ORIGINAL ARTICLE

Comparative Effects of Dynamic Stretching and Ice Bag Application on the Physical Performance in Recreational Basketball Players: A Randomized Crossover Study

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Abstract | Introduction | Methodology | Results | Conclusion | References | Citation | Tables / Figures

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Abstract

Introduction: Researchers found that cryotherapy at the ankle joint heightened adjacent muscle activity and reflex amplitude, which facilitated greater force production at the ankle complex. Furthermore, cryotherapy appears to increase musculoarticular stiffness, which has been associated with heightened muscular performance at a joint. **Aim and objective:** To examine the influence of dynamic stretching and IBA technique on the physical performance. **Methodology:** Total 20 healthy male basketball athletes encompassing two groups participated in the current study. The study consisted of two groups, Group A (ice bag application) and Group B (dynamic stretching). Cold compress was applied over the anterior thigh, posterior thigh, and calf. Subjects were assigned to Group A, and Group B, using Convenience sampling method. Each candidate performed the 5 minutes of jogging before taking intervention. All subjects performed three functional performance tests: Vertical Jump Test, Agility T-test & 20-meter sprint. Each participant attended an orientation session to become familiar with the testing procedures. Subjects were randomly assigned into two groups and exposed to a crossover study design. The experiment was performed on two separate occasions whereby one group received the dynamic stretching in the first session, while the other group uses the cryotherapy first. After 48 hours, (cooling session) on the next occasion, the groups were changed and the second group receives the cryotherapy, while the first group performs dynamic stretching. On both occasions, the dynamic stretching and cryotherapy interventions were the same. Between the sessions, the subjects will not allow to participate in any kind of vigorous physical activity. **Results:** The present study showed an increase in performance of recreational Basketball players by the combination of 5 minutes of warm up plus 6 min of dynamic stretching on the vertical jump height and 20-meter sprint.

Keywords

Physiotherapy; Dynamic Stretching; Vertical Jump Height

Introduction

Basketball is a multifaceted team sport that requires well-developed physical fitness. Many authors have suggested that strength, power, agility, and speed are important characteristics for elite basketball players. Consequently, anaerobic testing has been considered more important than aerobic assessment in evaluating fitness to play basketball.(1) Agility has been considered a physiological prerequisite in basketball because players are frequently involved in a variety of sudden directional changes during the game. Agility performance is determined by the speed in changing direction and has been reported to be influenced by explosive strength, balance, muscular coordination, and flexibility.(2)

Cryotherapy is a commonly used modality in sports medicine and rehabilitation. A typical clinical aim is to elicit an analgesic response in patients suffering from acute or persistent pain associated with musculoskeletal injury. This is achieved by decreasing nociceptor afferent nerve conduction velocity, which is proposed to be correlated with depth of cold penetration. Furthermore, cryotherapy depresses the excitability of free nerve endings and peripheral nerve fibers, which raises an individual's pain threshold and contributes to analgesia.(3)

An appraisal of the recent related literature revealed that cold water immersion of the foot and ankle complex yields the greatest decreases in skin temperature and sensory nerve conduction velocity and increase in motor nerve conduction velocity compared with an ice bag and ice massage. It is well known that neuromuscular function is temperature sensitive. Changing of muscle temperature can affect voluntary muscle contraction.

Researchers found that cryotherapy at the ankle joint heightened adjacent muscle activity and reflex amplitude, which facilitated greater force production at the ankle complex. Furthermore, cryotherapy appears to increase musculoarticular stiffness, which has been associated with heightened muscular performance at a joint. The results suggest that the use of 15 minutes cold pack over the arm can significantly increase muscle force, however, the use of hot pack had no change in force output. The results of a study support the use of joint cryotherapy immediately before activity.(4)

Rationale of the study: Although, various research has proved that increase in the physical performance of athletes via dynamic stretching and IBA in separate studies. However, there is lack of literature to study the comparative effects of stretching and IBA in basketball players.

