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Effect of Physical Education programmes on health-related fitness components of physically challenged pupils

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Effect of physical education programmes on health -related fitness components (cardio respiratory endurance, low back flexibility and body composition) of physically challenged pupils

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ABSTRACT

Objectives: To evaluate the effect of Physical education (PE) programmes in the improvement of health related fitness variables. *Methodology and Results:* Health-related fitness levels of persons with physical disabilities who participated in an eight week physical education programme were measured using the project UNIQUE physical fitness test battery of Winnick and Short (1985). The study group comprised of 17 boys and 14 girls from classes five, six and seven. Pre-test and post test design was used in this study. A pretest was carried out two weeks after school opening, from a five week vacation from December to January of 2009 and a post-test eight weeks later at the end of the treatment period. The data collected was descriptively analyzed and one-way ANOVA was computed to determine the significance of difference between pre and post-test means of the dependent variables under investigation, by gender and across the ages. The following hypothesis was tested in this study: - H_{o1} – there was no significant difference between the pretest and posttest data results with regard to the following variables of the physically challenged: cardio-respiratory endurance, low back flexibility and percent body fat**.** H_{o2} – there was no significant difference according to the gender on health-related fitness levels of the physically challenged pupils of Joyland Special School in relation to gender at pretest and posttest. The null hypotheses were rejected at $P<0.05$ level of significance. The findings showed that the pupils had a lower fitness level at pre test compared to after PE program. This study further established that in cardio respiratory endurance boys performed better than girls, while in low back flexibility both boys and girls demonstrated an improvement across all age groups. The overall findings of the study established that there were significant improvements on cardio respiratory endurance and low back flexibility. However, improvements on body composition were not statistically significant at $p< 0.05$ level. *Conclusions and applications of the findings:* The results showed that physical education improves health- related fitness of persons with physical disabilities. The study recommends that physical education should be encouraged in all schools even in those involving persons with physical disabilities. Physical Education should be allocated more time on the school time table than currently available. We recommend 5 Physical Education lessons each lasting 35

minutes totaling to approximately 3 ½ hours per week and further propose replication of this study to larger study groups and to include other categories of special needs groups, e.g. mentally handicapped and visually impaired persons.
Key words: physically challenged, health-related fitness, physical education programme

INTRODUCTION

Physical education has been recognized as an important part of the total educational process for all (WCEFA, 1990) as it influences development of organic, neuron-muscular and emotional as well as physiological development of the learner. Despite physical education being in the school curriculum, the subject is rarely taught. Persons with physical disabilities are even less exposed to Physical Education programmes compared to able bodied pupils (world summit on PE 1999).

According to Clark and Clark (1984) the development of physical ability occurs from childhood to maturity. For persons with physical disabilities the development of motor ability is either delayed or abnormal (Kalakian & Eistaedt, 1982), and has been attributed to inadequate opportunities to move and exercise as reported in Rehabilitation International Journal of 1991. A report by Martineck and Johnson (1979)] indicates a discrepancy as great as 4 years between motor skills level and chronological age for children with physical disabilities. According to Auxter and Huetigg (1993), persons with physical disabilities need to be in the best health status to overcome discrimination and gain social acceptance. The role of play, which is important for social, psychological and motor development, is limited for these children. Persons with physical disabilities have lower fitness level than their able bodied peers and so they have to work harder at their fitness level (Sherill, 1993). The PE lessons offered in school are an excellent way of integrating the persons with physical disabilities into situations in which they can gain social acceptance and adaptation to community living (Toluhi, 1990). The current study analyzed the effectiveness of physical education programme on health-related fitness of physically challenged pupils.

METHODS AND MATERIALS

This was a quasi – experimental research using pre test and post test design. The study lasted 8 weeks and it was based at Joyland Special School, Kisumu district of Nyanza province. The study group comprised of 17 boys and 14 girls (N=31) in classes 5, 6 and 7 all of whom had the following disabilities; amputees, spina bifida, cerebral palsy, osgoodschlatter disease.

Using intact classes with age and gender already designated, a fitness protocol chart was used for data collection. Information was recorded on demographic details and fitness levels of the pupils. The pupils performance on the dependent variables were assessed using the UNIQUE Physical fitness test battery developed by Winnick and Short (1985), cardio respiratory endurance was measured by 9 minute run /walk, upper body strength by soft ball throw in meters, abdominal strength endurance by modified sit ups in 1 minute, low-back flexibility by sit and reach in 1 minute and skin fold fat measurements were used to measure percent body fat. Permission to carry out the research was granted by the Ministry of Education. Three research assistants who were the P.E teachers in the school were trained in assessing the variables in the study.

The data collected were subjected to statistical analysis by (SPSS). Descriptive statistics were used to compute the mean, the standard deviation and percentage for each component of fitness. One way analysis of variance (ANOVA) was used to compare the pre and post test results on the same components. The level of significance was set at 0.05 alpha levels.

