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## IN THIS ISSUE

- PETROLEUM INDUSTRIAL HAZARDS: REMEDIAL MEASURES
- THERAPEUTIC TOUCH AS A CARING STRATEGY
- POWER FREQUENCY EXPOSURES
- WARMING UP ON BALANCE
- OCCUPATIONAL THERAPY: THE TREND IN NIGERIA
- CARDIORESPIRATORY RESPONSE TO EXERCISE  
REHABILITATION
- ANTHROPOMETRIC INDICES AND CARDIOVASCULAR  
PARAMETERS

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# EFFECTS OF WARMING UP ON BALANCE: IMPLICATIONS FOR PRIMARY PREVENTION AGAINST POSTURAL PROBLEMS AND SPORTS INJURIES.

BY

WALEED AL-DALI\*,  
O. A. MORONKOLA\*\*

AND

I. O. OLADIPO\*\*\*

## ABSTRACT

It is known that warming up has positive effect on motor or performance skills. We therefore deigned this study to evaluate the effect of warming up on control of balance and see the implication on using warming up as primary prevention against postural problems and sport injuries. Sixteen volunteers with records of shortening hamstring muscle took part in the study. The design for the study was one group pre-test-post test experimental design. Measurement of range of motor (ROM) was taken and the assessment of shortening hamstring in balance was carried out using the computerized balance master system (BMS) tests. The mean standard deviation and t-test were used to describe and interpret the results of the study at 0.05 level of significance. Although the study revealed that there was no significant relationship between warming up and control of balance with shortening hamstring muscle, a trend was established showing relationship between warming up and stretching of muscle. Therefore proper warming up exercises should be emphasised before any strenuous motor performance to prevent postural problems and sport injuries.

## INTRODUCTION

Man's postures are the expression of his thought's feelings and mood (Okunrotifa, 1989). During office work, factory work, leisure and sporting activities our postures will affect our efficiency, physical, mental, social and emotional health. Man's physical health needs to be at its optimum to function effectively as Owoeye (1992) affirmed that varying degrees of physical stresses characterised individual's daily routine without regards to age, sex and status. This means survival or continuity of life of the living individual rests on his or her cardio-respiratory responses to these varying intensities of physical stresses which the individual has to deal with everyday. Macfarlane and Nicholson (1999) admitted that physical function appears to determine the quality of life for each individual in the community.

Quoting Bankoff et al 1993, Bankoff, Valverde, and Moraes (2000) affirmed that various factors contributed to good posture; one of the most detrimental one is lack

of physical activity oriented to compensate for postural habits related to daily hours people remained in the same position. Sports/athletic injuries are of different categories but they all result when body anatomical and physiological conditions are not well prepared (poor training, disease, poor nutrition etc.) or are disturbed (falls, fracture, sprain etc.) due to body contact, loss of balance etc. The muscles, joints are to be in good stead for the body to maintain good posture and gracefully and efficiently engage in sporting activities to prevent poor emotional health and sports injuries.

Therefore, engaging in warming up is a primary prevention strategy to prevent and reduce incidence of postural problems and sports injuries and by implication protect the health of the public in general and athletes in particular. Unwin, Carr and Leeson (1997) described primary prevention as the prevention of disease or other health problems arising, it covers a very broad range of activities carried out by an equally broad range of people and organisations.

Warming up are simple exercises done at low or moderate intensity to warm up or raise body temperature. The temperature elevation reduces occurrence of injuries in muscle and connective tissue (Robbing, Power & Burges 1994). In addition, blood flow to the muscles aids in the delivery of fuels required for muscle performance (Hamarik, 2000).

Light jogging and easy calisthenics reduce mechanical efficiency and muscle power. Earlier onset of sweating promotes evaporative heat loss and as a result decreased the amount of heat stored by the body. This helps prevent body temperature from rising to dangerously high levels during more strenuous exercise.

Warming up properly also prepares the cardiovascular and muscular systems for the upcoming physical activity and provides a transition from rest to strenuous exercise (Hockey, 1993). Likewise, Meitner (1999) added that warm-up may reduce the likelihood of excessive muscular soreness from strenuous activities.

A proper warm up according to Timothy and Scheett (1999) should include moderately intense exercise for 8-10 minutes followed by light stretching and finally

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\*Dr. Waleed Al-Dali, Ph.D. is the Chairman, Department of Rehabilitation, College of Applied Medical Sciences, King Saud University, Riyadh, Kingdom of Saudi Arabia. \*\*Dr. O. A. Moronkola and \*\*\*Dr. I. O. Oladipo are of the Department of Human Kinetics and Health Education, University of Ibadan, Ibadan, Nigeria. Corresponding Author: \*\*Dr. O. A. Moronkola.

practise on the skills that are related to the work to perform. The 8-10 minutes of exercise can be easily performed on a stationary bike, treadmill, or any exercise equipment; however if there is no access to exercise equipment the same goal can also be achieved by jumping rope (rope skipping) or running in place. The easiest way to know if one has exercised enough is to break a sweat before stopping.

