



RESEARCH PAPER

EFFICACY OF INFRARED RADIATION THERAPY ON CHRONIC LOW BACK PAIN: A CASE STUDY OF NATIONAL ORTHOPAEDIC HOSPITAL, ENUGU, SOUTH EAST, NIGERIA

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ABSTRACT

Infrared radiation therapy is a modality widely used in Physiotherapy for the management of pain. The objective of this study was to determine the efficacy of six weeks infrared radiation therapy on pain intensity in subjects suffering from non-specific low back pain. The study was a pre-test post-test one group pre-experimental design. A total of fifteen (7 males and 8 females) of black African origin clinically diagnosed with nonspecific chronic low back pain that met the inclusion criteria were recruited for the study, and completed the six weeks study. The subjects received infrared radiation therapy on the lower back region in prone lying for 30 minutes, three times weekly, during the treatment period, for six weeks. Subjects' pre and post treatment pain level scores were assessed using the 10 point numerical rating pain scale. The data was analyzed using the paired sample t-test. Findings from the study showed significant decrease in the means of the pre-test and post-test scores of the variables by 95% C.I at $p < 0.05$. Six weeks infrared radiation therapy is effective in reducing pain in chronic low back pain.

Keywords: chronic low back pain, pain intensity, infrared radiation therapy

INTRODUCTION

Back pain is a musculoskeletal disorder with a high prevalence worldwide and a common cause for functional disability among the working population often with a negative psychological impact on its sufferers. It is a reason for intermittent absenteeism from work (Jansen *et al.*, 2001; Maul *et al.*, 2003; Roffey *et al.*, 2010; Samad *et al.*, 2010). It is described as pain restricted to the mid, high or low areas of the back bounded by T₁₂ superiorly and the buttock creases inferiorly (Owoeye, 1999; Waheed, 2003; Watson *et al.*, 2005). Non-specific low back pain is tension, soreness and /stiffness in the lower back region between L1 – L5, for which it is not possible to identify a specific cause of the pain (Savigny *et al.*, 2009).

The Epidemiology of low back pain in Africa is not well known. In 2002,2004, the prevalence of LBP in developed countries such as the United States of America (USA) and Australia, ranged from 26.4% to 79.2%(Deyo and Weinstein,2002; Walker *et al.*,2004). In Africa there appears to be a general notion that LBP prevalence is lower than what is reported in the developed nations (Omokhodion and Sanya, 2003; Gilgil *et al.*, 2005), albeit the lifetime prevalence of LBP is given as 85% for at least one episode of LBP in a lifetime (Walker, 2000) A systematic review into the global prevalence of LBP identified that of the 56 included studies; only 8% were conducted in developing countries, with only





one study conducted in Africa (Walker, 2000). The lack of information on the prevalence of LBP in developing countries is therefore a significant shortcoming (Gilgil *et al.*, 2005; Walker, 2000), as predominantly it is anticipated that the greatest increases in LBP prevalence in the next decade will be in developing nations (WHO 2003). The difference in disability prevalence between the developed and developing worlds is one example of global differences in health. Musculoskeletal disorders such as LBP accounts for about 4.3% of disability adjusted life years (years living with disability) in the developed world, whilst it is reported as accounting for approximately 1% in the developing world (Lopez *et al.*, 2001).

Furthermore, the economic, societal and public health effects of LBP appear to be increasing. LBP incurs billions of dollars in medical expenditures each year and this economic burden is of particular concern in poorer nations such as Africa (Walker, 2000; Childs *et al.*, 2004).

Infrared radiation therapy (heat therapy) is a physical therapy intervention modality classified under thermotherapy which is used in the treatment of low back pain. Infrared (IRR) is the electromagnetic radiation with longer rays than visible light shorter rays than a microwave but lying within the electromagnetic spectrum. IRR rays gives rise to heat when absorbed by matter, between the wavelengths of 4×10^4 Hz and 7.5×10^4 Hz. The heat emitted from IRR has been shown to increase tissue extensibility, improves joint range of motion, decreases pain and enhance healing of soft tissue lesions (Lehman *et al.*, 1999; Waddell and Burton, 2001; Punnet *et al.*, 2005). These actions are mediated through its physiologic effects of heating which results in a general increase in cell activity and blood flow and a reduction in the level of pain and decrease in metabolites such as bradykinin and histamine (Lehman *et al.*, 1999).

