12-Week, Pre-season Training Portfolio for High School Basketball Point Guards

An Honors Thesis (HONR 499)

by

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Abstract

High school basketball coaches are often times a teacher at that same school. While there are many benefits to having a coach being employed as a school staff member, many times these teachers do not have the proper education to train their athletes at a high caliber level of performance. The coaches may not understand either the physiological demands of a certain position on the court or the training needed for specific physiologic adaptations in the athlete. Seeing as many high school athletes are depending on a collegiate athletic scholarship in order to get the higher education they need to be successful in their professional careers, basketball coaches must acquire appropriate knowledge to train each player according to the needs demanded by the position that athlete plays. A pre-season training program for basketball point guards will equip coaches with a tool needed to jump-start their guards and increase the minds and bodies of their players to not only orchestrate achievement in competition but also to encourage success in life as well. Therefore, the following portfolio will outline a twelve-week, pre-season training portfolio for high school basketball point guards.

Acknowledgements

I would like to thank “Professor” Tonya Skalon for all her support throughout my college years, culminating with this final thesis. Her hard work and dedication given to my college experience drove me to grow and excel as a professional beyond the classroom and even beyond the borders of the United States.

I would also like to thank all of my friends who gave me a hard time for missing social events in order to work on this project ... Love you guys :)}
Subject Profile

The following training regimen was designed for a sixteen year old, female, high school basketball guard. She is five foot six inches and weighs one hundred and fifty pounds. The athlete has played basketball her entire life, so she is fundamentally sound and highly skilled. She stays active in the off-season by running and lifting three days a week but will not be in 'basketball shape' once the competitive season begins. The guard has no medical restrictions, though frequently rolls her ankles while playing. When training she prefers to mostly practice at game intensity but does wish to breakdown more difficult skills before performing them at game pace. She spends a considerable amount of time involved with other school organizations and homework but wishes to improve her basketball performance for the upcoming season.

Physiological Needs Analysis

Basketball is an intermittent sport in which both the anaerobic and aerobic metabolic systems seem to be engaged (Cuiti et al., 1996). While competition may require short sprints for a defensive player to catch up to her offensive counterpart, there are also times when long periods of continuous running are necessary (e.g. full court press). Player positions can further dictate the proportion of each metabolic system contributed (Mačkovic et al. 2012), so training goals should be developed in regards to a specific position, in this case, a guard. Guards have been found to have the highest VO2max of all the positions (Abdelkrim et al., 2007; Boone & Bourgois 2013), spend 33% less time stationary than centers (Miller & Bartlett, 1994), and engage in more moderate-intensity level of activity throughout play than all others (Abdelkrim et al., 2007). Thus, it appears guards should train for higher levels of aerobic fitness in relation to the other positions. However, anaerobic training cannot be ignored. In relation to the other positions, guards demonstrate higher reactivity, explosiveness, and speed (Boone & Bourgois, 2013), all of which are actions of anaerobic nature. In some
cases, guards have shown a greater vertical jump than other positions (Abdelkrim et al., 2010; Ostojic et al., 2006).

Aims

Therefore, this training program was designed to improve those qualities demanded specifically of basketball guards, whether aerobically or anaerobically based. Furthermore, the specific aims of this program are to obtain increases in agility, speed, jumping, strength, and endurance. To do so, the following training program has been proposed, and should be completed weekly over the 12-weeks remaining in the off-season.

Program Design

Periodization refers to manipulating specific training volumes and intensities to elicit more strength gains and body improvements. Since the athlete will not be in peak performance shape at the start of this program, the workload starts out with a moderate frequency and intensity and gradually gets more strenuous by utilizing a periodized program. Periodization has been shown to produce greater improvements in strength and muscle gains than a nonperiodized program (Baker et al. 1994). The goal of a periodized program is to apply the principal of overload (where the nervous and muscular systems adapt to unfamiliar loads and stressors) by varying the intensity and overload of a workout program. Overload will be applied to the variety of training methods to elicit the desired physiological responses.

