A Time Motion Analysis Based Physiological Demands Assessment of NCAA Division IA American Football and it's Application in Developing Football Specific Conditioning Programmes

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Specificity of training is considered to be a fundamental component of any detailed, goal oriented conditioning program. Whether one is training to improve functional ability, rehabilitate a musculoskeletal injury, or develop sport specific physiological attributes, the specificity of the exercises prescribed in a training regimen and their ability to mimic the demands associated with successful performance within the targeted activity, will dictate the magnitude of the myofibril and metabolic adaptive response expressed within an athlete's physiological performance profile. When applied to preparing an athlete to develop and enhance their capacity to execute movement skills and physical attributes correlated to successful sport performance, it is recommended that they participate in a conditioning program specific to the demands of their particular athletic event.

As the pressure to perform within competition increases, the degree of sophistication applied in assessing one's biomechanical, physiological and psychological performance factors is recommended. Recently the science of program design has experienced exponential growth in both breadth and scope as the application of new methods, and video and time techniques and technologies have been developed.

More specifically, the study of Time Motion Analysis (TMA), referred to as the quantifiable observation of the change in an object's movement pattern over a given time period, has been increasingly applied in assessing the physiological demands of high performance athletes (8).

The theoretical justification driving the application and integration of TMA technologies to the field of exercise and sport science research is supported in it's outcome potential. The strength of the support driving the utilization of TMA technology in performance assessment, is it's reported ability to provide measurable variables related to the active segments of an athletes performance to be used in more in-depth analytical assessment (8).

A methodological review of the techniques utilized during a TMA assessment investigating training or competitive performance is reported to provide the athlete, the coach, and the conditioning staff (strength coach, exercise physiologist, orthopedic surgeon etc.) with specific quantifiable information detailing the magnitude and volume of physiological effort an athlete exerts during a given period of athletic activity.

Through the application of thoughtful research design, TMA has the ability to produce measurable values for activity specific biochemical (average Heart Rate, blood lactate, aerobic and anaerobic enzyme activity), and physical kinetic and kinematic values produced during a relative time segment of an athletic competition or training performance and the movements executed within.

More specifically, the analytical application of this data can generate reflect isolated time segments; per play, per shift, per quarter, half, full game, season etc. These athlete-specific performance measures can then be applied to identify physiological demand profiles specific to the positional and competitive level differences between activities.

The calculated performance values can be applied to develop relationships correlated to successful playing ability and competitive level, and to identify and isolate positional differences.

Identification of these relationships provides the strength and conditioning professional with the ability to utilize training work to rest ratios, power and maximal strength profiles and metabolic demands that are specific to, and reflective of, sport, competitive level, and positional differences.

The following is a literature review attempting to isolate the physiological demands of National Collegiate Athletic Association (NCAA) Division IA American Football athletes. The review is intended to identify

TMA based positional differences in efforts of identifying position specific performance measures, and training methodologies associated with generating position specific performance enhancements.

This review includes a discussion on recommended NCAA Division IA American Football specific metabolic conditioning techniques as reported through the application of TMA technologies, a detailed review of performance measures associated with athletic success in NCAA Division IA American Football, and applicable training recommendations designed to enhance the above performance measures.

Due to the number of positional players that comprise a Division IA American Football team (5 different defensive positions (Defensive Linemen; and the different roles they individually have, 3 Defensive Backs, 2 Corner Backs, 1 Free Safety, and 1 Safety, and 8 different offensive positions; 5 Offensive Linemen, 2 Wide Receivers, 1 Quarterback, 1 Running Back, 1 Tight End, 1 Full Back, and 1 Tail Back, in addition to the 8 different special teams players), this review will limit it's Football specific training program discussion to running backs.

Energetics and Time Motion Analysis

A comprehensive review of the literature investigating the physiological demands of NCAA Division IA American Football, indicates that there is a significant lack of TMA based study.

A possible explanation for this may exist in the relative short history of TMA analysis as a means of assessing competitive sport situations, and as such, there is only a small group of researchers actively using this technology, or that due to the methodological difficulties associated with the dynamic and complex nature of the movement, and positional specific characteristics of American Football, it is time consuming and difficult to conduct a credible and reliable study. Further investigation is recommended to assess why American Football has not been investigated with TMA technologies.

It is speculated that due to the start and stop nature of individual plays in a NCAA Division I American Football game the process of TMA would effectively evaluate the demands of performance across a competitive game, however, upon taking a more critical look at how the game is played; considering elements of game strategy, the varying tasks executed within the different positions in different individual play schemes, the randomness of physical contact of each play and the issues of reliability and validity associated with TMA, significant challenges exist in accurately conducting a TMA in Football, and possibly explains why there is such a lack of published literature.

Only one study was identified as a TMA of American Football. Rhea et al. (28) TMA to identify exercise to recovery relationships and other 'descriptive' information about the physiological demands associated with performance at the three major levels of American Football (High School, Collegiate (NCAA), & Professional (National Football League)).

