean value is 78.46. The t value is 2.484 and p value is <0.0001, which is considered significant.

The present study "Effect of Nordic Walking in overweight individuals" consisted of 30 participants from Dr. A.P.J. Abdul Kalam College of Physiotherapy, and was conducted in the campus of Pravara Institute of Medical Sciences, Loni. The aim of this study was to study the effect of Nordic walking in overweight individuals and to assess the effect of Nordic walking on Heart rate, Blood pressure, BMI and $VO_{2max.}$

This study shows significant changes in BMI, BP, HR, and VO2max with 4 weeks of Nordic Walking

Weight

The mean weight of participants, pre Nordic walking was 74.66 while it was reduced to 72.36 after 4 weeks of Nordic walking. The interpretations of student paired 't' test with t value was 11.937, DF =29 and p value<0.0001, which was considered extremely significant. Similar results were found when T. Fritz conducted a study to record the effects of Nordic walking on health-related quality of life in overweight individuals with Type 2 diabetes mellitus, impaired or normal glucose tolerance. The study concluded that quality of sleep improved in the group with normal glucose tolerance following 4 months of Nordic walking. Hence, it states that Nordic walking can be introduced in a primary health care setting as a low cost mode of exercise that promotes weight loss and improved health satisfaction [12].

BMI

It showed slight reduction in the BMI, the pre mean value was 28.78 while the post mean value was 27.84. The t value was 10.014, DF= 29 and p value was <0.0001, which was considered extremely significant. Similar study was done by Min-Sun Song to assess the effect of Nordic walking on body composition, muscle strength and lipid profile in elderly women. They found significant difference in weight, grip strength, sits to stand, arm curl, total cholesterol between groups. The study concluded that Nordic walking was more effective than normal walking [13]. Previous studies [14, 15] have shown that 12 weeks of Nordic walking demonstrated a decrease in BMI, total fat mass, low-density lipoproteins, triglycerides and waist circumference and an increase in high-density lipoproteins. Similar results were found when a study was conducted on the influence of a ten-week Nordic walking training-rehabilitation program on the level of lipids in blood in overweight and obese postmenopausal women by Magdalena Hagner-Derengowska, *et al.* The results showed a statistically significant loss of body weight, as well as drops in BMI [7].

Heart Rate

There was a slight decrease in the HR; the pre mean value was 75.06 while the post mean value was 73.16. The t value was 3.976 and p value was <0.0004, which was considered extremely significant. Study by Seol-Jung Kang revealed similar results [16].

VO_{2max}:

There was a slight increase in the VO_{2max}, the pre mean value was 39.84 while the post mean value was 40.62 The t value was 3.050 and p value was <0.0049, which was considered very significant. Many observational studies have shown that the short-term benefits of Nordic walking include an increased VO2 of 11%–23% [8]. Study done by Seol-Jung Kang revealed similar results [16].

Blood Pressure

Obesity is linked with increased blood flow, vasodilatation, cardiac output, and hypertension.

Even though cardiac index does not increase, Cardiac Output and Glomerular filtration rate increases. However, renal sodium retention also increases, leading to hypertension [8]. When Nordic walking was continued for 4 weeks, there was slight reduction in Systolic BP; the pre mean value was 124 while the post mean value was 118.2. The t value was 7.316, DF=29 and p value was <0.0001, which was considered extremely significant.

Nordic walking can be recommended to a wide range of people as primary and secondary prevention [8].

Nordic Walking activates 90% of body muscles, burns up to 46% more calories than regular walking, increases aerobic effect by up to 25% compared to regular walking, decreases load and strain on lower body, tones upper arms, shoulders and back muscles, lateral mobility of the spine is improved, develops core stability and strength and promotes an upright posture. Nordic Walking is an ideal activity choice for sustainable weight loss. All major muscle groups are utilized causing greater calorie consumption and less perceived effort by the participant. Nordic Walking engages major muscle groups resulting in high calorie consumption, reduces body weight load on ankles and feet, low perceived exertion compared to the higher energy expenditure achieved, Muscle fatigue and discomfort decreases due to workload being spread across body, promotes a longer lasting post- workout calorie burn effect.

Current literature unanimously identifies Nordic walking as a safe, feasible, and readily procurable form of endurance exercise training, which exerts panoply of beneficial effects in a wide range of people with various diseases and the healthy. As part of primary or secondary prevention, Nordic walking can be entrusted to those who wish to increase their daily physical activity with an effective cardio respiratory training routine [8].

Results of this study clearly identify Nordic walking as a healthy and well-accepted mode of physical activity.

4. Conclusion

The present study concluded that Nordic walking, less popular form of activity in India, is one of the innovative styles of walking which helps in aerobic training with significant decrease in BMI, Heart rate, Systolic and Diastolic blood pressure increase in VO_2max after 4 weeks of intervention with Nordic walking in overweight individuals for 50 minutes.

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