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Do the Health, Motion, Function, and Occupational Performance of Iranian Police Personnel Change with Hydrotherapy Exercises?

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Background: Work-related Musculoskeletal Disorders (WMSD) are a common health related problem throughout the world. The aim of this study was to evaluate the effect of hydrotherapy training on health, function, motion, and occupational performance of the police personnel in Iran.

Materials and Methods: In this before/after prospective study, 30 participants were selected purposefully and divided into two experimental (n = 15) and control groups (n = 15) randomly. The 8-week hydrotherapy training program was just assigned for the intervention group. The occupational performance and physical fitness tests, Health related Quality of Life (HRQOL) questionnaire and Visual Analog Scale (VAS) were measured for both groups before and after intervention. data were analyzed through SPSS 16.

Results: Totally 15 policemen with mean age of 36.7 ± 7.7 years participated in the intervention group and 15 policemen with mean age of 35.2 ± 7.8 years were assessed in the control group .After intervention the flexibility rate, muscle strength, pain intensity and HRQOL were improved significantly in intervention group ($P < .05$). However, no significant change was observed in control group ($P > .05$).

Conclusions: It can be concluded that hydrotherapy training program could be recommended for reducing (WMSD) and to improve muscle strength/flexibility, pain intensity and HRQOL among policemen in Iran.

Keywords: Work Musculoskeletal Disorders (WMSD), Hydrotherapy, Flexibility, Muscle strength, Health related Quality of Life

Introduction

In industrial developing countries, work-place injuries are very serious (Shahnavaz, 1987). Poor work situations and lack of attention to effective programs on occupational injuries prevention, increase musculoskeletal disorders rate in industrial developing countries (Jafry & O'Neill, 2000).

Work-related Musculoskeletal Disorders (WMSD) are considered as one of the main cause of health decreasing, disability, and absence from work problems allocating about one third of health care costs to itself (Bermander & Bergman, 2008), which in turn cause damage to body's systems such as muscles, joints, tendon, ligaments, nerves, bones, and blood circulatory system (European Agency for Safety and Health at work, 2008). These disorders involve a wide range of inflammatory and destructive disorders and diseases, causing pain and performance weakening (Buckle & Devereux, 2008). Some body's area like back, neck, shoulder, forearm, and hand are more prone to injury while in recent studies, lower limbs have been reported as to be more prone (Punnett & Wegman, 2004).

Risk factors of musculoskeletal disorders are consisted of occupational and non-occupational factors (David et al., 2008). Occupational risk factors include physical tasks execution with inappropriate body posture caused by occupational applied force, repeated movement, duty period and vibrations. Non-occupation or personal risk factors also include age, gender, muscle power, physical readiness, and psychological-social factors such as work pressure, the lake of social support, and the lack of job

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satisfaction (David et al., 2008). Among the aforementioned factors, inappropriate body posture is considered as the most important risk factor.

Musculoskeletal disorders have close relationship with body posture during working. Neck, back, shoulder, forearm, and knee are such areas and organs to which the most adverse effects resulted from inappropriate body postures are imposed. Working with inappropriate posture leads to pressure, fatigue, and pain so that the person needs to stop working and take rest (Haslegrave, 1994). In previous studies, researchers investigated such cases as the relationship between neck and long-time shoulder pain with body posture disorders (lordosis) and inappropriate posture during sitting, the relationship between spinal cord posture and long-time backache and increasing lordosis of back area, undesirable body posture and its relationship with psychological pressures and musculoskeletal disorders signs, the relationship between body postures during sitting and spine curvature, posture and backache, and usually pointed to the meaningful relationship between pain prevalence and inappropriate posture (Straker et al, 2009; Dankeraerts et al, 2006; Cho, 2008;).

For instance, Soderberg reported that work type and one's placement style during work have a direct effect on increasing and decreasing the kyphosis and lordosis arcs (Soderberg, 1998). Some studies also showed the effects of occupational factors on appearing posture disorders and also joint, muscles, and bone pains (Habibi, 1992; Golpayegani, 1992; Bergman, Carlsson & Wright, 1996).