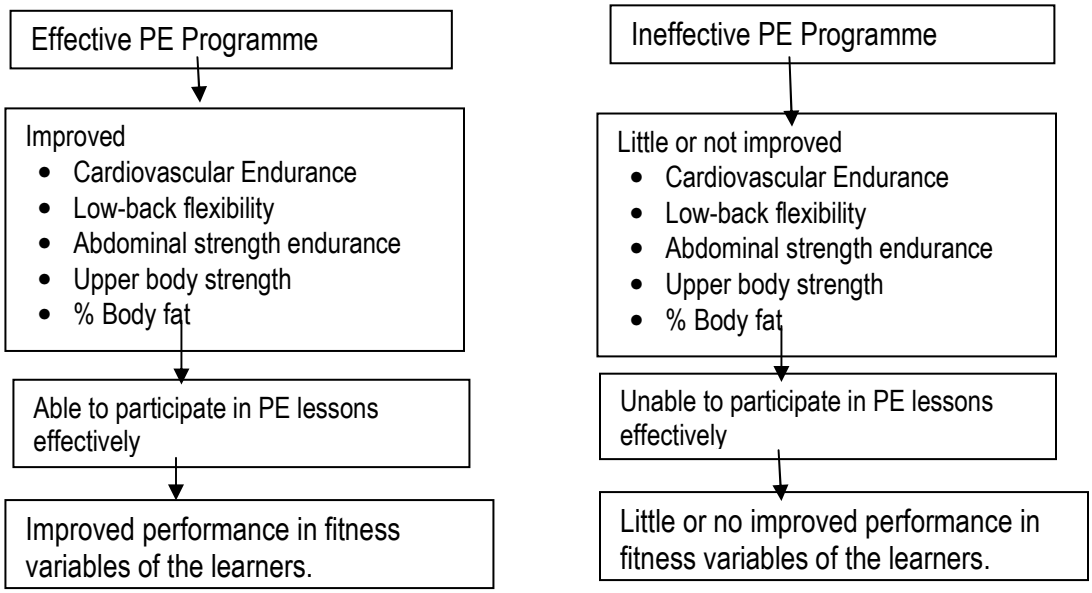

Figure 1: Conceptual framework

The study adopted and used the conceptual framework in Figure 1 above was developed by Franks and Howley (1997) which stated that effective participation in PE programmes leads to improved performance in all the fitness variables in the study. While ineffective PE programme leads to little or no improvement in the fitness variables of the learners.

Test administration

Anthropometrics:

a) Age was recorded from individual records or pupils in the school register.

b) Height was taken by the use of a tape measure, which was suspended on a pole.

c) Weight (Kg) for each pupil was taken without shoes and in light clothing.

Cardio-respiratory Endurance

i) Resting heart rate: This was beats per minute (bpm) felt with two middle fingers at the carotid artery, with the pupils seated and using a stop watch for timing. The carotid artery pulse was counted for 15 seconds. The number of beats was then multiplied by four to get heart rate in beats per minute.

ii) I mile run/walk in 9 minutes (Winnick and Short, 1985): The subjects ran or walked or pushed wheelchair on a marked rectangle of 50m x 100m for 9 minutes. Check marks were placed at intervals of 20 meters to help in determining accurate distances. There was a common starting point; starting, and stopping (after 9 minutes) was by a whistle blow. Each pupil stopped and continued jogging, walking or wheeling on the sport until research assistants recorded the distance in meters. The longer the distance covered in 9 minutes the higher the cardio-respiratory fitness level.

iii) Low-back flexibility: This component was tested by the sit and reach test. The pupils sat on the ground with knees apart, feet touching the bench so that the meter stick was equidistant with the feet without arching. The pupils were given three trials each and the average score was used as the final score.

The Fitness evaluation protocol chart used is as shown below (Appendix A)

Joyland Special School for Physically Handicapped

Name ……Gender ……..Class……..

Age……(yrs) Weight (kg)……. Height (cm)…….

a) Resting heart rate (Bpm)……

b) 9 min run/walk (Winnick and Short)

Distance covered in meters……..

c) Sit and reach (cm) 1st trial…… 2nd trial……. 3rd trial……

Research Assistant

Name …… Signature ……Date……..

Appendix B: Observation Score sheet

Name of teacher……..Date……..

Class…….. No of females ……No of males…….

Activity	Time spent	Comments
Warm-up		
Group – activity		
Game		
Cool down		
What to observe Cool down	1. Activities done 2. the intensity of participation 3. difficulties encountered by the teacher and pupils in the lesson 4. Adequacy of facilities and equipments	

RESULTS AND DISCUSSIONS

Table 1: Age distribution of pupils with physical disabilities participating in physical education study program in Kenya.