Table 1. 12-Week Training Program

<table>
<thead>
<tr>
<th>Week</th>
<th>Sunday</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-4</td>
<td>Rest</td>
<td>Intervals</td>
<td>Shooting</td>
<td>Circuits</td>
<td>Rest</td>
<td>Weights</td>
<td>Plyometrics</td>
</tr>
<tr>
<td>5</td>
<td>Rest</td>
<td>Intervals &amp; Circuits</td>
<td>Shooting</td>
<td>Weights &amp; Plyometrics</td>
<td>Rest</td>
<td>Intervals &amp; Circuits</td>
<td>Shooting</td>
</tr>
<tr>
<td>6</td>
<td>Rest</td>
<td>Weights &amp; Plyometrics</td>
<td>Shooting</td>
<td>Intervals &amp; Circuits</td>
<td>Rest</td>
<td>Weights &amp; Plyometrics</td>
<td>Shooting</td>
</tr>
<tr>
<td>7</td>
<td>Rest</td>
<td>Intervals &amp; Circuits</td>
<td>Shooting</td>
<td>Weights &amp; Plyometrics</td>
<td>Rest</td>
<td>Intervals &amp; Circuits</td>
<td>Shooting</td>
</tr>
</tbody>
</table>
Skidmore et al. (2012) found that combining aerobic circuit training with interval training produces an even greater improvement in aerobic capacity than either training method used alone. Thus, the two are combined further in the program as the athlete develops her motor skills within each type of exercise and her stress tolerance. Likewise, weight training and plyometrics are combined further along in the training program, as plyometrics has been found in a group of basketball players to be more beneficial in improving motor performance skills when paired with resistance training (Andrejic 2012).

'Shooting days' have been built in as active rest periods, as active rest periods have been shown to more effectively recover the muscles (Mukaimoto et al. 2014). This strategy will also be implemented to minimize the risk of overtraining.

**Aerobic Circuit Training**

Jacobs et al. (2001) found that after 12-weeks of resistance circuit training, both cardiorespiratory endurance and muscular strength increased in the subjects. However, Waller et al. (2011) did not find traditional circuit weight training to significantly increase aerobic fitness. It seems that if an aerobic aspect were added to the circuit, perhaps by jogging from station to station, aerobic endurance would likely increase more than if a weight training circuit was used. Indeed, Chittibabu & Akilan (2013) found aerobic circuit training to increase the aerobic capacity of male basketball players by over three percent in comparison to the one percent increases gained by males who underwent
regular physical activity training. Taken together this research suggests that aerobic circuit training would be more beneficial in improving the cardiovascular system and increasing overall aerobic fitness. Circuit training also provides maximal benefits in a limited amount of time (Skidmore 2012), which should appeal to the busy athlete for whom this program was designed.

**High Intensity Interval Training**

Hawley et al. (1997) defines high intensity interval training (HIIT) as repeated bouts of high-intensity activity interspersed with recovery periods of low-intensity exercise or rest. Interval exercise would thus mimic the continuous variation of exercise intensities encountered during a basketball game, providing a more specific-to-basketball method of fitness training.

HIIT training has been shown to increase many aspects of exercise performance for both the aerobic and anaerobic metabolic systems. Since basketball is an intermittent sport in which both the anaerobic and aerobic metabolic systems are engaged (Cuiti et al., 1996), it would seem that increasing efficiency of both metabolic systems would be beneficial. MacDougall et al. (1998) performed a 7 week study that tested the effects of HIIT training on participants who were previously active. The participants participated in 4 weekly training sessions that grew progressively in intensity as well as progressively decreased the rest periods between intervals. The findings of this study indicated that the participants increased both their glycolytic and oxidative capacities as indicated by increases in anaerobic peak power and VO₂max. Enzyme involvement of both metabolic systems also significantly increased following the HIIT training, indicating the up-regulation of both metabolic systems. HIIT training is also a time efficient way to train (Gillen & Gibala 2014), which is beneficial as the participant is busy with many other extracurricular activities and homework.