The authors evaluated a total of 30 games, 10 at each the high school, NCAA Division I, and National Football League (NFL) levels. The TMA methods applied incorporated videotaping each game in their entirety, and timing portions of each game through the use of a stopwatch. Work periods were determined as the time segment between the snap of the ball to the time at which the whistle sounded signaling the stop of play. Recovery or 'rest' periods were determined to be the time between the whistle signaling the end of the play, and the snap of the ball starting the next play. Experimental design included consideration for the random stoppages in play that occur throughout the duration of a game. Stoppages for penalties, called time-outs, end of quarter or half, first down measurements, and injured players were incorporated into determining the mean number of plays per series, the length of time in recovery between plays, the number of stoppages per series, and number of series per game.

Due to the lack of research validating methodological design or the results of this study, all practical application of the results reported must be taken with some level of professional criticism. However, after reviewing the study's design, a practicing strength and conditioning professional can take the calculated Football specific work to rest ratios with a level of confidence in that the methodology used by Rhea et al. (28) produced a legitimate assessment of physiological demand, and that the data provided can be utilized in conjunction with other American Football specific knowledge to develop effective full-season periodized conditioning programs.

The results of the investigation by Rhea et al. (28) suggests that NCAA Division I American Football athletes are subject to 6.26

+/- 2.74 plays per series, with 1.05 +/- 1.11 stoppage per series, and that they complete 13.78 +/- 2.22 series per game. Further Rhea et al. determined the average length of time per run play was 5.13 +/- 1.45s and 5.96+/-1.62s per pass play, while the length of recovery between play without stoppages was found to be 33.98+/-4.19s and 90.66+/-47.24s per recovery with a stoppage. Through analysis of the average time per run and pass play, and the average recovery time per stoppage, Rhea et al. (28) determined that NCAA Division I American Football players have an average work to rest ratio of 5.60s to 33.98s, or a 1:6.07 ratio.

A review of the literature did not yield results indicating the average movement distances covered per athlete per play, per series or per game. It is speculated that due to the complexity of TMA in football, this is an area of research has been neglected, and is warranted of further research attention.

There are several published reports identifying distances covered per play of other sports, specifically sports that are similar in terms of physiological and movement demands as American Football, such as those of Rugby Union (20), Rugby League (23). It can be suggested that the appropriate application of the work to rest, and movement demand values when compared across positions of similar physiological demand between sports can provide a strength and conditioning coach with valuable insight into Football specific training.

However, Dobson & Keogh (8) report that the reliability of comparison of TMA based performance variables between different sports, makes sport to sport comparisons unreliable due to the intrinsic methodological limitations of TMA as a practice. As a result, the lack of published research regarding the average distance covered per play on a position specific basis for American Football, significantly increases the difficulty in accurately assessing the physiological demands of the associated work to rest ratios of NCAA Division I Football players.

It is also speculated that the current conditioning practices employed by Football conditioning coaches is based on a combination of objective assessment of the physical demands incurred by an athlete and team strategy (a function of the set offensive and defensive schemes utilized by the coaching staff). This approach implies that physical preparation may be individually specific to the athlete's role, the number of plays the athlete is involved in over the course of a game (the rules of American Football allow players to entre and exit a game on a play by play basis, and as such it is not uncommon for 'positional' players to play in certain situations and not in others, significantly varying the demands an athlete incurs over the course of a play, a series, or a full game), and the physical tasks executed during their playing time.

From this review, it is recommended that Football conditioning be athlete specific based on the coaches game strategy and intended use of an athlete, and the athlete's personal athletic goals (starter vs. non-starter, or division of playing competition – Division I or III etc.)

In application of the published research concerning the average work to rest ratios as established by Rhea et al. (28), and the contention that American Football is considered to be an anaerobic sport (10,15), training must enhance metabolic and physiological abilities.

Identification of TMA Football Specific Energy System Performance Demands

In review of Rhea et al's (28) 'Competition Modeling of American Football' research, the conclusions made by Dos Remedios et al. (9), Hoffmann et al. (15) and through observational assessment, it can be accepted that the average NCAA Division IA Football run or pass play, work to rest ratios, and the exertion of football specific physical movements, are powered by anaerobic metabolism.

Acceptance of this position requires an understanding of anaerobic metabolism and the mechanisms which promote its positive adaptation. This includes identification and comprehension of the relationship that exists between Football specific work to rest ratios, and the volume and magnitude of the physical stresses endured during the course of a competitive game from a positional perspective.

Seiler et al. (32) suggest that anaerobic power is highly movement and sport specific. The literature reveals that the primary movement patterns associated with successful performance in elite level American Football include running, jumping, and pushing, as it is these movements which are assessed at the annual NFL Combine (the physical performance assessment camp attended by collegiate athletes entering the NFL college draft).