Age (years)	frequency	Percent %
12	4	13
13	4	13
14	5	16
15	3	10
16	4	13
17	6	19
18	5	19
TOTAL	31	100

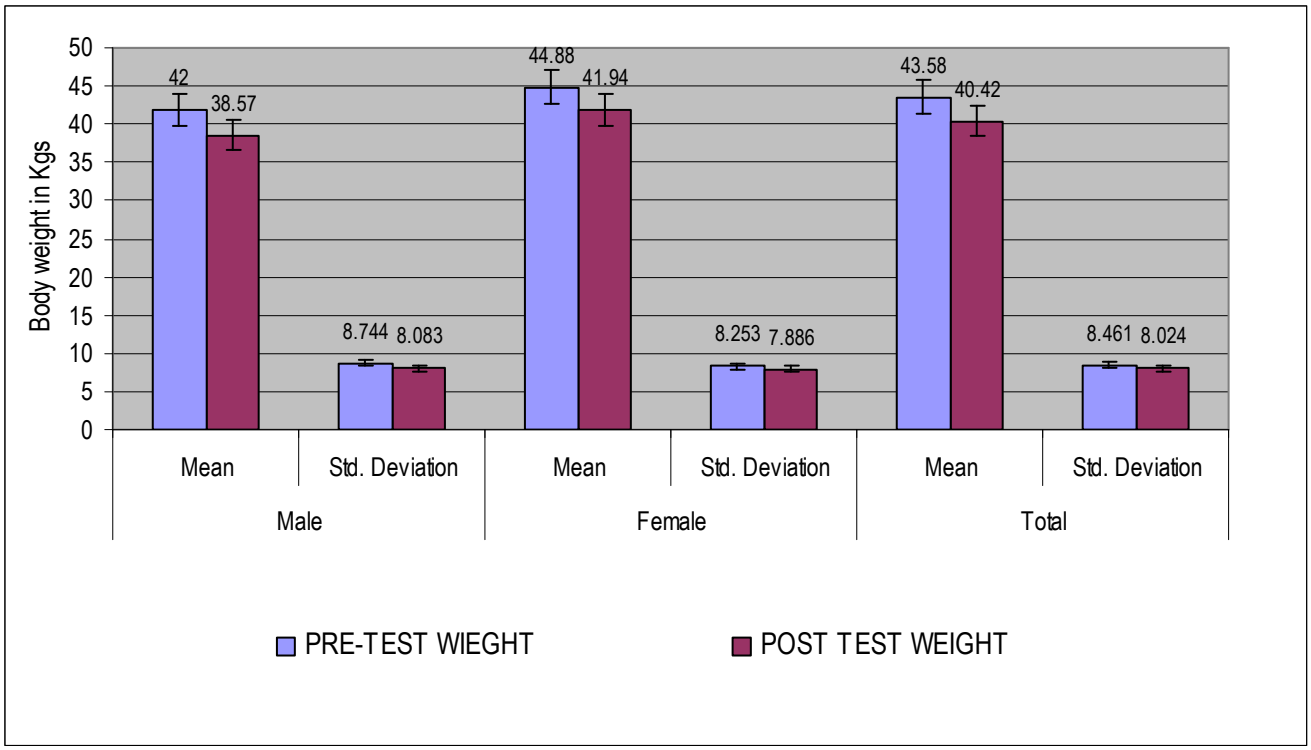

Figure 2: Decrease in body weight by gender between pretest and posttest

This figure shows the decrease in body after exposure to 8 weeks physical education programme by gender**.**

From the findings, the physically handicapped pupils remain in primary school at older ages than the able bodied pupils (up to 18 years) (table 1). One explanation for this is that parents hide their handicapped children during their early age when they are supposed to have joined school. In addition, parents choose to educate their able-bodied children at the expense of the handicapped children and as a result by the time they are identified and placed in primary school they are already overage. These findings agree with the results of a survey carried out by site Kenya society for the physically handicapped (KSPH, 2001).

PE exercises led to decrease in body weight in majority of the pupils, since 81% (25 of the 31) of the pupils registered a reduction in weight .[There were some pupils who did not register decreases in body weight of whom more were female (Figure 2). In relation to gender; fewer males registered no change in their body, weight compared to females (that is, 33% of males did not change weight compared to 67% of females whose weight did not change). This finding demonstrates that P.E. programmes can reduce body weight of pupils with physical handicaps. This finding agrees with that of Kinoti (1998) and Nkatha (2002).