Our null hypothesis was- there is no significant difference between pre and post intervention measures in both groups upon components of physical performance and our alternative hypothesis was there significant difference between pre and post intervention measures in both groups upon components of physical performance.

Aim & Objective

To examine the influence of dynamic stretching and IBA technique on the physical performance.

Material & Methods

Total 20 healthy male basketball athletes encompassing two groups participated in the current study. Before participating in the study, all subjects signed an informed consent form approved by the human subjects committee of JamiaMilliaIslamia University, New Delhi. The study consisted of two groups, Group A (ice bag application) and Group B (dynamic stretching). Cold compress was applied over the anterior thigh, posterior thigh, and calf. Subjects were assigned to Group A, and Group B, using Convenience sampling method. Male collegiate athletes without any lower limb injury recreationally participating in collegiate field- based team sport specifically basketball. The number of subjects were determined using Software G. Power 3.15 using data of changes in vertical jump height from a previous study, in which effect of dynamic and static stretching on vertical jump performance was examined and 13 subjects were shown to be necessary based on the effect size of 2.38, alpha level of 0.05 and power (1-beta) of 0.95.But we will take the sample size 20 for increasing the power.

We included the study subjects who were between 18-24 years of age, males, not having congenital/acquired deformity, had not experienced knee surgery or debilitating knee injuries in past, who reported no hypersensitivity to cold, voluntarily be ready to participate in the study, not sustained an injury to the lower extremity within the past 6 months and those recreationally participate in the basketball game.

We excluded who had involved in resistance training for at least 3 months prior to this investigation, using steroids, protein supplement or ergogenic aids and don't had chronic diseases like diabetes and hypertension. It was a pre-test- post-test experimental crossover design. Our dependent variables were-20 Meter Sprint Agility, T test, Vertical jump height and independent variables were 06-minute dynamic stretching, 05-minute ice bag application Various instruments were used in data collection of study includeField measuring tape, Digital (Racer) stopwatch, Field cone, Stadiometer, Weight machine, Inkpad& chart papers, Markers, Inch tape, Towels and Crushed Ice Bags. The study was approved by Institutional Review Board, and subjects gave their informed consent. Subjects wear T-shirts, short pants, socks, and sports shoes. Each candidate performed the 5 minutes of jogging before taking intervention. All subjects performed three functional performance tests: Vertical Jump Test, Agility T-test & 20-meter sprint. Each participant attended an orientation session to become familiar with the testing procedures. Measurements of height, weight and history will take during the orientation session. Subjects were randomly assigned into two groups and exposed to a crossover study design. The experiment was performed on two separate occasions whereby one group received the dynamic stretching in the first session, while the other group uses the cryotherapy first. After 48 hours, (cooling session) on the next occasion, the groups were changed and the second group receives the cryotherapy, while the first group performs dynamic stretching. On both occasions, the dynamic stretching and cryotherapy interventions were the same. Between the sessions, the subjects will not allow to participate in any kind of vigorous physical activity.

The subjects performed 3 practice trials of each of the 3 functional tests to ensure proper technique. Before and after each stretching and Cryotherapy protocol,

participants performed 3 trials of Vertical Jump Test, 20-meter sprint test and Agility T-test. Three functional test trials were performed with 15 second rest interval between each trial. There was a one-minute period before the subject performed the test. The time of stretching will measure by a handheld stopwatch. The order in which the muscle groups stretched was randomized.

Dynamic stretching exercises: Immediately after the warm-up, each participant assumed a standing upright position and began to perform the DS exercises under the verbal guidance of the experimenter. The exercises were demonstrated to the participants, who received verbal feedback while performing each DS. The exercises were performed in the order for 06 minutes. The dynamic stretching exercises were performed from low to high intensity, with a 15-s rest period between each set of exercises. We were involved the three groups of muscle in our study i.e. hamstring, quadriceps and calve muscles. Each group of muscle was dynamically stretch for one minute bilaterally so two minutes for every group totally 6 minutes protocol.