Backache is considered as one of the most prevalent work-related health problems in economical developing countries (Jin & Sorock, 2004). More than 80% of people experience this pain at least one time during their life time (Omino & Hayashi, 1992). Training therapy widely is regarded as one of the appropriate interventions in treating backache (Hayden et al., 2006) and returning to work in occupational cares (Staal et al., 2005).

Training therapy is known much more than bed rest (Hagen et al, 2002). Countless studies showed the effect of training therapy on reducing backache, shoulder, and upper limb disorders (Kasai, 2006; Hayden et al, 2006; Staal et al, 2005).

Generally, physical activities and exercises are considered as one of the main primary cares methods in facing with musculoskeletal chronic pains. Water is sky manna that can be bath in it, can be freshen up, and even drink it. This material after the air constitutes the most important element of our life, but apart from the absolute fact that all of us cannot live without water, this elixir of life present to us lots of blessing.

Using water correctly not only maintains our health but also returns health to patients losing their health or having disorder by cleaning up the body (Abbasi et al., 2012). Taking warm shower is approximately natural after sport and match or after executing heavy daily tasks that all of the individuals do consciously or unconsciously (Pourreza & Khabiri neamati, 2006).

One of the common and useful water usages is hydrotherapy. Hydrotherapy means diseases treatment through water. Since hydrotherapy is remembered, both primary tribes and civilized nations have used water for treatment. Even in wild and pet animals, it was observed that when they become ill, they should drink water. In fact, human beings have realized the power of hydrotherapy in providing body and soul comfort for many years.

In the past, hydrotherapy was considered and used by Iranians, Japanese, Egyptian, and Greeks. Perhaps water is the easiest and the most convenient tool for people in order to deal with tiredness, boredom, and to achieve lull and convenience. Hydrotherapy is a popular method and unlike to many other methods not only resolve muscular tiredness but also bring happiness and satisfaction (Sowry et al, 2014).

Among the advantages of hydrotherapy, it should be noted that with recognizing and knowing water physiological and curative effects, it can be used easily and conveniently. Using water in therapeutic cases and resolving tiredness and achieving physical and spiritual relaxation has a long history equal to human being life.

Advantages and properties of hydrotherapy are numerous, including pain relief, creating lull, and in curative cases resolving tiredness, and achieving physical and spiritual relaxation.

Another hydrotherapy advantages include it's availability for all, being more inexpensive than other methods, easy measurement of water temperature, light body weigh in water and its popularity for all (Pourreza & Khabiri, 2006).

Various training can be done in hydrotherapy pools, which are more useful than other activities and have good results such as walking and running in water without the help of various tools. Forward and backward horizontal movements are very useful for arm and hip joint. Temperature and stream intensity of water in professional application of this method can be variable according to the curative purpose. Water temperature along with water stream

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can be effective on patients' muscular and physical relief. Warm water causes blood to reach to the damaged tissue.

Increase in blood stream provides needed oxygen and foodstuffs to tissues and removes cell's waste material. Water's heat reduces muscle spasms and causes pain relief and increases motion range. Cold water reduces blood stream, which is effective in reducing inflammation, muscle spasms and pain (Abbassi et al, 2012) Hydrotherapy advantages are as follow:

1) By increasing various body tissues temperature, metabolism rate or public tissues metabolism also increases. 2) High water temperature increases body's temperature and subsequently causes dilated arteries and capillaries. Also, arteries dilation can be resulted from increase in cell metabolism which need to additional oxygen and to remove the waste material resulted from metabolism. 3) Increase in body's temperature causes increase in cell metabolism. For compensation of this case, body increases tissue's bloodstream, and so bloodstream rate increases as a result of placing in warm water. 4) As a result of arteries dilation and increase in bloodstream rate, the rate of incoming blood to heart increases, and according to frank starling laws (the more incoming blood to heart, the more blood goes out), cardiac output rate and activity increases (Lin et al, 2006).