Balance is defined as the ability to maintain the body's centre of mass over its base of support. Pretence (1999) opined that balance is the ability to maintain some degree of equilibrium while moving or standing still. Shumway-cook, Gruber, Baldwin and Liao (1997) listed the following factor as contributors to good balance: Strength, flexibility, vision, touch kinesthetic awareness, vestibular feedback, cognitive factors, medications and medical condition. They further expressed that exercise can improve balance and mobility function and reduce the likelihood for falls. Central to posture and participation in sport is the balance construct.

The hamstring is a group of muscles located at the posterior thigh, they include semimembranous, semitendinosus and biceps femoris. They are most powerful and important muscles of the leg. The main functions of the hamstrings include extension of the thigh and flexion of the knee. They play important role in walking (Nwankwo, 1992).

Hamstring tightness or shortness seems to be linked with the natural evaluation of lumbar lordosis pelvic tilt, bending forward defect, discomfort when sitting and a shambling gait (Jozwiak, Petrzak & Tobjabz, 1997) which all tell on balance of the body in motion or when still.

The purpose of this study therefore was to examine the effects of warming up on balance of volunteers who have shortening in hamstring muscle and using the result to justify the use of warming up as primary prevention activity against postural problems and sports injuries.

## METHOD AND PROCEDURES

### Subjects

The subjects for this study were 16 randomly sampled volunteers young adult men, who do not have any neurological or orthopaedic hamstring muscle. The age range was between 20 and 26 years old with mean age of 22.3 years with an average weight of 71.9kg and average height of 171.4cm.

### Design

The design is one group pre-test, post-test research design.

### Test procedures:

Screening test of the volunteers was done to recruit the subjects for the study. The hamstring stretch test was done using the calibrated flex box. The performer remove shoes and sit with knee fully extended and the bottom of the feet against the surface of the flex box. The arms are

extended forward, with one hand placed on the top of the other. The performer steadily reaches as far forward as possible and maintain the position for 3 seconds. No bouncing or jerking movements are allowed. (Hockey, 1993). Those with distance in front of the edge of the board were recruited..

After recruitment, the participants are taken through a group of 7 tests which constitute the procedure of the balance master test. Measurement of range of motion (ROM) was the first measurement. The hip measurement range of motion was taken from supine position with knee extended and foot in dorsi flex, that is straight leg raising (SLR); while for the knee, the measurement range of motion was taken while in supine position with hip at 90° flexion and knee at 90° flexion. The measurement was taken through the use of goniometer. One end on the moving part beginning from full flexion to the most possible extension.

The assessment of shortening hamstring in balance was carried out using the balance master system (BMS). This was used for the pre and post balance activities of the participants. The BMS consist of force plates linked to computer and monitor screen which provides visual feedback on the position of the participant's centre of gravity (COG). The Neuron International system mastum V3.4 Software (1992) was used. The position of the subject's COG was recorded after two trials. The subjects were instructed to stand on the BMS platform with their arms by their sides. They are expected to stand still while looking straight ahead initially with their eyes open and then with eyes closed. Postural sway was recorded for 20 seconds. The third test was on centre target the subjects were instructed to remain on the target zone for 20 seconds.

The fourth test was rhythmic weight shift from side to side. This required the subjects to match the direction and speed of the movement of the cursor on the monitor screen by shifting their body weight as required from side to side.

The fifth test was rhythmic weight shift in anterior-posterior direction.

The sixth was to test limits of stability. The subjects were, requested to shift their body to match the position of eight targets arranged in an ellipse anal shape. The targets were presented in sequence fashion and each one remained on the screen for 3 seconds.

The seventh test was also on limits of stability so it was similar to the 6<sup>th</sup> test except that target was presented in random fashion.

The above tests were taken and data collected as pre balance ability of the participants before the warm up exercises training programme (i.e. the treatment).

### Training Schedule

The training programme for the study lasted three weeks. The participants went through the following warm up exercises as recommended by Hamarik (2000).

- Walking on the treadmill for 10-15 minutes with speed 10 kilometre per hour.
- Side stepping:- Step sideways with right foot out and back then left foot out back (10 repetitions to each side).
- Arm swings: The participants keep arms straight and slowly cross arms in front, spreading shoulder blades apart, then slowly swing arms out to the side while squeezing shoulder blades together (10 repetitions).
- Arm circles, participants keep arms straight and slowly circle left arm up, back, then down. (repeat 10 times on each arm).
- Partial squats:- stand with feet hip-width apart and hands on hips. Bend from the hips and slowly sit back. Don't go lower than about 25cm. Make sure your knees don't go beyond your toes (10 repetitions).