Ice bag application: - Each ice bag comprised 3 lb (1.36 kg) of crushed ice in a 1-gal (3.79-L) plastic bag 20 Subjects were in high sitting position and the ice bag was applied on anterior thigh, posterior thigh and on the calve for 05 minutes.

Criterion Measure

Vertical Jump Height: The VJ is the most common jump test reported in scientific studies on basketball, and it was previously used in the comparison of anaerobic fitness according to playing position (Hoare; 2000 &LaMonte; 1999). Prior to and following each condition, participants performed three maximal countermovement VJ attempts with a 15 second rest period between attempts. To complete the VJ trials, the participants stand on the ground, feet shoulder width apart and their hands on their hips. A rapid descending squat movement was allowed prior to the rapid ascending jump, with no step taken. Participants jump with both feet at the same time and landed in the same position. The highest VJ height (cm) of the three trials will use as the representative VJ value (Ryan et al; 2013).

Speed: A 20-m sprint, starting in a stationary position, was performed on the basketball court or other ground and time will record by stopwatch, two volunteers placed at the start and finish line. Subjects will allow 3 trials, and the best performance was recorded. This distance had been chosen because it is slightly shorter than the length of a basketball court. The 20-m sprint test has demonstrated high levels of reliability in physically active men (correlation coefficient of 0.91 between test and retest) and does not need any practice session beforehand (Moir et al; 2004). Performance of this test was also significantly correlated to playing time in NCAA Division I male basketball players (r = 20.62) (Hoffman; 1996).

a) Starting position for sprint

b) 20-meter Sprint test

Agility: Agility T-Test widely used by coaches and scientists; the agility T-test is an appropriate agility test for basketball because it uses most of the basic movements performed during a game. Indeed, the subjects were asked to sprint from a standing point in a straight line to a cone placed 9 m away. Then they had to side shuffle to their left without crossing their feet to another cone placed 4.5 m away. After touching this cone, they side shuffled to their right to a third cone placed 9 m away, side shuffled back to the middle cone, and ran backward to where they had started. The fastest of 3 attempts was recorded.(5) Participants will randomly assign to two experimental groups using a simple randomization method: -Group A: - DS: 05 minutes of active warm-up or jogging at self-selected speed followed by 6 minutes of dynamic stretching.Group B: - IBA: 5 minutes Ice Bag Application only.Data were analyzed using SPSS 21.0 version. Shapiro-Wilk was used to assess for normality of scores and distribution of all variables was found to be normal. The subjects were given both interventions in different order after washout period of 48 hours. Group 1 received Ice Bag Application followed by Dynamic Stretching and group 2 received Dynamic Stretching followed by Ice Bag Application. Baseline scores between the 2 groups were compared using independent t-test. Effect of each intervention was assessed using paired t-test. Difference between the 2 interventions was assessed using independent t-test. Further independent t-test was used to compare the order of interventions. Level of significance was set as $p < 0.05$.

Results

Twenty subjects were included in this study to compare the effects of dynamic stretching and ice bag application on physical performance in recreational basketball players. The subjects randomly were divided into two groups, group 01 (n=10) and group 02 (n=10). Mean+SD of age, weight, height, and BMI of the subjects were 20.60 ±2.13 years, 62.0 ±8.03 kg,175.80 ±6.04 cm and 20.06 ±2.13 kg/m2 respectively. Comparison of baseline criterion measurement between the Ice Bag Application and Dynamic Stretching group were done using independent t-test to prove the homogeneity between the groups. (Table-1) No significant difference in Vertical jump, Agility T-test and 20-meter Sprint was found between the groups.

Paired t test was used to compare the physical performance variables at the baseline and Post-test measures after dynamic stretching. There was a significant difference in the vertical jump and 20-meter sprint scores as shown in Table2.

Paired t test was used to compare the physical performance variables at the baseline and Post-test measures after Ice Bag Application. There was a significant

difference in the vertical jump as shown in Table 3. & Table 4

Table 5 Independent T test I used to compare the effect of order of interventions on criterion measures. Group order effect that has been found to be insignificant in terms of these three variables.