At this camp, elite NCAA Division IA Football athletes have their performance in a 36.6m (40yard) sprint – with split times recorded at 9.15m (10yards) and 18.3m (20 yards) – an

18.3m (20 yard) ProAgility test, a 54.9m (60yard) shuffle, a 3 cone drill, a vertical jump, and a broad jump measured. It is their performance in these tests which, according to the published prediction equations reported by McGee & Burkett (21), and the test performance relationships identified by Barker et al (2), significantly influence their draft selection status through the 7 rounds of the NFL NCAA entry draft (10,21).

A review of the research indicates that criticism exists with regards to the credibility and reliability of these test protocols, specifically the 36.6m sprint (32) in assessing Football playing ability, however, it is this set of performance measures which are accepted within American Football culture, and used annually by scouts and coaches in their assessment of NCAA IA Football playing ability.

It is speculated that through further research assessing the reliability of the conclusions of Seiler et al (32) who suggest that some of the NFL Combine performance tests (36.6m sprint, and vertical jump) are not effective in predicting Football performance abilities, can provide greater insight into the utility of the current performance assessment protocols.

Following a biomechanical review of the movement patterns associated with successful performance in the NFL Combine series of testing protocols, it can be concluded that NCAA Division IA football is typified by speed and quickness lasting from a fraction of, to five seconds (32), and as such are powered through the anaerobic based ATP-Phosphocreatine (ATP-PC) and aerobic Glycolytic energy systems. Barnes & Attaway report that a full 90% of the energy for football comes from the ATP-PC system, with the remaining 10% coming through other aerobic and anaerobic pathways. They suggest that the ideal training situation is to spend 90% of the training session targeting the ATP-PC system and the remaining 10% targeting lactate and oxygen metabolism (4).

It should be noted that Barnes & Attaway's (4) recommendation was based on Football specific agility training and not resistance training. However, the principles governing anaerobic conditioning can be considered to have an universal element of utility, and suggest that this recommendation, if applied correctly, can induce positive resistance training adaptations, specifically in 'Power' based resistance training.

Based on this review of energy system contributions in regulating the performance of NCAA Division IA Football specific tasks, targeted anaerobic adaptations are the recommended and desired outcomes of Football conditioning, as it is these outcomes which are known to decrease an athlete's sensitivity to the chemical precursors triggering the onset of fatigue associated with repetitive high intensity, short duration athletic movements.

Anaerobic energy system adaptations have been quantifiably assessed as improved hydrogen ion buffering capacity generated through increased efficiency of the bicarbonate ion reaction (which can be aided by pre work-out sodium bicarbonate or sodium citrate supplementation) (18) and elevated glycolytic enzyme (phosphructokinase and lactate dehydrogenase) concentrations (15).

Due to the lack of TMA based biochemical analysis of NCAA Division IA Football the magnitude of these changes are presently unknown, however, they can be conceptually substantiated through the known physiological adaptations associated with anaerobic training protocols utilized through performance testing in other sports.

The metabolic responses are reported to be a decrease in muscle deoxygenation as a result of the increase in oxidative metabolism, leading to decreased blood lactate and muscle acidosis levels, which cumulatively, contribute to an improved oxygen affinity to hemoglobin (15). When applied to the adaptations incurred over the course of a season the athlete would develop a greater ability to recover from high intensity, repetitive exercise more quickly. Hoffman et al. (15) support this argument, in reporting that continued anaerobic activity over the course of a NCAA Division IA Football game can improve an athlete's aerobic activity.

While it is reported (2), that fast twitch Type IIb 'fast glycolytic' fibres experience morphological changes resulting in them expressing characteristics of Type IIa 'fast oxidative glycolytic' fibres the conditioning focus of NCAA Division I Football must remain concentrated on enhancing one's anaerobic power, speed and force profiles so they can strengthen their ability to generate the physical abilities associated with producing a Football specific competitive advantage.

The goal is not to integrate long duration aerobic conditioning, which is highly correlated to inducing positive adaptations to muscle oxygen saturation levels and increasing glycolytic enzyme activity, and reduced lactate concentrations (15) and improving body composition values (2,16), rather the goal is to

set the training session work to rest ratios to mimic game situation work to rest periods.

It must be noted that aerobic conditioning does have a justified position within Football conditioning, as the associated enhanced oxidative capacity is significantly correlated to muscle deoxygenation rate during acute high-intensity exercise, and the positive changes in body composition that can be developed with aerobic conditioning (15). However, due to the reported (16) interference effects of combining subsequent periods of anaerobic and aerobic conditioning, and the compromised effect this has on the desired adaptive responses associated with these training methods, it is suggested that aerobic conditioning be limited to off-season body composition focused conditioning programs.

Table 4.0 illustrates how long distance (1.5-2 mile ~3-4km) running can be included in to a conditioning program on a microcylce level.