Besides positive effects on musculoskeletal system, hydrotherapy reduces pain feeling. With regard to the importance of correct posture in work activities, and its role as one of main risk factors of musculoskeletal disorders, the purpose of this research (study) was to evaluate the effect of hydrotherapy training on physical function, motion, and occupational performance of the police personnel in Iran.

Materials and Methods

The participants who were studied in this study were the fulltime policemen working 12 hours a day from 7 A.m. to 7 P.m. Furthermore, the participants were the individuals spending the majority of their time at the desk without any physical activities. Exclusion criteria were as follow: having current surgery, having any muscular and skeletal problem (like fracture), having no diagnosed pathology. Also, the individuals who were informed about their illness before performing research or according to their doctor's recommendation performed actions for their treatment were removed among the sample.

To assess the effect of hydrotherapy training on health, motion and occupational performance of these participants 30 policemen were selected purposefully and randomly divided into two experimental (n = 15) and control groups (n = 15). Before beginning the study, the study's purpose and procedures were described for the participants and consent form was signed by each participant.

In this study, due to common limitations to get policeman, simple non-random sampling method was used. Simple sampling is consisted of collecting information from society members who are easily available for providing information. This research was a prospective (in which researcher manipulate independent variable in order to investigate its effect on changing dependent variables) and applied based on the study's subjects and purpose. This study was based on pre-test/post-test method in which the participants were randomly assigned into experimental and control groups. Before performing hydrotherapy training (independent variable), dependent variables were measured through pre-test in both groups, then hydrotherapy training enforced on experimental group. Finally, dependent variables were investigated in both group. It should be noted that control group was consisted of the policemen who were asked not to participate to any sport program during research period except in daily activities.

Before beginning the research, all the participants signed a testimonial letter for attending in study's tests, and then during one session, the method of performing tests was described for them. For performing pretest, 24 hour before executing trainings, each subject's weight and height as well as the tests were measured. SF-36 questionnaire was used to evaluate the staffs' Health- related Quality of Life (HRQOL). Visual Analogue Scale (VAS) was also used to measure pain intensity among the participants.

With regards to the main principles of appropriate training in this field, special modified training program was adjusted and used after reviewing and approving by expert. Therefore, in experimental group, fifteen cases were involved in hydrotherapy program for 8 weeks (3 sessions per week that each session lasted for 60 minutes).

In this study, descriptive statistics were used for statistically describing variables. Paired sample t-test and independent two samples t-test were also used for information analysis. Statistical analysis was done with SPSS software version 16. Significance level was considered as $P < .05$.

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Results

Totally 15 policemen with mean age of 36.7 ± 7.7 years participated in intervention and 15 policemen with mean age of 35.2 ± 7.8 years in control group were assessed. The height and weight of participants in intervention group were 172.7 ± 4.8 cm and 74.8 ± 8.1 kg respectively. Also the height and weight of participants in control group were 170.36 ± 5.9 cm, and 73.91 ± 8.21kg respectively. Information related to the HRQOL of the samples in pre-test and post-test in both control and experimental groups are presented in Table 1.

Table 1. Health-related Quality of Life score in experimental and control groups.

Groups	Pre-test		Post-test	
	Mean	Criteria deviation	Mean	Criteria deviation
Experimental	58.2	14.86	80.1	16.29
Control	43.3	9.85	42.13	9.15

A significance difference was observed in HRQoL score of experimental group between pre-test (58.14 ± 14.86) and post-test (80.13 + 16.29), (t = 3.8684, $P \leq .05$).

In control group no significant difference was observed regarding HRQOL score. between pre-test (43.3 ± 9.85) and post-test (42.13 ± 9.15), (t = 0.849, $P \geq .05$). Totally, a significance difference was observed in life quality's scores between control and experimental groups in post-test ($P \leq .05$, t = 6.4).