Vertical Jump: Independent t-test displayed no significance difference for the baseline values of vertical jump between the groups receiving IBA and DS at t (38) = -1.8, p= 0.079. Paired t-test used to assess the effect of each intervention showed significance difference in vertical jump scores following Dynamic Stretching at t (19) = -4.73, p<0.01, as well as application of Ice Bag at t (19) = -4.55, p< 0.001.

Agility T-Test: Independent t-test displayed no significance difference for the baseline values of Agility t-test between the groups receiving IBA and DS at t (38) = .64, p= 0.52. Paired t-test used to assess the effect of each intervention showed no significance difference in Agility t-test scores following Dynamic Stretching at t (19) = 0.16, p<0.001, as well as application of Ice Bag Application at t (19) = -0.22, p< 0.001.

20 Meter Sprint: Independent t-test displayed no significance difference for the baseline values of 20-meter sprint between the groups receiving IBA and DS at t (38) = -1.27, p= 0.21. Paired t-test used to assess the effect of each intervention showed significance difference in 20-meter sprint scores following Dynamic Stretching at t (19) =0.18, p<0.001 and shown no significance difference after application of Ice Bag at t (19) = -0.38, p< 0.001.

Discussion

The present study is the only research to the investigator's knowledge that examined the comparative effects of dynamic stretching and Ice Bag Application on the physical performance of young recreational basketball players. Other researchers have completed many studies on dynamic stretching and ice bag application; but all studies are separately shows the effect of dynamic stretching and ice bag application. Few studies are done till now which compare the effect of these techniques. However, they usually used dynamic stretching as a warm-up protocol prior to the events. The purpose of this investigation was to find the comparative effects of the dynamic stretching and ice bag application on physical performance in recreational basketball players.

Independent t-test was used to assess the baseline data of all the variables and pre post intervention scores were analysed with the help of the paired t-test. There was no significance difference in the scores of all three variables between IBA and DS groups at the baseline level and after interventions. Vertical jump performance was elevated after DS as well as IBA and significance difference was seen. Agility t-test results shown decreased performance after DS but increased performance after IBA, but results was not significant. 20-meter sprint test findings demonstrate the increased scores in DS group with significance difference in the values and decreased test results scores after IBA.And during the results of the analysis of this study no significant difference was found in the scores of all assessed variables between the group orders. Thus, group orders have no effects upon the results of the study.

The decrease in performance with the use of static passive stretching provides supporting evidence for a number of studies. One study suggest that static stretching (active or passive) has a negative effect on 20m running time.(6) The significantly poorer jump and sprint performances after the static stretching warm-up compared to the dynamic warm-up support evidence from the numerous studies that have shown better performance on tests of muscle strength and power after a dynamic warm-up routine.(6)However, it is difficult to elucidate whether the differences in performance following static stretching and the dynamic warm-up were solely due to the stretching intervention, as it is possible that muscle temperature had a confounding effect on the results. That is, it is likely that the dynamic warm-up elevated muscle temperature significantly more than the static stretching protocol, which has been shown to encourage more rapid and forceful muscle contractions.(7)

In previous research it has been recommended to use dynamic stretching as the primary method of stretching pre-event warm-up before high speed, and power activities. The findings of this study agree with that recommendation for agility activities as well. This study supported the use of dynamic stretching in eliciting the greatest performance in agility movements by decreased T-Drill time. The findings of the current study are consistent with those of who determined that dynamic stretching elicits the best performance in power and high-speed activities.(8)

Warm-ups, which utilize dynamic stretching, help to elicit the greatest performance in speed, power, and agility. Static stretching is shown to have a negative effect on agility performance. When dynamic stretching is combined with static stretching it was determined that static, stretching after dynamic stretching dilutes the effectiveness of the dynamic stretching. These finding are consistent with the researchers who found static stretching diluted the effectiveness of the general warm-up in jump performance.(9)

Most of the effects of warm up have been attributed to temperature-related and non-temperature- related physiological mechanisms. However psychological mechanisms have also been proposed (e.g. increased preparedness). Non-temperature-related and psychological mechanism is common for both the groups, but temperature related mechanism varies from group to group due to different warm-up protocols. Proposed temperature related mechanisms include decreased stiffness, increased nerve conduction rate, altered force-

velocity relationship, increased anaerobic energy provision, and increased thermoregulatory strain.