From a theoretical perspective, an anaerobic training foundation will provide the athlete with a metabolic stress targeted at enhancing the athlete's ability to recover more efficiently from repetitive bouts of high exercise intensity and mimic the demands of Football competition. When applied over a prolonged period of training or a 14-week season of competition, the athlete is capable of enhancing their gylcolytic energy system adaptations triggering improve oxygen supply to exercising muscle and local tissue recovery (15).

Barnes & Attaway (4) report that the available energy from the ATP-PC system can be supplied for about 8-10 seconds, and that for ATP-PC enzymatic adaptations to occur the system requires work intervals of 6 or more seconds. In addition, they suggest that to effectively target the ATP-PC system, the work to rest ratio be set at 1:3, with rest intervals that never exceeding 1 minute.

Table 8.0 outlines the time sequencing of a Football running back specific agility session, utilizing the timing recommendations of Barnes & Attaway (4).

Barnes & Attaway (4), further suggest that after an intense work interval in which the ATP-PC stores are depleted or near depletion, 50% of the stores are replenished within 20 seconds, 75% after 40 secs, and 87% at 60 secs.

The work to rest ratio values recommended by Barnes & Attaway (4), can be applied to the competition modeling assessment reported by Rhea et al. (28), who suggest that NCAA Football has a work to rest ratio of 1:6.07 or 5.6s to 39.98s, it can be concluded that from a theoretical perspective concerning TMA and the ATP-PC energy system, NCAA Division I Football conditioning programs should utilize a work to rest ratio of 1:6, where the active work period is set between 6-10s, with rest sets of 36-60s.

This recommendation is structured within a theoretical foundation, and does not take into account position differences. An American Football team generally consists of 48 players who 'dress' for a game, with approx 95 players who are considered on the team (these include roster and non-roster or practice players who might not see game action at all during a season). Of these 48 players, there are three 'teams' that they may be eligible to play on during the course of a game. Depending on what position(s) a player is eligible to play, how often, and in what physical capacity, the magnitude of the physical stress and anaerobic fatigue the will incur during their work to rest ratio, and the distance they cover.

It is this characteristic of American Football is what makes it so difficult to accurately quantify the magnitude of physical stress incurred during the course of a play or game, and as such, creates a degree of interpretation as to how a player should train during their 1:6 work to rest ratio.

Review of NCAA Division IA Football Performance Measures

To gain a better understanding of how this training intensity should be applied, a review of the literature concerning NCAA Division I Football performance measures is necessary. A review of the literature (3,5,9,10,11,14,15,20,24,25,29-32) indicates that the application of performance measures is position specific. As such, training programs need to reflect these differences.

Due to the methodological differences applied in each study (sample size, subject grouping, performance measure protocols etc.), direct comparison from one study to another is difficult to legitimatize as a credible practice. However, after critical review of the published research, allows for the development of position specific performance measure value ranges, that, once identified, can provide the strength and conditioning professional with the ability to set training program goals with quantifiable outcomes.

Table 1.0 provides a summary of the performance measures standards found throughout the literature.

In assessing the functional application of the values identified in Table 1.0, several assumptions, recommendations, and conclusions may be made concerning training program outcomes and performance measures of NCAA Division I American Football.

The following is a series of training recommendations suggested in review of the published literature concerning Football specific performance measures, the theory of muscle hypertrophy, strength, power and anaerobic adaptations as achieved through periodized program design

Training Recommendation 1

Body Composition

A review of the literature concerning positional differences of NCAA Division I Football suggests that body composition, and more specifically body fat %, are limiting factors in an athlete's ability to develop explosive force, speed and power (9).

Table 1.0 summarizes a partial review of the literature concerning body fat % ranges for NCAA Division IA Football athletes. Review of these body fat % ranges can be used to identify positional specific body fat % standards and if necessary, can be applied to establish off-season training objectives.

Barker et al (3) assessed NCAA Football playing ability physical and psychological performance indicators. Their investigation included a coach's assessment of each player's playing ability. Through this objective assessment they determined that a coach's ranking of a player was significantly influenced by their body mass and body fat %, reporting that 'coaches believe heavier, fatter players are poorer athletes'.

In assessing game strategy, it may be understood that due to the nature of positional differences, there is a strategic advantage in one's body size, and composition.

In reviewing this trend more specifically, the published literature reveals that there is a strong positive correlation between vertical jump height and body fat percentage up to 10%, and that when body fat exceeds 10%, vertical jump height decreased sharply (7).

Applying this relationship to the positional specific performance measures outlined in Table 1.0, the low body fat % values for the Wide Receiver, Running Back, and Defensive Back and Line Backer positions are theoretically supported, as it is these positions that require the ability to jump up to catch passes, and make hard, powerful quick multi-directional movement changes, all movements associated with high lower body power, as assessed through vertical jump ability.