Information related to the sample' flexibility in pre-test and post-test in two control and experimental groups is presented in Table 2.

Table 2. The comparison of pre-test and post-test's flexibility rate (score) in experimental and control groups.

	Pre-test		Post-test	
	Mean	Criteria deviation	Mean	Criteria deviation
Experimental	16.6	4.1.	22.7	5.4
Control	16.6	1.6	16.4	9.5

A significance difference was observed regarding the flexibility rate in experimental group between pre-test (16.6 ± 4.1) and post-test (22.7 ± 5.4) ($P \leq .05$, t = 2.2) so thatthe flexibility rates increased 36% after executing 8 week trainings. But no significance difference was observed regarding the flexibility rate in control group between pre-test (16.6 ± 1.6) and post-test (16.4 ± 9.5) (t = 0.037, $P \geq .05$). Totally, a significance difference was observed regarding flexibility rate between control group (16.4 ± 9.5) and experimental group (22.7 ± 5.4) after executing 8 weeks training (t = 4.517, $P \leq .05$).Information related to sample's muscle strength in pre-test and post-test in two control and experimental groups is presented in Table 3.

Table 3. The comparison of muscle strength between pre-test and post-test in experimental and control groups.

	Pre-test		Post-test	
	Mean	Criteria deviation	Mean	Criteria deviation
Experimental	11.5	7.4	17.7	6.1
Control	12.5	4.8	12.5	5.9

A significance difference was observed regarding the police personnel's muscle strength rate in experimental group between pre-test (11.5 ± 7.4) and post-test (17.7 ± 6.1), (t=-1.8, $P \leq .05$), so that muscle strength rate increased about 50% after executing 8-week intervention. However, no significance difference was observed in muscle strength rate of control group between pre-test (12.5 ± 4.8) and post-test (12.5 ± 5.9) (t = 0.047, $P \geq .05$). Totally, a significance difference was observed between the muscle strength rate of control group (12.5 ± 5.9) and experimental group (17.7 ± 6.1) after executing 8 -week trainings (t = 3.9, $P \leq .05$)Information related to sample's pain intensity in pre-test and post-test in two control and experimental groups is presented in Table 4**.**

Table 4. The comparison of pain intensity between pre-test and post-test in experimental and control groups (score).

	Pre-test		Post-test	
	Mean	Criteria deviation	Mean	Criteria deviation
Experimental	6.1	6.7	3.1	7.5
Control	6.1	5.3	6.1	3.3

A significant difference was observed regarding the police personnel's pain intensity rate in experimental group between pre-test (6.1 + 5.7) and post-test (3.1 ± 7.5) (t = 4.53, $P \leq .05$), so that pain intensity rate decreased about 42% after

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executing 8-week trainings, but no significance difference was observed in pain intensity rate of control group between pre-test (6.1 ± 5.3) and post-test (6.1 ± 3.3) (t = 1.4, $P \geq 0.05$). Totally, a significant difference was observed between personnel pain intensity rate of experimental group (3.1 ± 7.5) and control group (6.1 ± 3.3) after executing 8 -week training (t = 2.1, $P \leq .05$).

Discussion

The obtained results of this research showed that the quality of life, muscle flexibility, muscle strength, and pain related to the police personnel were significantly improved in hydrotherapy group compared to control group after 8 weeks of hydrotherapy training. Therefore, the findings of this research are in line with other researches' findings, including Behtash et al. (2006), Nicksepher et al. (2009), Karimi et al. (2009), Farahpour & Marvi Esfahani (2006) and Ezati (2012).

Chronic pains are considered as one of the most important medical complexities in the world, by which millions of people suffer annually without receiving any appropriate treatment. These pains are the most important cause of human's offense and disability. One of the points regarded by patient in using and selecting treatment modalities, is inexpensiveness along with more and faster effect in improving illness. Sport therapy has plenty effects such as bone health and strength, prevention from osteoporosis, increasing coordination and balance, maintaining mobility in the joint and soft tissue, increasing stamina and body's force, improving special tissue specially inter-vertebral disks and buoyancy, improving social relationship, increasing muscle strength, and decreasing pressure on inter-vertebral disks. Improvement in the above cases using sport is an indicative of the effect of exercise on health development. The effect of hydrotherapy mechanism on the quality of life is like such classes held in hot and intimate spaces without any concern for experimental group, in which the quality of life is improved.

