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Uphill and Aquatic Training Improves Agility and Speed Among Normal Healthy Individuals

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Agility and speed are two most important skills for an athlete and non-athlete. Aquatic and uphill training environment provides enough resistance to improve both skills.
This article aimed to determine the effectiveness of uphill and aquatic training in improving the agility and speed of normal individuals. Healthy male living in Oslob, Cebu completed a pre and post- test measurement using Illinois Agility Test and 30m sprint. Participants were given different types of agility and speed training exercises in their respective training environment. Results showed that the mean difference between pretest and posttest speed for the control group control (M=3.74, SD=0.05), aquatic group (M=3.69, SD=0.05), and uphill group (M=3.80, SD=0.05). Mean difference between pretest and posttest in agility for the control (M=17.56,SD=0.36), aquatic (M=17.24, SD=0.36), and uphill (17.72, SD=0.36). Results showed that both uphill and aquatic training improves speed and agility. Although uphill training showed more improvements in both agility and speed.

Keywords: Illinois Agility Test, 30 meter sprint, aquatic group, uphill group

Introduction

Most of the common sports like basketball, volleyball, soccer, etc. require different skills a player should have. Among these skills are agility and speed. Everytime an individual's body moves as fast as possible, these two skills are involved [5]. These two skills are important factors in the success of every athlete. Studies showed that decreased speed and poor agility can also lead to injuries. Agility and speed are major factors in preventing injuries among athletes [17,4]. Although agility and speed are more common essential for athletes, normal healthy individuals without being part of any professional sports still use these two skills in their daily activities.

Agility is commonly defined as to change in direction quickly. This can acquire many ways, from uncomplicated footwork to shifting the body in different directions while running at high speed [7]. We can say that speed is an element of agility. Speed is not the only component of agility, it also includes balance, coordination and the ability to react to a change of movement [15]. Although agility is commonly described as the ability to shift direction, it is also responsible for initiating and stopping the movement quickly. Aside from the different skills required in sports, agility is the principal determining factor of success. Agility can also be essential for daily activities. This skill is useful in individual's coordination and can also help avoid injury. In 2017, less agile rugby players have increased risk in having injury during game and practice [3].

Speed is the shortest time required for objects to move along a fixed distance. Speed is an important ability of an individual to move as rapidly as possible over a set distance. Speed is divided into different phases: acceleration, maintenance of maximum speed and deceleration [3]. Speed is important especially for athletes but it can also be essential for normal people. In 2019, study shows that decreased speed in the military and civilian population has a moderate risk of musculoskeletal injury [12]. In today's generation, it is really hard for people to commute with the heavy traffic taking place, most people walk going to schools or offices without being late, improving individuals speed could help with these challenges.

Uphill training offers a viable training prescription to elicit training without needing any specialized equipment [9]. However, this type of training is not always possible to complete outside because of the weather or if the inclination is not suitable to give enough resistance. This training is effective in terms of exercise programs and athletic training. Long distance runners at Pudukkottai District showed significant improvements on speed endurance and cardiovascular endurance after six weeks of uphill training [20]. A study by Barnes showed an improvement on runner's speed, cardiovascular endurance and speed endurance after a different high interval uphill training [2]. A study conducted in 2018 compared the effects of uphill sprint training and sprint interval training . The study involves seventeen healthy men that train on an uphill with 10% inclination and a cycle ergometer with specific resistance. The study concludes that uphill sprint training is more effective than the sprint interval training in improving cardiopulmonary capacity of healthy individuals [9]. Parallel to that, a study conducted in 2016 about four weeks of high interval uphill training can improve speed performance and specific abilities among hockey players [8]. Uphill training was also combined with downhill training in which the study showed that training in sloping surfaces improves running speed compared to horizontal training [14]. Uphill sprint training improves not just the speed and agility among athletes, these specific training involves strengthening, improving the muscles action and joints proprioception. These training involves other abilities such as power, balance, and endurance. This is supported by the study of Kavaliauskas in which uphill training improves not just the speed and agility of soccer players. Running distance, strength and cardiopulmonary endurance also showed significant increase [10].