The power requirement for receivers and backs do not outweigh the power requirements of linemen, the physical expression of their power abilities differs in their position demands.

Dos Remedios et al (9) & Seiler et al (31) report that size is important for successful performance in linemen, in that the use of larger linemen in the interior line may generate more forward momentum providing a positional advantage on either the offensive of defensive side of the ball.

Seiler et at (31) further report that linemen exhibit significantly less explosive ability than 'backs', and suggest this lower explosive ability is related to their higher percentage of body fat %. When viewed in conjunction with the 15-17% body fat % recommendations for linemen established by Dos Remedios et al (9), the range of offensive and defensive linemen body fat % as found in Table 1.0 (14.2-23%) and the body fat ranges for receivers and backs (6.6-13%) the relationship between position and body fat percentage can be identified.

It is important to note that body fat % is not the only contributor to an athlete's body composition rating and athletic performance. Dos Remedios et al (9) report that Fat Free Mass (FFM) is more critical to performance in linemen and backs than total body weight. While a 'mass' advantage exists in linemen, a greater advantage is developed through increased mass as a result of higher muscle mass, as increased muscle cross-sectional area (muscle hypertrophy) is associated with increases in absolute and peak strength and force outputs.

In reviewing the literature, Fry & Kraemer (9), and Table 1.0 positional specific relationships are found between absolute strength values of linemen and receivers and backs. This review produces the contention that linemen have greater absolute strength values than backs, and more specifically, defensive linemen having significantly greater absolute strength than offensive backs (3).

It has been suggest that the high energy cost of practice and games incurred over the course of a season, positional players, more specifically, linemen, experience decreases in total body

weight and body fat % with no change in FFM (9).

The practicing strength and conditioning coach must recognize the relationships that exist between body fat % and an athlete's power profile, body fat % and FFM, and volume of FFM and absolute strength, so they can develop conditioning programs specific to improving an athlete's body composition profile to fit their positional specific body composition requirements.

Training Recommendation 2
Training for Speed and Power

As is characteristic to all sport, an athlete's movement ability significantly influences their the chances of producing a successful performance. As has been previously mentioned, a Football athlete's ability to run jump, and push are used to measure their performance abilities. As the level of competition increases, the demands on an athlete's ability to execute these movements increases in a curvilinear relationship.

When assessing the differences between NCAA Division IA and Divisions IIA or IIIA, or High School, are relatively small, although statistically significant. For example, Garstecki et al (11) investigated the performance differences between NCAA Division IA and IIA Football players, and reported a 0.06s or -1.5 t-score difference in 36.6m sprint scores, and 9.5cm or 3.71 t-score difference in vertical jump heights, among other performance variable differences.

A review of Fry & Kraemer (10), Garstecki et al. (11), Sawyer et al. (30), and Schmidt et al (31) will provide greater insight into the performance measure differences between the 3 major levels of American Football.

From this research comes the contention that differences in playing ability (competitive level) are a function movement speed and power. More definitively, the quicker, faster, stronger athletes, or the more agile athletes separate NCAA Division IA Football players from Division IIA or IIA. This concept is supported by Barnes & Attaway (4) who suggest that enhanced agility; the ability to change direction quickly and easily, is beneficial to performance in football, and Barker et al. (3) who report that the most significant relationships evaluating NCAA Division IA Football performance, suggest that explosive movements such as vertical jumps and short shuttle runs are more important in the coaches evaluation of athletic ability than other performance variables.

Barnes & Attaway (4) further suggest that there are 2 objectives when training for enhanced agility; a) enhancing power, balance, speed and coordination, and b) enhancing anaerobic / aerobic endurance, to develop the ability to repeat high intensity work intervals.

When assessed through a positional needs analysis perspective, backs and receivers require a greater range of explosive multidirectional movement abilities than linemen, and as such, the literature reveals that they exhibit greater vertical jump and sprint abilities when compared to linemen (10).

The exact training mechanisms for developing increases in muscle power, and physical speed will not be addressed in detail, other to note that these adaptations are the result of stresses to the neuromuscular and anaerobic energy systems. Physical conditioning and training program design principles used to target these adaptations for enhanced Football performance will be covered in the next section of this review.

Training Recommendation 3
Performance Nutrition

Exercise nutrition is an element of conditioning program that must not be overlooked. The following is a review of 3 exercise nutrition techniques, forms, functions, and methods should be discussed and integrated into a NCAA Division IA athlete's conditioning program. The discussion will be limited due to the nature of this review being TMA focused, however, it is important to mention that more detailed investigation of exercise nutrition strategies would significantly increase a Football strength coach's ability to develop player specific conditioning programs. Refer to Table 3.0 for a model of exercise nutrition practices integrated within a periodized conditioning program.

1) Nutrient Requirements

It is reported (2) that athletes have different nutrient requirements than non-athletes. It is suggested that as the volume of physical stress incurred during a work-out increases, the nutrient demands associated with generating the energy to handle the stress increases.