Cardio respiratory endurance: The majority (97%) of the pupils recorded an increase in cardio respiratory endurance after participating in physical education program for eight weeks (Fig.3). Cardio-respiratory endurance is important to persons with physical disabilities. The key advantage is that people with high levels of cardio-respiratory endurance have lower risk of heart disease and increased longevity. The health benefits include reduced risk of type II diabetes, lower blood pressure and increased bone density in weight bearing bones. Another positive factor associated with developing cardio-respiratory fitness, is that as fitness improves, energy for work and play also improves. This translates into one being able to perform more work with less fatigue. It also improves self esteem coming from such factors as starting and maintaining a programme which provides a strong sense of accomplishment. Similarly, regular exercise improves good muscle tone and assist in weight control, all these factors result in improved physical appearance. Fit people sleep longer without interference compared to non-fit people resulting in a better night's rest and a more complete feeling of being mentally restored. Studies have shown that persons with physical

handicaps have poor posture and low cardio-respiratory fitness because they are rarely exposed to exercise programmes. They have low endurance compared to able bodied persons. Therefore they require more physical activities to improve their cardio-respiratory fitness which will help them reduce incidents of heart attack as excess fats can be expended during physical activities. Individuals with superior cardiovascular fitness have the ability to perform high level endurance type activities.

V_{O2} max (volume of maximum oxygen uptake) is the most commonly accepted criterion measure of cardio-respiratory fitness. This indicates the ability of the system to take in, transport and deliver oxygen to the working muscles. V_{O2} max is commonly expressed as a function of body weight in millimeters per minute. It is then divided by the subjects body weight in kilograms. V_{O2} max is expressed in millimeters consumed per minute = ml / Kg / min. The higher the relative V_{O2} max the greater the cardio-respiratory fitness and the greater the work efficiency.

These findings agree with those of Esmail (1983), Mulder and Allen (1983), Winnick and Short (1935), Njororai et at (1997), Kinoti (1998) and Nkatha (2002). Previous studies were carried out on normal primary and secondary school pupils but this current study was carried on physically handicapped pupils.. The marked improvement was boosted by the performance of male subjects. The pupils covered longer distances in 9 minutes run/walk during the post test (after exposure) compared to the pretest (before exposure).

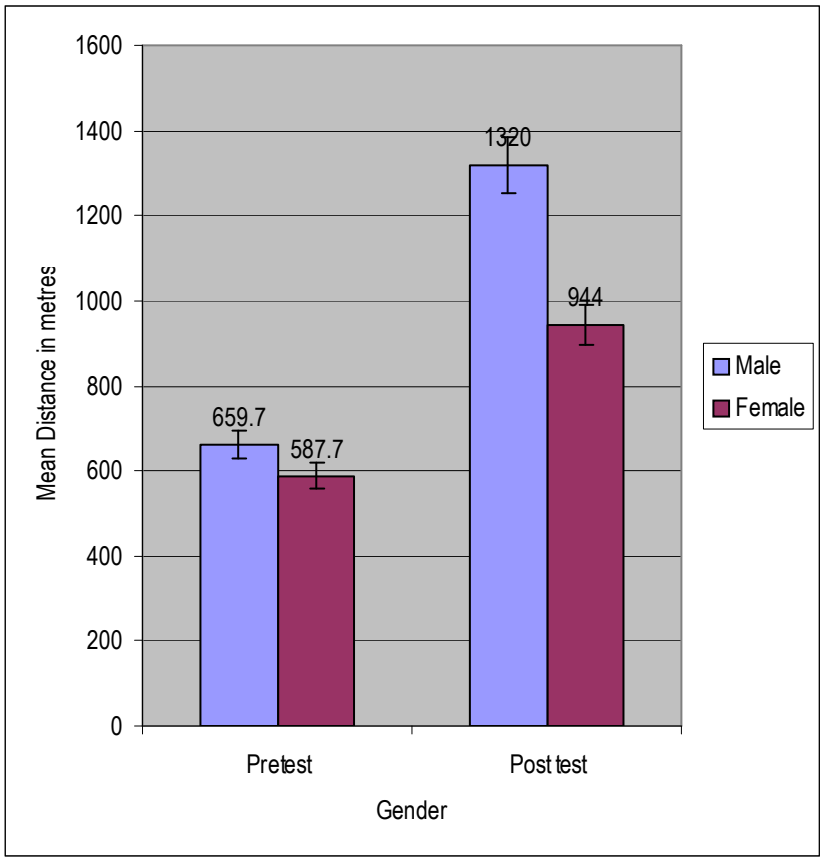

Figure 3: Cardio respiratory endurance of physically handicapped pupils. Pre-test and post-test

Low-back flexibility: All groups performed better after 8 weeks of PE activity compared to pre test findings. Generally, girls performed better than boys both in the pretest and post test indicating that in physically handicapped children girls have more flexible low backs than boys]. Lack of low back flexibility is a health hazard as it leads to bad posture, compression of peripheral nerves and painful menstruation. It also limits work efficiency and makes individuals prone to injuries. Physically challenged pupils suffer from

restricted movements, awkward posture, and low work efficiency as a result of their handicapping conditions. They also have poor postural development. Low back pain is caused by misalignment of the vertebral column and pelvic girdle caused by lack of low back flexibility and weak muscle which is a characteristic feature common among physically challenged persons.