**Plyometric Training**

As defined by Voight and Draovitch (1991), plyometric exercises are quick powerful contractions involving pre-stretching or countermovement of the muscle and thereby activating the stretch shortening cycle of the muscle in order to excite the
neurological system and get the greatest response from the neuromuscular system. Because this type of muscle exercise creates greater muscle tension than traditional resistance training (Asmussen & Bonde-Peterson, 1974), plyometrics are widely used to increase vertical jumps (Verkhoshanski, 1973), an area of improvement desired by the individual for whom this study is designed.

Plyometric exercise has been incorporated into many basketball off-season training regimens (Adkins et al., 2007). Furthermore, Voight and Draovitch (1991) say that plyometrics provide a functional form of exercise that should be used just before sport-specific training. Incorporating plyometrics into this individual training program will follow both of these recommendations. The individual will be partaking in plyometric training during the remaining 12 weeks of the off season and develop the necessary neurological and neuromuscular adaptations needed before starting more sport specific training once the season commences.

Resistance Training

According to the National Basketball Conditioning Coaches Association (2007), strength is a key characteristic identified in high-performing basketball players, and strength can be increased through strength training. Indeed, strength training has been identified as an important part of basketball training programs in order to improve motor performance (Micheli & Purcell 2007) and decrease muscle injury (McKeag 2003). Given that guards frequently utilize strength in contact situations such as using their non-dribbling arm to hold off defenders who are trying to steal the ball or holding their ground in a trap situation, a strength aspect should be incorporated into the training program. Guards are also generally the shorter players on the court, and given that strength training has also been found to significantly improve vertical jump performance (Marzilli, 2008), strength training could benefit rebounding as well.

Timing and duration of the training must be considered to prevent an adverse effect on performance. Training for improved strength has been used frequently in the pre-season (Price 2006), and Fleck and Kramer (1997) found that hypertrophy, rather than neural adaptations, occurs only after 10 weeks of training. Such research
correlates perfectly with the needs of the individual for which this program is designed given that she has 12 weeks until the start of the competitive season.

**Three Individual Training Sessions**

*Stretching*

Many types of stretching are currently in literature today, so a brief overview of a few stretching techniques will first be given. Dynamic stretching consists of controlled swinging of body parts while gently increasing reach and speed of movement in order to push the limits of a person’s range of motion. This technique of stretching is not to be confused with ballistic stretching, which uses momentum of the body to push a muscle or other body part beyond its normal range of motion, increasing the risk of injury. A third type of stretching is static stretching, which entails stretching a muscle as far as possible and then holding that position for a set amount of time. Similar to static stretching is passive stretching, but instead of the athlete holding the pose on his or her own, an assistant is holding that body part and muscle in the stretch.

According to Hough et al. (2009), static stretching beforehand had a negative effect on vertical jump performance whereas dynamic stretching prior to the movement had a positive enhancement. McMillian et al. also found dynamic stretching during warm up to positively augment performance on selected measure of power and agility. Taken together, these studies strongly suggest that dynamic stretching before competition or training – plus the exclusion of static stretching – can significantly improve athletic performance. Therefore, before each exercise session, the athlete will perform dynamic stretches (see Table 2) that will incorporate major muscles groups and movements that are necessary for her during competitive play.