A brief review of energy metabolism reveals that the macro nutrients carbohydrate, protein, and fat, are all broken down to release energy. It is recommended that a Football athlete consume

a diet comprised of 55% carbohydrate, 30-35% protein, and 10-15% fats (2,18).

The conditioning coach should provide the athlete with as detailed a description of energy metabolism as they can comprehend so they can apply this theory in their meal creations.

2) Caloric Balance

Weight management is all about caloric balance, calories consumed versus caloric expenditure. A football athlete training to alter their body composition to either increases FFM or decrease body fat % should be aware of the caloric intake guidelines as published by the NSCA (2), which suggest that to decrease body weight/fat% an athlete should consume 12-13kcals / kg of body weight per day. An athlete attempting to maintain body weight and FFM 15-16kcals/kg/day, and to increase body weight / FFA 18-19kcals/kg/day.

This information is of particular relevance to linemen, who have a strategic advantage in having increased mass, but are limited in performance ability by high body fat %.

3) Pre & Post Training Session Requirements/Supplementation

As mentioned, the stress induced through physical activity and sport performance places high demands on your metabolism. To ensure that an athlete is able to promote a net gain in muscle synthesis following resistance training, pre and post work-out nutrition strategies must be employed.

The research (18) suggests ingesting a light carbohydrate and protein snack prior to exercise (50g of high glycemic carbohydrate and 5-10g protein – where 3-6 grams of that protein is made of Branched Chain Amino Acids (BCAA's – leucine, isoleucine and valine) and glutamine). It is reported that this concentration of macronutrients serves to increase blood glucose and amino acid availability during the work-out and decreases exercise-induced muscle protein catabolism.

It is also suggested (18) that the athlete consume this pre-work-out snack, to take place 45-60 minutes before the initiation of the training session with 600-1000ml of water or fluids. It is recommended that this fluid volume be ingested as an exercise Glucose Electrolyte Solution (GES), consumed either mixed with the recommended volumes of protein and creatine, or individually.

Creatine supplementation in conjunction with resistance exercise has been found to induce increases in muscle size, strength, and power outputs (2). A typical creatine cycle lasts for 5 weeks, where the 1st week (5 days) is characterized by a 20g per day loading phase, followed by a 2g per day maintenance dose for the following 4 weeks. However, the efficacy of creatine supplementation in highly trained NCAA Division IA Football players is questioned as Wiler et al. (31) reported no significant improvements in strength, body composition, or anaerobic muscular endurance were experienced in 10 weeks of either high dose (7g/day following 20g/day 7 day loading phase) or low dose (3g/day for 10 weeks).

In efforts of increases muscle synthesis the conditioning coach should also integrate a periodized cycle of amino acid, branched chain amino acid, and protein supplements.

This can be achieved solely through an isolated or hydrolyzed Whey compound, or through the use of concentrated individual forms. The practical experience and athlete history should be considered before any specific recommendations are provided.

Lastly, due to the poor nutritional behaviors exhibited by college students, the use of a multi-vitamin is recommended to ensure that the athlete is consuming the required concentrations of vitamins and minerals on a daily basis. A balance diet made of whole foods is ideal as probiotic forms of all micronutrients function at high efficacy levels than synthetic forms.

Special Considerations for Exercise Nutrition

A strength and conditioning coach has a professional responsibility to discuss the safety and ethical issues regarding supplementation.

The athlete needs to understand the risks associated with using supplements that are developed and manufactured in an unregulated industry, and the influence their use has over their potential in returning a positive analytical findings result on a NCAA drug test, and the implications this would have on their playing and academic eligibility.

Program Design Considerations for Enhancing NCAA Division IA Football Playing Performance

A review of the literature concerning the methodology and techniques associated with enhancing athletic abilities reveals that many different program design elements exist.

When beginning to construct the framework for a goal oriented conditioning program, the

outcome goals and the time in which they are required must be identified.

In relation to developing Football conditioning programs, the literature suggest that the goal of a Football athlete's conditioning program is to attain peak strength and conditioning prior to the start of the season, and to be able to maintain that strength throughout the season (9).

The positional differences characteristic to Football dictates that for an athlete to develop and maintain sport specific strength throughout a season, specificity in the type of work performed can greatly enhance their ability to transfer the induced training adaptations; metabolic and physical, to game competition (28).

A review of the research demonstrates that over the past 30 years Matveyev's (2) concept of periodized training has become increasingly applied to sport conditioning programs (17,28). The progressive integration of this style of program design is based on it's reported ability to reduce the potential for overtraining with long-term programs by allowing for scheduled rest periods (18) and for developing increases in training adaptations (18, 34).