Therefore improved low back flexibility enables those pupils to undergo day to day activities with comfort and is effective in rehabilitation in athletic performance. This also results in the following benefits: increased joint mobility, prevention of low back pain, efficient body movement, improved posture and personal appearance. These benefits contribute to improved health-related fitness levels of pupils with physical handicaps and hence the necessity of Physical Education programmes to improve low back flexibility among them.

These findings are supported by study by Berger (1982) which found out that there are performance differences among the sexes, girls are superior on tasks that require balance, co-ordination and flexibility whereas boys excel in power strength dependent events such as throwing, jumping, running, kicking and hand gripping]. A study by Vogel (1986) was done outside Kenya with different environmental settings and was on normal children. Few studies have been done on the effects of Physical Education on physically handicapped children in Kenya. Similar findings on improved cardio-respiratory fitness and low back flexibility by Nkatha (2002) were on deaf pupils. Kinoti (1998) was on able bodied Diploma Teacher Trainees.

The findings of this study are significant because it is one of the very few studies which have been done in Kenya applying the project UNIQUE physical fitness test battery by Winnick & Short in Kenyan context. The implications of this study's findings is that physically handicapped pupils can also reap health-related benefits with proper programme implementation, there is therefore a need to expose all physically handicapped pupils to physical education programmes to improve their health status at all levels of the education system.

Studies by Wesonga (1989) used structured physical education programmes while this study used the Ministry of Education physical education programme as taught in schools. Previous studies by Nalletamby and Ngumo (1987) did not use pre and post test hence their results could not confidently reflect effectiveness of physical education programmes. This study left a yawning gap which the current study findings have tried to fill.

The differences in studies done in secondary schools by Wasonga (1989) had not accounted for maturity which could have interfered with performance. Ngumo (1983) had also used 2400m distance running which had not received any empirical justification and all this could have caused differences in the results.

The current study used project UNIQUE test battery which had been used among orthopedic handicapped which had received empirical verification when compared to laboratory tests. This study has created awareness that physical education programmes can intervene and improve health status of the physically handicapped children in Kenya and so it recommends that these children should be exposed to physical education programmes. The study has suggested increased frequency for more significant changes on body composition.

The study findings further suggest that the physical education programme if well programmed and supervised can improve health-related fitness of the physically handicapped who for long have been denied access to meaningful adapted physical education programme, because of their handicapping conditions.

The study gap on effects of physical education programmes on physically handicapped pupils which has been lacking in Kenya has been filled by the findings of this research study. Finally this study's finding has provided baseline data on adapted physical education which can be comparable to that of developed countries.

Pupils who participated and attained the highest improvements in this study had passed the adolescents stage (16-18 years) hence flexibility could only have improved through physical activity. These findings are supported by those of Wasonga (1989), Kinoti (1998) and Nkatha (2002). Furthermore a study by Wilmore and Costil (1994) are in support of these findings when they stated that physical activity improves trunk flexion and flexibility is lost easily during period of inactivity and that significance changes in flexibility occur in 5 to 15 weeks in joints exercised. Flexibility increases with age until adolescent stage when it starts to decline (Borms, 1985). Failure to continuously move a joint through its fall range of motion can lead to shortening of muscles and ligaments (Muller and Allen, 1989)