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Description</th>
<th>Major Muscle Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butt kicks</td>
<td>Jog in place, bringing the heel of the foot to the gluteus with every step.</td>
<td>Quadriceps</td>
</tr>
<tr>
<td>Tin Men</td>
<td>Start with arms straight out in front, palm down. Keeping the legs straight, swing legs to touch toes</td>
<td>Hamstrings</td>
</tr>
<tr>
<td><strong>High Knees</strong></td>
<td>Jog in place, bringing the knee up as close to the chest as possible every step.</td>
<td><strong>Gluteus</strong></td>
</tr>
<tr>
<td><strong>Step and Reach</strong></td>
<td>Take a step and land on the heel with the ankle dorsiflexed. Simultaneously, reach the opposite hand down to touch the toes. Alternate with every step.</td>
<td><strong>Gastrocnemius</strong></td>
</tr>
<tr>
<td><strong>Butterflies</strong></td>
<td>Lean slightly forward from the waist. Briskly cross arms in front of chest and then extend them out behind the back.</td>
<td><strong>Pectoral, Trapezius, Deltoids, Triceps, Biceps</strong></td>
</tr>
<tr>
<td><strong>Windmill Side Bends</strong></td>
<td>Stand with feet shoulder width apart. Lean to one side, dropping that same hand towards the floor and bringing the opposite hand over top of the head. Lean the other way and reverse the hands. Continue to alternate.</td>
<td><strong>Abdominals, Latissimus Dorsi</strong></td>
</tr>
</tbody>
</table>

*Training Session One – Circuits (week one)*

The athlete should jog a quarter-mile and conclude her warm up with dynamic stretching (reference Table 2). She should start the workout by performing the activity at a station for 30 seconds (see Table 3). Utilizing how Chittibabu & Akilan (2013) demonstrated that basketball specific endurance circuit training with a work to rest ratio of 1:1 is effective in improving aerobic capacity and cardiovascular fitness, the athlete should then take 30 seconds of active rest to lightly should jog a lap around half court and move forward one station. As Takahashi et al. (2001) found that cooling down after exercise enhances the recovery of the post exercise heart rate, the player should finish her training session by cooling down with a four minute walk, starting at a brisk pace and gradually slowing to a leisurely gate by the end of the four minutes.
Table 3. Circuit Training

<table>
<thead>
<tr>
<th>Station</th>
<th>Activity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Arched ball dribble</td>
<td>Lay face down on floor, lift chest off ground while dribbling a basketball</td>
</tr>
<tr>
<td>2</td>
<td>Shuttle run</td>
<td>Shuffle side to side across the paint, touch the line with opposite hand, quickly as possible</td>
</tr>
<tr>
<td>3</td>
<td>Juggling sit ups</td>
<td>Sit ups while fingertip juggling the basketball held above the forehead</td>
</tr>
<tr>
<td>4</td>
<td>Power shots</td>
<td>Get own rebound and alternate sides, don’t let the ball touch the floor, jump high on every shot, quickly as possible</td>
</tr>
<tr>
<td>5</td>
<td>Ball control (arms)</td>
<td>Use basketball to make figure eights through the legs, circles around the back, waist, and ankles, quickly as possible</td>
</tr>
<tr>
<td>6</td>
<td>Dribbling</td>
<td>Player dribbles in and out through circle of cones, switches dribbling hand at every cone, quickly as possible</td>
</tr>
</tbody>
</table>

Progression will be achieved by increasing the duration of performance at each station while still maintaining a 1:1 work to rest ratio. This will develop greater muscular and aerobic endurance while still allowing adequate rest periods to adequately recover the fatigued muscles.

Training Session Two – HIIT Training (week one)

The athlete should jog a quarter-mile and finish her warm up with dynamic stretching (reference Table 2). With the understanding that Acevedo and Goldfarb (1989) demonstrated how aerobic endurance significantly improves as exercise intensity increases when done by performing intervals at a rate 90-95% of heart rate max, the athlete should perform seven, 30-second intervals (see table 4) at 90-95% of heart rate max. A rest period of 30-seconds between each interval should be allocated to correspond with Chittibabu & Akilan’s (2013) research that depicted how a work to rest ratio of 1:1 was effective in recovery and improving endurance. As Takahashi et al.
(2001) found that cooling down after exercise enhances the recovery of the post exercise heart rate, the player should finish her training session by cooling down with a four minute walk, starting at a brisk pace and gradually slowing to a leisurely gate by the end of the four minutes.