Infrared radiation is produced in two forms as luminous and non-luminous radiations. To facilitate changes within the body tissues, absorption depends on the structure, type, vascularity and pigmentation of the body tissues. Energy penetration into a medium is dependent upon the intensity of the Infrared source. Maximal penetration occurs with wavelengths of 1.2mm, where the skin is usually opaque to wavelengths of 2mm and more (Moss *et al.*, 2015). In acute inflammatory conditions, the non-luminous generator may be used because of the sedative effect of the rays which may be effective in relieving pain, than the counterirritant effect produced by the shorter rays of the luminous generator which is more effective in lesions of a chronic nature (Moss *et al.*, 2015).

Different results from trials involving infrared radiation therapy have provided conflicting evidence on its efficacy and this has further been interpreted within the clinical guidelines as an ineffective intervention in the management of chronic low back pain (Berkely, 1997; Filligim 1999; Filligim and Edwards, 1999; Filligim *et al.*, 2009; Gallagher, 2012; Pool *et al.*, 2007). Nouredin *et al.* (2013) documents statistically significant evidence on the efficacy of infrared therapy on all outcome measures as pain intensity, functional disability and mobility. All the studies conducted to determine the efficacy of infrared therapy in chronic low back pain management have been carried out in Whites and Asian population. It is therefore important to determine its efficacy on pain management and functional disability among black African adults.

MATERIALS AND METHODS

Study design: In this present study a single group pre-test post-test pre experimental design was used to determine the effect of IRR on pain intensity in chronic low back pain

Study area: The study location was the physiotherapy department of the National Orthopaedic hospital, Enugu (NOHE), Nigeria. Enugu is the capital of Enugu state, located in South Eastern Nigeria.

Ethical clearance: This was obtained from the institution ethics review board, National Orthopaedic hospital, Enugu, Nigeria. Subjects were fully informed about the experimental procedures, risks, and protocol after which they gave their written informed consent. (IRB/IEC; S/313/853. Protocol number; 154).

Inclusion criteria: subjects who freely volunteered, with chronic low back pain ≥ 12 weeks of non-specific origin, of African (Nigerian) origin. Subjects on similar NSAIDs were also recruited.

Exclusion criteria: Subjects with low back pain of traumatic origin, pain ≤ 12 weeks, impaired sensory ability, of non-African origin, neurological and metabolic diseases, and those on other forms of Physiotherapy intervention and drugs outside NSAIDs.





Data collection Procedures:

Pre-treatment procedure: The subjects’ pain intensity level prior to intervention was assessed using the 10 point Numerical Pain Rating Scale.

Treatment procedure: Infrared therapy was applied to subjects’ low back region in prone lying, after being tested for thermal sensation using test tubes containing cold and warm water respectively. The patients’ low back region was cleaned using methylated spirit and cotton wool prior to IRR treatment. The group received only IRR for 30minutes, at a distance of 65cm, 3 times a week for six weeks, the group was on NSAIDS (diclofenac 50 to 200mg trice daily), as prescribed by the Orthopaedic surgeons. Avoidance on any strenuous exercise through the period of the treatment was advised.

Post-test procedure: post-tests pain assessment was also conducted using the Numerical Pain Rating Scale.

Statistical analysis: The data collected was analyzed using inferential statistics. Paired sample t-test was used to find the differences between pre and post treatment measurements of pain. . All statistics was performed using the statistical package for social sciences (SPSS; Version 20.0). The probability level for all the above tests was set at $p < 0.05$ level of significance.