Increase in temperature has the potential to improve performance especially strength and power related tasks. There was more increase in anterior thigh muscle temperature after active warm-up than ice pack with active warm-up.So increase in muscle temperature may affect the performance via decrease in the viscous resistance of muscle. Mild warming has also been reported to reduce the passive resistance of the human metacarpal joint by 20%. It has also been suggested that performance changes following warm up may result from increased oxygen delivery to the muscles via a right ward shift in the oxyhemoglobin dissociation curve and vasodilatation of muscle blood vessel. Furthermore, an elevated temperature also stimulates vasodilatation of blood vessels and increases muscle blood flow. An increase in muscle temperature may also contribute to improved performance by augmenting the function of the nervous system. Researchers has demonstrated that increased temperature improves central nervous system function and increases the transmission speed of nervous impulses.(10)The method of pre cooling determined the extent to which heat strain was reduced during intermittent sprint cycling, with leg pre cooling offering the greater ergogenic effect on PPO than either upper body or whole-body cooling.(11) It was also evident that there is a gradual performance increase for each measure of functional performance across time after cold whirlpool. The ergogenic benefits of effective pre-cooling procedures in warm conditions for team-sports may be predominantly evident during sub- maximal bouts of exercise.(12)The study establishes the effect of Dynamic Warm Up and Ice Bag Application on the physical performance of recreational Basketball players aged 18-26. Dynamic Stretching has improved the vertical jump height and 20-meter sprint performance. But after Ice Bag Application only the performance of vertical jump was increased. It is possible that dynamic stretching can be used to increase the physical performance of any player.

Conclusion

The present study showed an increase in performance of recreational Basketball players by the combination of 5 minutes of warm up plus 6 min of dynamic stretching on the vertical jump height and 20-meter sprint.

Limitation of the study

Small sample size is the limitation of our study.

Authors Contribution

All authors contributed equally.

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References

1. Behm DG, Chaouachi A. A review of the acute effects of static and dynamic stretching on performance. Eur J Appl Physiol. 2011;111(11):2633–51.
2. Taylor KL, Sheppard JM, Lee H, Plummer N. Negative effect of static stretching restored when combined with a sport specific warm-up component. J Sci Med Sport. 2009;12(6):657–61.
3. Swenson C, Swärd L, Karlsson J. Cryotherapy in sports medicine. Scand J Med Sci Sports. 1996;6(4):193–200.
4. Beauregard TA, Vaile J, Whitney L, Merrick M, Moody V. Rapid Facial Cryotherapy for Combat Sports: A Comparison of Materials and Methods for Cooling Facial Tissues in 60 Seconds or Less. J Sport Rehabil. 2020;30(2):177–81.
5. Calleja-González J, Terrados N, Mielgo-Ayuso J, Delextrat A, Jukic I, Vaquera A, et al. Evidence-based post-exercise recovery strategies in basketball. PhysSportsmed. 2016;44(1):74–8.
6. Fletcher IM, Jones B. The effect of different warm-up stretch protocols on 20 meter sprint performance in trained rugby union players. J Strength Cond Res. 2004;18(4):885–8.
7. Brun-Cottan N, McMillian D, Hastings J. Defending the art of physical therapy: Expanding inquiry and crafting culture in support of therapeutic alliance. Physiother Theory Pract. 2020;36(6):669–78.
8. Williams S, Whatman C, Hume PA, Sheerin K. Kinesio taping in treatment and prevention of sports injuries: a meta-analysis of the evidence for its effectiveness. Sports Med. 2012;42(2):153–64.
9. Makhlouf I, Chaouachi A, Chaouachi M, Ben Othman A, Granacher U, Behm DG. Combination of Agility and Plyometric Training Provides Similar Training Benefits as Combined Balance and Plyometric Training in Young Soccer Players. Front Physiol. 2018;9:1611.
10. Anderson E, Shivakumar G. Effects of Exercise and Physical Activity on Anxiety. Front Psychiatry [Internet]. 2013 Apr 23 [cited 2021 May 16];4. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3632802/
11. Périard JD, Houtkamp D, Bright F, Daanen H a. M, Abbiss CR, Thompson KG, et al. Hyperoxia enhances self-paced exercise performance to a greater extent in cool than hot conditions. Exp Physiol. 2019;104(9):1398–407.
12. Peiffer JJ, Abbiss CR. Influence of environmental temperature on 40 km cycling time-trial performance. Int J Sports Physiol Perform. 2011;6(2):208–20.