Aquatic training is a trend in improving an athlete's abilities. Water offers a unique training medium in which it reduces the load on an athletes joint, while water itself creates resistance to movement [16]. Aquatic training is effective for many aspects of an athlete's exercises and conditioning programs. Hoogenboom stated that aquatic training is essential because of its physical properties, one important property is buoyancy. Buoyancy is defined as the upward thrust acting on any partially or fully immersed object in the opposite direction of gravity. Aquatic training gives resistance to an individual's movement with its properties [6]. A study conducted in 2019 aquatic exercises showed improvements in walking speed and balance among post stroke individuals. A study concluded that water based exercises are prescribed as alternative interventions and said the modifying exercise environment will still be based on an individual's preference [13]. A study showed improvements on lower extremity strength and gait speed on elderly men after aquatic and non aquatic exercises. Aquatic training gives benefits in improving an athlete's physical fitness and makes an athlete's post game and post training recovery. Sadeghi conducted a study which concluded that water is a good environment for different types of training, especially plyometric training [18]. Arazi et al, 2011 concluded that aquatic training improves strength, agility and speed among basketball players but land training has significant

improvements on the skills for a basketball player. A significant difference in the improvements on the balance between the aquatic group and land group. The study concluded that aquatic training has less improvements on balance since an aquatic setting can reduce weight bearing stress on the legs in which it reduces the impact on the joints, hence proprioceptive function cannot be used properly [1].

Method

The study first determines the pre assessment measurement of agility using Illinois Agility Test and speed using 30m sprint test. As physical therapy students, concepts and ideas learned from school, data from previous studies and advice from registered Physical Therapists were utilized to be able to create an exercise program. Individuals participated in the program conducted in Oslob, Cebu with the consent of each participant and the barangay captain. This study aims to differentiate the effectiveness of aquatic training and uphill training on the agility and speed of normal individuals. Specifically, this study aimed to:

1. Compile studies that prove the importance of agility and speed.
2. Collect data on speed and agility among normal individuals using Illinois Agility Test and 30 meter sprint.
3. Implement a training program that will be applied to the subjects in the study.
4. Determine the difference between agility and speed prior to and after the intervention

Participants

All participants of the study were normal healthy individuals that live in Oslob, Cebu.

Inclusion Criteria

All participants should be a male ages between 20 to 28 years old that live in Oslob, Cebu.

Exclusion criteria

Participants that have a previous or current injury, are overweight and have cardiovascular problems.

Measures

Assessment Tool. Illinois Agility Test was used to measure agility and 30 meter sprint was used to measure speed.

Procedures

Respondents were gathered at Purok Center of Purok 3, Gawi, Oslob, Cebu. The researcher gave each participant a consent to formally ask the participant's 28 permission. Participants were divided into Aquatic group, Uphill group and a control group. All the participants performed the Illinois Agility test and 30 meter sprint before the intervention. The researcher and the participants went to the training area and performed the intervention. All the participants performed the intervention twice a week for one hour each training for six weeks. Participants performed the Illinois Test and 30 meter sprint 1 week after the training program.

Analytical Approach

The researcher used convenience sampling and number of participants were computed using G power considering the participants live on Purok 3, Gawi, Oslob, Cebu. F test was used in the study and ANOVA repeated measures between factors was used as the statistical test. The researcher used 0.05 as the alpha error probability and 0.90 as the standard power probability. Effect size was determined based on the related previous study. The total sample size of this study is 21. The researcher used non-probabilistic design specifically convenience sampling in which respondents selected meet the criteria of the study. The data gathered were encoded in microsoft excel and was put on the table named, pretest agility, post test agility, pretest speed time and post test speed time for the aquatic , uphill and control group. Pretest and post test mean was computed and analyzed.

Ethical Considerations

This research project subscribes to the ethical principles of the conduct of research involving human subjects mandated by the Philippine Health Research Ethics Board and relevant national and international organizations. It was approved by the Southwestern University PHINMA Research IntegrityBoard on December 7, 2019.Informed Consent Forms were provided, verbally explained, and signed by the respondents prior to the start of involvement in the study.