Table 4. High Intensity Interval Training Exercises

<table>
<thead>
<tr>
<th>Interval</th>
<th>Exercises</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sprint 35 meters, 10 pushups, repeat</td>
</tr>
<tr>
<td>2</td>
<td>15 squats, 15 jumping jacks, repeat</td>
</tr>
<tr>
<td>3</td>
<td>Jump rope 15 times, 15 mountain climbers, repeat</td>
</tr>
<tr>
<td>4</td>
<td>15 burpees, 15 jumping jacks, repeat</td>
</tr>
<tr>
<td>5</td>
<td>15 box jumps, 10 pushups, repeat</td>
</tr>
<tr>
<td>6</td>
<td>Sprint 35 meters, 10 burpees, repeat</td>
</tr>
<tr>
<td>7</td>
<td>Jump rope 15 times, 15 mummy kicks, repeat</td>
</tr>
</tbody>
</table>

Progression will be achieved by increasing the duration of each interval bout while maintaining the intensity and a 1:1 work to rest ratio. This will improve muscular and aerobic endurance while still allotting adequate rest periods to adequately recover the fatigued muscles.

Training Session Three – Weight Training (week one)

The athlete should jog a quarter-mile and end her warm up with dynamic stretching (reference Table 2). Because the athlete has previous experience with lifting, she should begin this program trying to hypertrophy, which the ACSM guidelines (2010) suggest as 8-12 repetitions at a resistance (60-80% 1-RM) that fatigues the muscle without bringing it to failure. Therefore she should perform 3 sets of 10 repetitions (at 70% 1-RM) for the major muscle groups (see Table 5) with 30 seconds of rest between each set. Lifting load will be established once the 1-RM for the individual has been determined. As Takahashi et al. (2001) found that cooling down after exercise enhances the recovery of the post exercise heart rate, the player should finish her training session by cooling down with a four minute walk, starting at a brisk pace and gradually slowing to a leisurely gate by the end of the four minutes.
Table 5. Resistance training for specific muscle groups

<table>
<thead>
<tr>
<th>Muscle</th>
<th>Exercise</th>
<th>Muscle</th>
<th>Exercise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biceps</td>
<td>Bicep Curls</td>
<td>Abdominals</td>
<td>Weighted Crunches</td>
</tr>
<tr>
<td>Triceps</td>
<td>Skull Crushers</td>
<td>Quadriceps</td>
<td>Leg Extensions</td>
</tr>
<tr>
<td>Deltoids</td>
<td>Dumbbell Lateral Raise</td>
<td>Hamstrings</td>
<td>Leg Curls</td>
</tr>
<tr>
<td>Pectorals</td>
<td>Butterfly</td>
<td>Gastrocnemius</td>
<td>Calf Raises</td>
</tr>
<tr>
<td>Trapezius</td>
<td>Shoulder Shrugs</td>
<td>Latissimus Dorsi</td>
<td>Lat Pull Downs</td>
</tr>
</tbody>
</table>

Progression will be achieved by progressive overload (ACSM, 2010), which means increasing the weight while maintaining the same number of repetitions as the muscles get stronger. This will achieve gains in strength rather than just muscle maintenance.

Conclusion

A fully justified twelve week portfolio based on underpinning scientific theory has been described as a potential training program for a high school point guard. The portfolio included an in-depth description of the individual and a complete sport analysis evaluating the positional demands of point guards in basketball. Included was a rationale for the overall program design and a description of the key features. Detailed plans for three individual training sessions were also described, providing exercise selection, exercise intensity, work to rest ratio, and suggested methods of progressing the session in the future. All aspects of each session were supported through reference to appropriate theoretical material.

During this 12-week training program, continual assessment in strength, speed, and power should be utilized every three weeks to ensure the athlete is benefiting from the proposed program. The aims of this program are to improve motor performances that will lead to an increase in basketball performance. Therefore, improvement, rather than maintenance, of agility, speed, jumping, strength, and endurance should be developing.