RESULTS

The subjects’ age ranged between 24 and 65years. Mean age, height, body weight and pre pain score of the subjects were 33.86 ± 10.93 years, 1.57 ± 0.04 meters, 49.07 ± 9.83 kg, and 6.27 ± 1.29 respectively. Detailed physical characteristics of the subjects are depicted in table 1. The pretreatment and post treatment pain scores and standard deviation were 6.27 ± 1.29 and 4.93 ± 1.03 respectively. Table 2 shows the effect of infrared radiation therapy on chronic low back pain level. Table 3 shows the effect of gender on chronic low back pain before and after intervention. Figure 1 shows a graphical representation of the decrease of pain for each subject before and after treatment. There was a 21.37% decrease in pain at the end of the 6 weeks.

Table 1: Subjects’ physical characteristics(N = 15)

Variables	Mean \pm SD
Age (years)	33.86 ± 10.93
Height (meters)	1.57 ± 0.04
Weight (Kg)	49.07 ± 9.83
Pre pain score	6.27 ± 1.29

Table 2 Pre and post treatment mean, standard deviation and students t-test values (N=15)

Variables	Mean	SD	t-value	p-value
Pretreatment pain score	6.27	1.29	9.869	0.000
Post treatment pain score	4.93	1.03		

* Significant, $p < 0.05$





Table 3 Gender comparison for Pre-pain and Post pain scores

Variable	Mean ±SD	t-value	p-value
Pre-pain male	6.14±0.90	0.888	0.384
Pre-pain female	5.91±1.72		
Post-pain male	4.75±0.62	1.963	0.062
Post-pain female	3.95±1.35		