Results

Aquatic Group	Pre test Speed Mean (Secs)	Post Test Speed Mean (Secs)	Pre Test Agility Mean (Secs)	Post Test Agility Mean (Secs)
Aquatic 1	3.87	3.77	18.44	18.35
Aquatic 2	3.78	3.69	17.52	17.51
Aquatic 3	3.72	3.67	18.88	18.43
Aquatic 4	4.01	3.89	17.44	17.32
Aquatic 5	3.92	3.9	17.42	17.4
Aquatic 6	3.88	3.86	17.37	17.35
Aquatic 7	3.9	3.79	18.56	17.69
	3.87	**3.80**	**17.95**	**17.72**

Uphill Group	Pre test Speed Mean (Secs)	Post Test Speed Mean (Secs)	Pre Test Agility Mean (Secs)	Post Test Agility Mean (Secs)
Uphill 1	3.92	3.82	18.48	18.45
Uphill 2	3.68	3.54	16.01	15.87
Uphill 3	3.79	3.64	16.6	15.96
Uphill 4	3.82	3.77	17.82	17.44
Uphill 5	3.74	3.52	16.62	16.04
Uphill 6	3.91	3.76	18.8	18.17
Uphill 7	3.86	3.81	19.37	18.72
	3.82	**3.69**	**17.67**	**17.24**

Control Group	Pre test Speed Mean (Secs)	Post Test Speed Mean (Secs)	Pre Test Agility Mean (Secs)	Post Test Agility Mean (Secs)
Control 1	3.82	3.8	16.76	16.74
Control 2	3.78	3.72	16.81	16.8
Control 3	3.57	3.52	17.92	16.9
Control 4	3.92	3.87	18.42	18.39
Control 5	3.91	3.88	16.79	16.73
Control 6	3.65	3.62	18.95	18.93
Control 7	3.82	3.79	18.45	18.42
	3.781428571	**3.742857143**	**17.72857143**	**17.55857143**

Discussion

Compile studies that prove the importance of agility and speed.

Agility and speed are two most important components an athlete should have. Studies showed that these two skills are important in game. Recent studies showed the improvement of agility and speed could reduce the risk for injuries. In a meta analysis conducted in 2019, civilian and military people with poor speed and agility have higher risk
for musculoskeletal injuries [312].

Collect data on the speed and agility among normal individuals using the Illinois Test and 30 meter sprint prior to the intervention.

Speed and agility time was gathered using a 30 meter sprint and Illinois agility test. Aquatic Group pretest speed time was 3.87 seconds and pretest agility time was 17.94714286 seconds. Uphill Group pretest speed time was 3.82 seconds and pretest agility time was 17.67 seconds, and the Control Group pretest speed time was 3.78 seconds and pretest agility time was 17.73 seconds. A study by Fabricus showed the mean pretest agility time using Illinois Agility Test among rugby players was 16.68 seconds and for 30 meter sprint was 3.43 seconds [3].

Implement a training program that will be applied to the subjects in the study.

The participants performed exercises that are specific in improving speed and agility. These exercises were gathered from recent studies and protocol that improves both agility and skills. All the groups performed the same exercises with the same parameters and sessions.

Warm Up Exercises

1. Hamstring Stretch for 16 seconds hold for 2 sets
2. Quadriceps femoris Stretch for 16 seconds hold for 2 sets
3. Pre-tibials Stretch for 16 seconds hold for 2 sets
4. Calf Stretch for 16 seconds hold for 2 sets
5. Jogging for 1 minute
6. Hip in and out exercises for 2 rounds
7. Burpees for 15 reps

Training Program

1. Forward Running for 3 rounds
2. Side steps for 3 rounds
3. High Knees for 3 rounds
4. Cone Drills for 3 rounds
    - X drills
    - Zig Zag
    - Run Shuffle Run

Determine the difference in agility and speed prior to and after the intervention. Results showed a mean difference of 0.073 seconds in speed time; difference of 0.23 seconds in agility time of the aquatic group. The uphill group showed a mean difference of 0.12 seconds on speed time; difference of 0.44 seconds on agility time. Control group showed a mean difference of 0.04 seconds on speed time;

difference of 0.17 seconds on agility time. Results showed that both aquatic and 31 uphill training improves speed and agility. However uphill training showed more improvement on speed and agility among normal individuals. This correlates with previous studies that uphill training improves agility and speed among athletes and non athletes [9,11,19].

Practical Application

The current study explores the effect of uphill and aquatic training in these two skills. This introduces new and unfamiliar exercises in the participants. The results of these studies can give coaches, personal trainers, instructor and also physical therapist ideas in improving agility, speed and other skills among their clients.

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Declaration of Conflicting Interest

The researchers declared no conflict of interest in the making, implementing, finalization and publication of this study

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