Exercise II to V were done on five sets with a rest period of 2 minutes between each set. The training duration lasted 30 minutes each work-out and took place twice a day (morning and evening), after which post test was done.

## RESULT AND DATA ANALYSIS

The data was collected, based on the seven tests conducted on the Balance Master System (BMS). The records included the name of the participants, data file

**Table 1: Descriptive statistics of participants in pre and post tests n = 16**

|             | Mean  | SD     | std: Error Mean |
|-------------|-------|--------|-----------------|
| PRE.RPM. H  | 55.69 | ±10.36 | 2.59            |
| POST ROM. H | 62.19 | ±11.31 | 2.83            |
| PRE.ROM. K  | 61.00 | ±12.45 | 3.11            |
| POST ROM. K | 67.94 | ±12.94 | 3.24            |

and control of balance were mean  $62.19\% \pm 11.31$ . The t was 21.984 with the significant difference of .000 at df 0.05.

However, the range of motion (PO.ROM. H) after the warm up programme has the following results:- mean  $62.19\% \pm 11.31$  range  $44^\circ$  to  $181^\circ$ . The correlation result obtained with control of balance was  $t = 21.984$ , while the significance difference of .000 fell below 0.05 level of significance.

Comparing the pre and post mean values the study revealed that there is significant effect of warming up on muscle stretching/range of motion. On the other hand the t-values on the control of balance indicated no significant relationship.

**Table 2: Summary of analysis of t-test n = 16**

|              | t      | sig. of t | mean dif. | Confidence Interval of t dif. |       |
|--------------|--------|-----------|-----------|-------------------------------|-------|
|              |        |           |           | Lower                         | upper |
| PRE. ROM. H  | 21.491 | .000      | 55.69     | 50.16                         | 61.21 |
| POST. ROM. H | 21.984 | .000      | 62.19     | 56.16                         | 68.22 |
| PRE. ROM. K  | 19.603 | .000      | 61.00     | 54.37                         | 67.63 |
| POST ROM. K  | 20.995 | .000      | 67.94     | 61.04                         | 74.83 |

target/prot type, age, height, target sway (i.e. % max area) participant position (which included percent distance error and direction error).

Results of this study were analysed using descriptive statistics of mean, standard deviation and inferential statistics of t-test. All results were tested at 0.05 level of significance.

The age range of participants for this study was 20 to 26 years old with mean of 22.3 years. The height mean was 171.4cm with range between 150cm to 180cm.

The participants recorded a pre-test hamstring range of motion (ROM) mean of  $55.69\% \pm 10.36$  range was between  $40^\circ$  to  $75^\circ$ . The t-value of 21.491 with the significant difference of .000 at df 0.05 were recorded for pre-test correlation value between ROM and control of balance.

While the post test values of shortening hamstring

## DISCUSSION

The results of the study revealed that there are 55 (31.4%) significant paired sample test that indicated positive warming up effect on balance; and 120(68.6%) non-significant paired sample test warming up effect on balance.

Nevertheless, a trend was established showing relationship between warming up and stretching of muscle. This is in line with the findings of Al-Dali, Abass and Moronkola (2001) who reported a significant improvement in range of motion after hamstring stretch activities.

Warm-up activities have been established to improve performance of motor skills (Robbins, Power & Burgess, 1999). However, the non significant relationship between the balance master test results and warm up activities and balance might be as a result of the kinds of activities chosen which is a recommended warm up battery

(Hamarik, 2000). Out of the five exercises, two were arm exercises while three were for legs. This in essence shows that more leg exercises need to be included for positive result.

Likewise the non-significant relationship may be as a result of length of time for the warm-up. Although Robbins, Powers and Burgees (1999) recommended 5 to 15 minutes as being adequate.

## CONCLUSION

Based on the findings of this study it was concluded that warming-up activities can improve flexibility of the muscles. There by making the muscle to stretch better, and improve on its extensibility and amplitude. This will further improve the range of motion of the joints controlled by those muscles. Furthermore the muscles to be used during the warming up should be more relevant to the actual activity. Therefore, warming up can be a primary prevention activity against postural problems and sport injuries.

## RECOMMENDATIONS

Based on the outcome of this study, we make the following recommendations.

1. Coaches and sport administrators must insist on their athletes warming up before any sporting engagement especially any competition or match.
2. Community health education officers must of necessity incorporate the need to engage in warming up activities especially early in the morning in their various health talks. However, they should stress the need to see specialist for advice especially those with coronary heart diseases and respiratory system diseases.
3. Medical rehabilitation officers must also use all avenues to advice people on the need to engage in physical exercises to prevent postural problems.
4. Pre-primary, primary and post primary, physical education and health education teachers needs to inculcate into learners the desirability of using engagement in physical activity as a strategy to achieve quality of life.

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