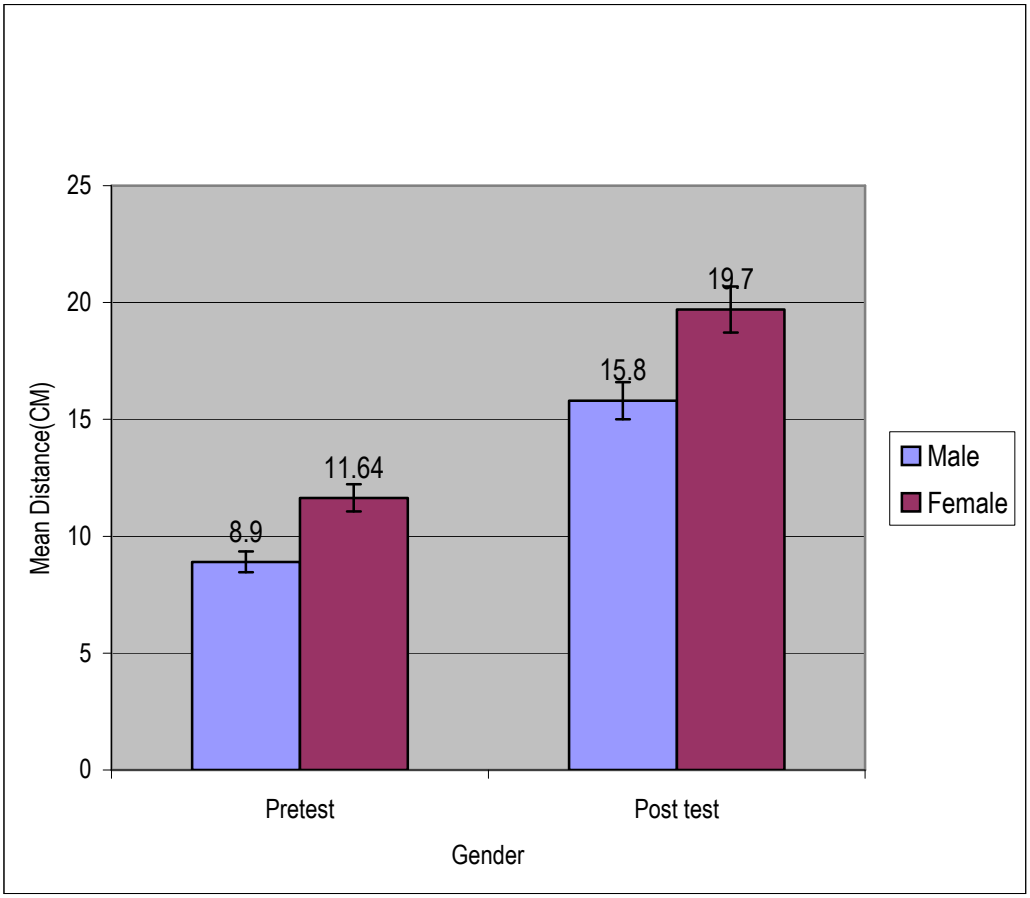

Figure 4: Performance by gender on low-back flexibility of physically handicapped pupils between pretest and post test

Percent body fat: - refers to relative amount of fat and lean body tissue that makes up the body. The data on skin fold fat measurements is presented in Figure 5.

Both girls and boys recorded marginal reduction in their skin fold measurements after 8 weeks of PE activity (post test) compared to pretest. Boys had less skin fold fat measurements than girls.

When one way analysis of variance was computed the results showed no significant difference between post test and pre test = after exposure to 8 weeks PE program and pretest=before exposure to PE programme regarding percent body fat/body composition. It is concluded from this study that the physical education programme did not significantly improve the pupils body composition after 8 weeks exposure. These findings disagree with those of Vogel (1986), Kinoti (1998) these two studies reported that eight weeks physical activity resulted in significant reductions in body composition, however this was on able bodied diploma teacher trainees and secondary school students, who are exposed to two over years physical education and sports programs, but agrees with Esmail (1983), Wasonga (1989) and Nkatha (2002). It could be that a period of eight weeks was too short a duration to bring significant changes on body composition. This study recommends that more research need to be carried out to establish if physical activity can actually bring significance changes on body composition.