The results of this research showed that 8 week training in water have a significant effect on the police personnel's flexibility rate. The obtained results of this research are in line with Glopayegani's findings (2006), with conducting a study in the field of training therapy effect on flexibility improvement rate in patient with back pain. Sokhanguee in a study conducted in 2007 on the effect of training therapy on flexibility showed that exercise therapy can improve flexibility. With regard to above results, it seems that training in water plays an important role in improving the flexibility rate of spine and hamstring muscles.

In fact, the effectiveness of training program in water is like exercise training in water, increasing semi-tedious muscles, semi-membrane, and two femoral head flexibility. Increase in flexibility of this group of muscles prevents from muscle stiffness and rigidity and finally increases anterior pelvic turning. This concern leads to decreased lumbar lordosis and natural range of executing motions (Golpayegani, 2007). The current study's results showed that hydrotherapy trainings increase the muscles strength of the police personnel of the Islamic republic of Iran. In another study by Metalle and colleague in 2005, investigating the effect of aerobic and coordinator trainings and their combination on spine flexor rate, it was shown that aerobic and coordinator trainings lead to flexor muscle improvement. With regards to the obtained results, it seems that training in water plays an important role in improving spine flexors.

Indeed, therapeutic training program increases flexor muscle endurance (strength) capacity by creating body's (trunk) stability, and through increasing fatigue threshold of body's muscles, improves pain and disability in performances of patient.

Moreover,, atrophy and body's (trunk's) muscle thinness in sufferer police personnel, compared with healthy persons, can be the reason for lower muscle strength in these people.

Spine muscles as holder of the muscles and body posture become more contracted, weak, and skinny. So these are factors which can be involved in fatigability and flexor muscles strength reduction, and subsequently, back pain and disability occurring in motor function (performance) of these people. The current study's results showed that hydrotherapy training decreased pain intensity in the police personnel of Islamic republic of Iran. In this regard, it can be concluded that long sitting behind desk (work-table) along with increasing curvatures, cause spine center to transform from near the middle to the back part of the vertebrae, and shocks papilla to be closed together, resulting in reduced size of duct and vent between vertebrae through which spinal nerves pass. One in water feels light tensile effect in spine and joints due to gravity force which is neutralized through water's buoyancy effect. At the result of this tension, inter-disk pressure reduces, spinal cord canal size increase and may create little space between joint surfaces.

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Following the muscle and skeletal contraction due to exercise in water, there is reflection and release in reply. The more powerful contraction, the more muscle released.

It seems that weight in water removes or significantly reduces muscle spasms. Many researchers have based the treatment foundation upon the prevention of or removing the incoming force on spinal cord and back in patients suffering from back pain; so the sport on land is known as harmful due to the increase in incoming forces on spinal cord, but by sport in water, one can control his weight and reduce incoming force on spinal cord. The research's results are consistent with Stone's findings in 2007. He showed that central stabilization training program decreases back pain rate. Also, this research's results are in line with Backer's findings in 2003. He believed that trainings which do not bear body weight are good options for decreasing function-motion disorders, and one can control his weight, if is placed inside water (Sedaghati, 2013).

Conclusion

It can be concluded that hydrotherapy training program could be recommended for reducing work-related musculoskeletal disorders and to improve muscle strength/flexibility, pain intensity and HRQOL among policemen.

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Conflict of Interest

There is no conflict of interest for this article.

Author contribution

NH: Study implementation, Data collection and analysis, writing the first draft of Paper.

NF: Study design and data analysis, editing and confirming the final draft of the paper.

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