Tables

TABLE1 COMPARISON OF BASELINE VARIABLES BETWEEN IBA AND DS GROUPS

Variables	IBA Mean(SD)n =20	DS Mean(SD)n =20	*t*-value	Independent-test (*p*-value)
VJH(inch)	16.71(2.20)	18.04(2.44)	1.80	**.079**
T-test(sec)	11.73(.49)	11.62(.62)	.644	**.523**
20msprint(sec)	3.28(.31)	3.39(.25)	1.273	**.211**

VJH- vertical jump height, T-test- agility t-test, 20m- 20 Meter sprint, IBA- Ice Bag Application, DS-DynamicStretching,SD- Standard Deviation, Level of significance (p< 0.05)

TABLE 2 COMPARISON OF VARIABLES WITHIN DYNAMIC STRETCHING GROUP WITH THE PAIRED T-TEST:-

Variables	Premean(SD) n =20	Postmean(SD) n =20	*t*-value	*p*-value
VerticalJump(inch)	18.04(2.44)	18.35(2.40)	-4.730	**<.001***
AgilityT-Test(sec)	11.62(.62)	11.65(.79)	0.160	**.745**
20meterDash(sec)	3.39(.25)	3.29(.29)	0.188	**0.017***

SD-Standard Deviation, p< 0.05,=significance difference*

TABLE 3 COMPARISON OF VARIABLES WITHIN ICE BAG APPLICATION GROUP WITH THE HELP OF PAIRED T-TEST

Variables	Premean(SD)	Postmean(SD)	*t*-value	*p*-value
VerticalJump(inch)	16.71(2.20)	17.27(2.21)	4.55	**<0.001***
AgilityT-Test(sec)	11.73(.49)	11.71(.86)	.228	**.900**
20meterDash(sec)	**3.28(.31)**	**3.29(.32)**	**.388**	**.778**

TABLE4 COMPARISON OF THE POST INTERVENTION VARIABLES BETWEEN IBA AND DS GROUPS WITH THE HELP OF INDEPENDENT T-TEST

Variables	IBA Mean(SD)n =20	DS Mean(SD)n =20	*t*-value	Independent t-test(*p*-value)
VJH(inch)	17.27(2.21)	18.35(2.36)	1.49	**.724**
T-test(sec)	11.71(.86)	11.65(.79)	.247	**.262**
20mSprint(sec)	3.29(.31)	3.29(.29)	.051	**.097**

IBA-icebagapplication,DS-dynamicstretching,VJH-verticaljumpheight,T-test-Agilityt test,20m-20meter sprint.

TABLE5 COMPARING THE ORDER OF INTERVENTIONS

Variables	GpOr01 Mean(SD)	GpOr02 Mean(SD)	*t*-value	Independent t-test(*p*-value)
VJH(inch)	17.68(2.29)	17.94(2.40)	.349	**.729**
T-test(sec)	11.76(.89)	11.60(.75)	.592	**.557**
20mSprint(sec)	3.37(.32)	3.21(.26)	1.756	**.087**

VJH- vertical jump height, T-test- Agility T-test, SD- standard deviation, Gp Or- Group Order,GroupOrder01 = IBA –DS, GroupOrder02 =DS–IBA.