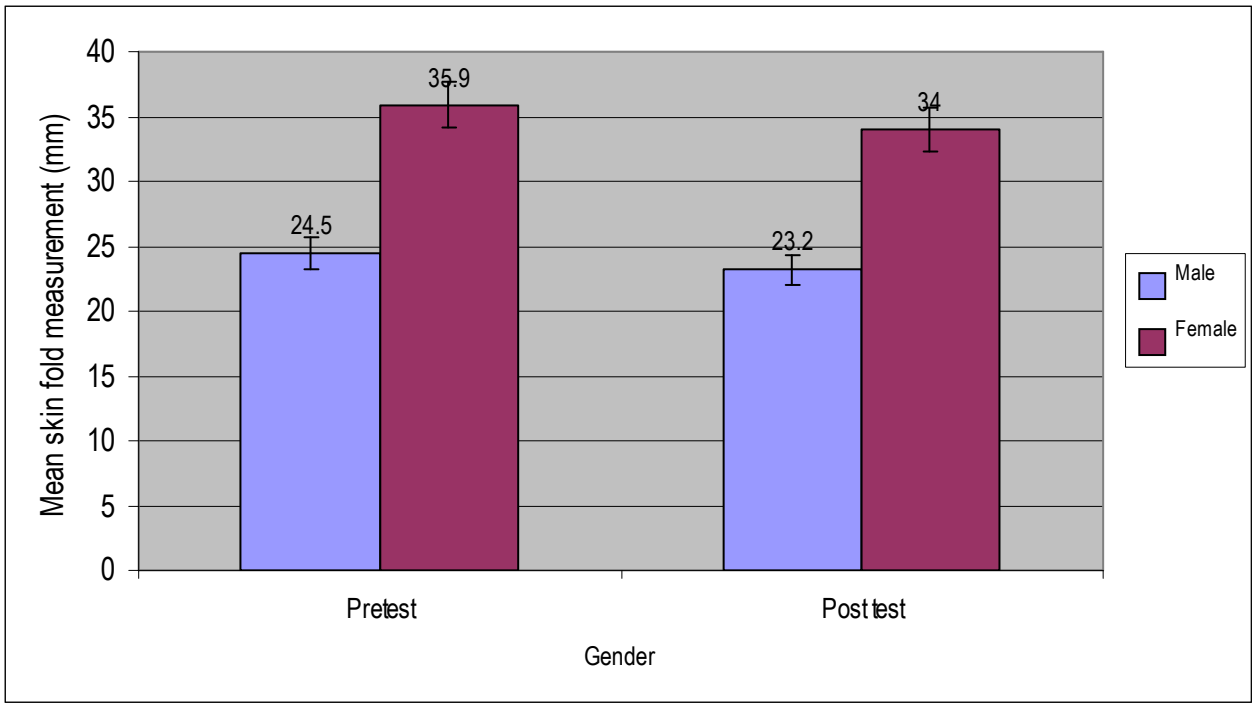

Figure 5: Performance by gender on skin fold fat measurements of physically handicapped pupils between pretest and posttest

Resting Heart-Rate : The pupils recorded lower heart rate in the post test as compared to pre test . This was an indication that the PE programme was effective in improving subjects resting heart rate. The results were statistically significant when one-way analysis of variance was computed. This findings agree with those of Winnick and Short (1985), Nkatha (2002) regarding the physical education programmed on persons with disabilities. Other studies which agree with the findings of these studies include that of Bourchard and Lortie (1984) which stated that physical activity improves cardio respiratory endurance. The improvement on the cardiovascular system was due to increased stroke volume, increased mitochondrial activity and hypertrophy of the myocardia.The respiratory system improved due to increased lung volume, lowered respiratory rate, and improved pulmonary ventilation and diffusion this findings is further supported by Wilmore and Costil (1984).] The following changes lead to rise in aerobic capacity and improved health-related fitness among the physically handicapped pupils; heart rate at rest will decrease markedly as a result of continuous training through physical activities. Highly conditioned individuals have a resting heart rate of up to 40 beats per minute. During exercise the heart rate for the same rate of work will be less as one becomes highly conditioned. At maximal levels of exercise, the maximal exercise will remain approximately the same following endurance training (Wilmore and Costil, 1993).

The major function of the heart rate during exercise is to combine with stroke volume to provide the approximate cardiac output for the rate of work being performed. If the heart rate is too high, the diastolic filling period is reduced to a point where the stroke volume is compromised. But if the heart rate is low, the diastolic filling period is increased resulting in an increased stroke volume and hence increased cardiac output. Additionally physical education activity participation by physically handicapped pupils enables their heart rate to recover at a faster rate from exercise; there is therefore a faster return to pre exercise levels.

Pulmonary blood flow – physical education activities among pupils with physical handicaps increases maximal pulmonary ventilation from values of 120 Liters per minute in the untrained up to 180 Liters per minute following training and even higher in trained athletes. Lung diffusion also improves with exercise, which is as a result of enhanced ventilation of the lungs, which provides a large and more efficient surface area for gaseous exchange during exercise and during recovery from exercise (Watson, 1995). This low heart rate will help theses pupils partake in their daily chores with ease and improve their health. Therefore low resting

heart rate l s beneficial to pupils with physical handicaps.

Changes in stroke volume are closely related to changes in the heart rate that result in participating in continuous physical activity. At rest the stroke volume is substantially higher following a physical education program. Similarly, stroke volume is higher a sub-maximal standardized rate of work as well as at maximal levels of exercise. This increase is as a result of more complete filling of the heart during diastole, resulting in a greater systolic blood volume. This avails adequate blood for delivery of oxygen and nutrients for utilization by the working tissues. The walls of the left ventricle tend to hypertrophy with training. This increased ventricular muscle mass allows an increased power of contraction which pushes a greater volume of ousted blood to the aortic arc and the working tissues of the body (Wilmore and Costil, 1993)

Cardiac output – at maximal levels of work the cardiac output is increased, this is the result of the increase in maximal stroke volume. As a result of these improvements on resting heart rate, the physically handicapped are able to participate effectively in daily tasks of living and improve on their life skills e.g. eating, bathing and performing daily chores, thus reducing overdependence on caregivers hence getting rid of feelings of helplessness.

Resting heart rate is also a measure of cardio-respiratory fitness. Individuals with high cardio-respiratory fitness levels have improved physical activity, which results in the following benefits for the physically handicapped; help them handle their bodies under a variety of circumstances, long active living, improved health and assisting in preventing and controlling health problems. This is critical for the child with physical impairment which for long has been discriminated against due to attitude and societal stratification. Improved physical activity helps the child to achieve optimum physical, mental and social growth through carefully selected activities. It also gives the child a feeling of worth and value despite the handicaps imposed on him by the impairments.