Significant, $p < 0.05$

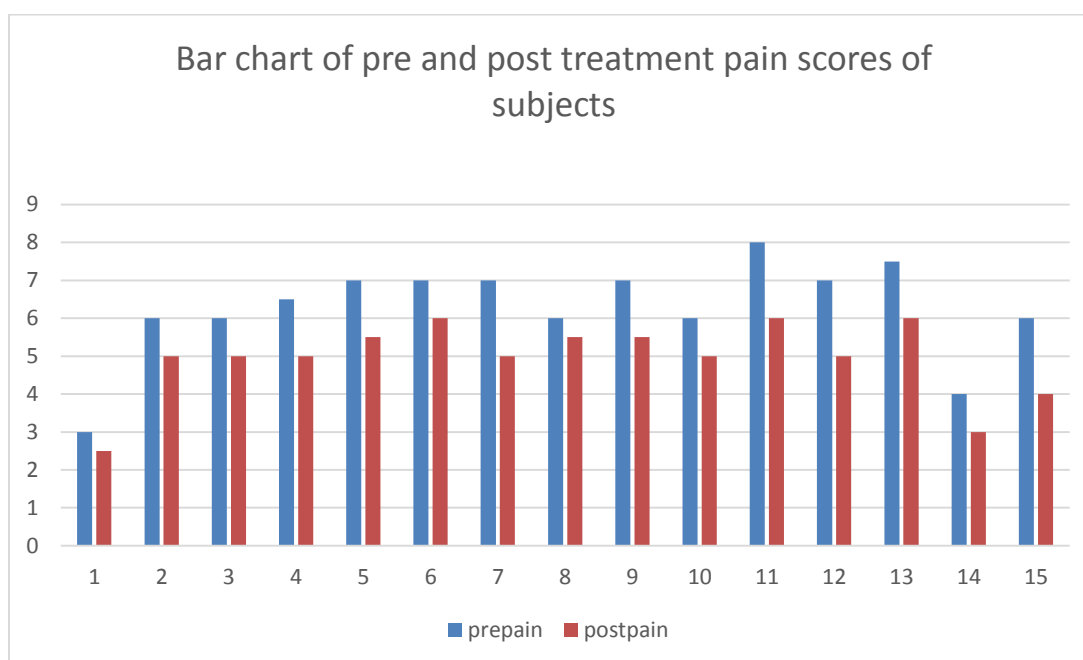


Figure 1 Bar chart of pre and post treatment pain scores of subjects

DISCUSSION

Efficacy of infrared radiation therapy on pain especially among black African subjects with chronic low back pain has not been fully investigated. There is a dearth of publications in this regard. 15 participated and completed this study, 8(53.3%) were males while 7(46.7%) were females with age ranged from 24 years and 65 years. Studies show that the working population within this age range are prone to low chronic low back pain.(Chen *et al.*,2013;Gale *et al.*,2006) The pretreatment pain was 6.17 which decreased to 4.27(21.37%) at the end of treatment showing that with the application of IRR, pain reduces. This is in line with clinical study by Gale *et al.*, (2006) on the effects of infrared therapy on chronic LBP in Ontario which showed mean pretreatment pain intensity was 6.9 and 3.0 at the end of 7weeks with a 50% decrease. The application of heat may alleviate pain through a number of physiologic mechanisms; this may include increase in blood flow locally, enhancement of mild inflammatory reaction mediated through the release of histamine and





prostaglandin, promoting vasodilatation, acting as a counter-irritant, and increasing small non myelinated C-fibre activity that inhibits the nociceptive signal within the spinal cord and brainstem thus blocking pain. Local heating has pain relieving effects and can increase elasticity of connective tissue and joint range (Nuhr *et al.*, 2004, Lehmann and Latuer, 1990). Similar findings were reported by Nouredin *et al.* (2013) who demonstrated that infrared therapy is significantly effective in the treatment of pain. The results were also partly supported by Nadler *et al.* (2002) who also found that IRR was effective in relieving pain, but claimed that it was more effective than NSAIDs in treatment of CLBP. In this current study, both IRR and NSAIDs had significant effects in pain reduction.

French *et al.* (2006), documented moderate evidence in the use of superficial heat using IRR as a pain relief modality in CLBP. Their findings agreed with the results of this study. Also similar studies by Chen *et al.* (2013) and Nuhr *et al.* (2004) supported the findings of this study. In contrast, Youssefi-Nooraie *et al.* (2008) concluded that infrared radiation therapy was of “no effect”.

Several studies show that gender plays a significant role in pain intensity, it has been documented that the female gender is more sensitive to pain, has a lower pain threshold and an increased ability to discriminate against pain stimuli, therefore the female gender may have a higher pain intensity than their male counterparts (Berkely (1997), Filligim (2005), Fillingim *et al.* (1999; 2009), Gallagher (2012), Pool *et al.*, 2007). However when pain scores were compared there was no significant effect between the males and females, within the male and female subjects there was a significant decrease in pain score after the treatment intervention

The beneficial effect of infrared radiation therapy on chronic low back pain as seen in this present study may be related to the hypothesized theory that infrared radiation therapy reduces pain intensity by, vascular changes in blood flow, reflex activity, possibly through the activation of pain gate theory, through reducing muscle spasm associated with it (Lehman and Latuer, 1982) and at cellular level through the increased production of ATP and some neurotransmitters such as bradykinin which lead to increase metabolism of proteins and nitric oxide causing an increase in blood flow and inhibiting inflammatory processes resulting in a decrease in pain and increase in soft tissue healing (Desmet *et al.*, 2006; Dungal *et al.*, 2014; Xavier *et al.*, 2010). Reasons for probable discrepancies between the present study and others may be as a result of variations in subject characteristics, length of study period and methodology.

CONCLUSION

From the findings of the present study it may be seen that 6 weeks of infrared radiation therapy will result in a decrease of pain intensity among subjects of black African descent with chronic low back pain of nonspecific origin.

CLINICAL SIGNIFICANCE

The continued use of infrared radiation therapy in physiotherapy practice is encouraged as it is seen to be effective in pain reduction. However further randomized controlled trial studies are being recommended with to remove any bias and conclusively determine the efficacy of this modality

LIMITATIONS

The sample size may have been too small and the convenience sampling technique utilized may give a bias and not be a true representation of the population. The effects of placebo IRR could not be carried out in this study, due to ethical reasons, considering that the study was long.

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AUTHORS' CONTRIBUTION:

Ogechukwu Ngozi Ojeniweh was involved with the study design, literature review and data collection. Charles Ikechukwu Ezema was responsible for data analysis, presentation and manuscript draft. Goddy Chuba Okoye edited the final draft of the research work.