More specifically, Kraemer (17) reports that when training can be undertaken for an extended period of time, dramatic gains in physical development are possible. This claim is supported by Wilder et al (34) who found significantly greater differences in strength body composition, and short-term endurance changes in those individuals who were involved in periodized training. Further, Wilder et al (34) reported that highly trained NCAA Division IA Football players who were involved in a well-structured and monitored periodized resistance training program can increase strength and anaerobic muscular endurance.

The process of periodization refers to the planned sequencing of work and rest periods within a training program, where each of these work periods are divided into individual training segments with individual training concentrations specific to the goals of the specific training period.

As the degree of sophistication in the program's design increases, a conditioning coach can dictate the exact training volume and intensity level of each work-out of each training period and can apply this precision across the entire program's intended length. This control of the accumulation of work-out induced physical stress is reported to provide a strategic advantage to the training athlete.

Table 2.0 summarizes the training intensities associated with the various cycles in a 'periodized' program.

It is this intrinsic and differentiating feature of periodized program design that is so effective in developing results in collegiate athletes, who according to Kraemer (17) constantly face interruption in their off-season training, due to their varying time demands; spring football that requires it's own maintenance / injury prevetion program, academic and work demands, and the student lifestyle. Without a planned training approach, these factors may negatively influence optimal player development.

The following training program recommended in this review, incorporated a periodized approach that is a modification of the periodized Football specific programs found in the literature.

Table 3.0 is a 12 month, 52 week model of a periodized program recommended for offensive and defensive backs.

It is structured to reflect the competition demands of a typical NCAA season. The NCAA Division IA Football season includes an official 4 week training camp beginning at the start of August (however, 'unofficial' training can take place beginning in late July) which leads into a 14 week season beginning the 1st week of September and finishing in mid December, where, if a team qualifies through the Bowl Championship Series Standings (BCSS); a point value based on win/loss percentage and degree of schedule difficulty, will play in a 'Bowl' game. For the 2008 season, the NCAA has licensed 32 'Bowl' games, with the number 1 and 2 BCS ranked teams competing in the 'Orange' Bowl for the National Championship January 9th, 2008.

Review of this full year training model identifies the specific training periods assigned for developing the physiological and metabolic performance measures required for NCAA Division IA Football performance as outlined in the literature, and summarized in Table 1.0

Consistent with the cycle approach used throughout periodized training, the training model outlined in Table 3.0 uses 4 macrocycle periods, each of which are defined as either 'Winter Conditioning', 'Off-Season Conditioning', 'Pre-Season / Training Camp', and 'In-Season'.

Further inspection of this periodized training model indicates the specific training purposes, and recommended lengths of time engaged in that type of training per macrocycle. These individual training focuses, referred to

mesocycles in the literature, where developed in part, on review of the literature.

Wilder et al (34) report that hypertrophy gains may be expected with low intensity and high volume training, a proposed goal of the 1st 5 weeks of a training program, and that strength and power adaptations can be expected during the 2nd 5 weeks of a conditioning program characterized by high intensity, low volume training.

Further, the program model outlined in Table 3.0 has a training volume set up utilizing a modified linear approach, which takes into consideration the training results experienced by Wilder et al (34).

The program design utilizes this linear model through the course of Macrocycle 1 and 2. This is reflective of the time demands placed on the student athlete during this time of the year, but is shorter than that recommended by Wilder et al (34).

Confidence is applied to this cycle design, as it includes both hypertrophy and basic strength phases, and the planned volume of work is consistent with the recommendations outlined by the National Strength & Conditioning Association (2), and summarized in Table 2.0

More specifically, Marcocycle 1 incorporates a 4 week hypertrophy stage, a 3 week basic strength phase and a one week rest phase. Specific work to rest, set to repetition ratios, and exercise order recommendations for each upper (Appendix 1.0) and lower body hypertrophy (Appendix 2.0) are identified in the Appendices.

For further mesocycle analysis and the identification of the supplemental training requirements accompanying the hypertrophy and basic strength phases of the 'Winter Conditioning' program, refer to Table 4.0 as it outlines a typical week work-out schedule for one of the 3 weeks the athlete is actively completing the Basic Strength work-out. Taking this review further Tables 5.0, 6.0, 7.0, 8.0, 9.0, and 11.0 outline and provide description for the a typical training day schedule and drill selection / plan.

The mesocycle scheduling modifications applied during the 'Winter Conditioning' mesocycle is due to the typically high academic demands at this point during the academic calendar, and to provide the athlete with a decrease in training load following the competitive season. The rest phase for this cycle was strategically selected as 'Spring Break' or 'Reading Week' were students are provided with a week free of classes for the purpose of mid-term examination preparations, or take the time to travel home or to some tropical destination to experience American 'Spring Break' culture.

This 7 week work and 1 week rest cycle is designed with the intentions on getting the most out of the athlete during a time period where their focus has shifted from sport, and onto academics and possible injury rehabilitation.

In looking at the other macrocycle elements of this program, it can be noticed that there are 3 'Testing' periods that are structured within the program.