Exercise has therapeutic value to the physically handicapped. Sports represent the most natural form of remedial exercise. It restores the physically challenged strengths and productivity of mind, self dignity, self confidence and comradeship which gives them a completely new outlook of life. Sports and in particular physical activity enables persons with physical handicaps perform daily activities with vigor and reduce hypokinetic (movement) problems. Furthermore sports is useful in integrating physically handicapped learners in situations which helps them to achieve success, group approval and improve their level of function. For victims of muscular dystrophy participation in physical activity make these children make friends who will stick by as he becomes increasingly helpless as the disease progresses.

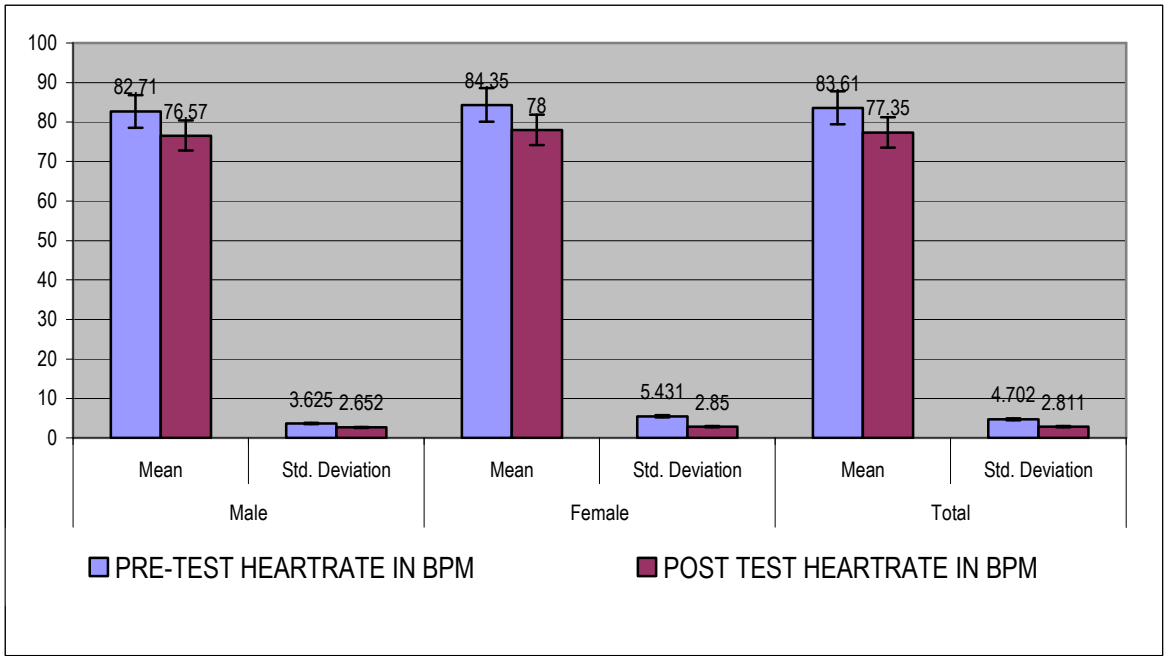

Figure 6: Performance by gender on resting heart rate of pupils with physical disabilities before pre-test and post test.

The magnitude of improvements between the pre-test and post-test were as shown in Table 2

Table 2: Analysis of health-related fitness components of pupils with physical disabilities after exposure to physical education for 8 weeks.

Variable unit	Pre	Post	F-ration	F-critical	Remarks	Magnitude of improvement	r
Cardio respiratory endurance	618.5m	1141.7m	27.3133	4.17	S	84.5%	0.0
Resting heart rate (Bpm)	82.74 (Bpm)	77.35 (Bpm)	17.6282	4.17	S	6.5%	0.4
Low back flexibility	10.4cm	17.96cm	35.7431	4.17	S	72.4%	0.8
Skin fold measurements (mm)	30.77m	29.12mm	0.3121	4.17	NS	5.3%	0.9

Key: S – Significant, NS – Non significant.
Result significant at $p<0.05$ at df 30

CONCLUSION AND RECOMMENDATIONS

It can be concluded that the physical education programme at Joyland special school was effective in improving the health-related fitness of pupils with physical disabilities over the eight week study period. The overall findings of the study established that there were significant improvements on body weight, cardio respiratory endurance, low-back flexibility and abdominal strength endurance. Thus, if well programmed and supervised, the P.E. programme can enhance the health status of persons with physical disabilities at all levels of education.

The study recommends that policy makers, curriculum developers at Kenya Institute of Education and other teacher training institutions should review and adapt physical education curriculum to promote the health of persons with physical disabilities.

- Physical education programmes should be encouraged in all schools involving persons with physical disabilities in Kenya. There is need to carry out nationwide survey of fitness levels of persons with physical disabilities including larger samples from primary secondary and university levels. This can help to establish national norms for this group, which are currently missing in Kenya.
- There is need to replicate the current study on other categories of special need groups e.g. visually impaired and mentally handicapped persons in Kenya's training institutions.

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