For an over view of the testing protocols to be used note table 10.0.

It is recommended that test protocols be used throughout the training periods so that consistent measures of athletic performance can be made, and provide a reference for training progression assessment. In addition, these tests were selected to reflect the performance measures used by the NFL Combine, potentially preparing the athletes with the playing ability to garner draft selection attention, familiarity with the testing measures, which can possibly lead to greater test results when compared to other athletes with comparable 'talent'.

The testing session for marcocycle 2 was set for the 1st week of June to test for the training adaptations developed over the Winter and Off-Season conditioning programs, and to establish new benchmark values before heading into the Pre-Season training period.

A review of Table 3.0 indicates that Macrocycles 2 and 3, begin to introduce more Football 'specific' performance based exercises, particularly with the integration of 'power' phases.

Due to the heavy reliance of power outputs in executing successful football performances, the specificity of the training programs requires that the exercises begin targeting and enhancing the athlete's power profile.

Appendix 5.0 is an example of a 2 week Power phase program. The set to repetition ratio is set in compliance with the recommendations of Baeche & Earle (2), and the rest length is set to mimic the rest duration established by Rhea et al. (28) of 90 seconds. The recommended 80 seconds in the program is set lower than that outlined by Rhea et al. (28) in efforts of increasing the anaerobic adaptations and hormonal response (22) associated with high intensity anaerobic, power exercise.

Marcocycle 2 follows a training pattern of similar length and phase sequencing of that recommended by Baechle & Earle (2), with a planned rest and testing week scheduled before the onset of the Pre-Season / Training Camp program. Refer to Appendix 4.0 for a sample 2 week 'Power' training program for phase IV of the Off-Season Conditioning cycle.

Macrocycle 2 utilizes a 14 week hypertrophy, basic strength, strength / power, and power individual phase program. The phase sequencing is consistent with that outline by the National Strength & Conditioning Association's periodization training guidelines (2), and includes a modified hypertrophy and basic strength phase duration than that reported by Wilder et al. (34).

The decrease in phase I and II training duration was made on the basis of 2 considerations; i) the perceived necessary training volume requirement to induce hypertrophy and basic strength changes, and ii) so that individual strength / power, and power phases could be integrated into the 14 week cycle.

It is this 14 week period where the athlete is expected to make largest increases in local muscular strength, size and power output.

Due to the nature of a NCAA Division IA Football pre-season and training camp length, Marcocycle 3 is structured through training phases that contradict those found in the literature.

Review of Table 3.0 identified that the 'Pre-Season' component of the cycle consists of a 6 week, 3 phase program design, where 5 of the 6 weeks are concentrated on developing power. The heavy emphasis on training for power, is intended to mimic the high impact and power demands that the athlete will be subject to at the onset of training camp.

Phase IV of macrocycle 3 is based on developing Football position specific skills. It is during this 6-7 week conditioning camp where the athlete participates in a greater volume of practice situations, with less emphasis on weight heavy weight training. A strength training program is required during this phase, however it is specific to targeting the recommendations suggested by the coaching staff following the assessment of pre-camp testing results.

Macrocycle 4 is based on a 14 week competitive season and play-off preparation schedule. A general conditioning program is recommended to prevent muscle atrophy, and to maintain muscle strength. The research supports maintenance of anaerobic power throughout a competitive season, however, depending on playing status, a player might not endure the physical stress required to maintain their FFM and straight / power profiles. A review of Table 11.0 and Appendix 6.0 will identify a typical weekly Football training schedule, and general in-season Football specific weight training program.

Practical Applications

In review of the published Football specific TMA literature, and the mechanisms regulating anaerobic and muscle fibre adaptations, the practicing Football strength and conditioning professional is recommended to develop position specific conditioning programs concentrating on the utilization of 1:6 work to rest ratios and anaerobic energy systems.

Due to the lack of Football specific TMA positional assessment of distances covered per play, the strength coach must integrate specificity in their program design, factoring to include team strategy and offensive/defensive play schemes, and positional demands.

While the strength of, and purpose of periodization based training is to provide the Football athlete with schedule periods of fluctuating training intensity, a degree of flexibility must be applied. Collegiate athletes are students first, athletes second. While many athletic programs lose sight of fact, it remains true, and as such, program design must reflect the academic demands of the athlete. Scheduling individual training sessions must maintain an element of flexibility to prevent over-training, over-reaching, and psychological fatigue.

The periodized training model and the resistance and training programs outlined are examples of training schemes that can develop enhanced Football specific abilities. These programs are mere examples based on application theoretical principles. Conditioning coaches are encouraged to apply the techniques and models described while integrating personal observation and field tested experience in developing conditioning programs for their Football athletes.

The Periodization Model for Resistance Training

Table 2.0

Period	Preparation → First Transition			Competition		2nd Transition
	Hypertrophy/Endurance	Basic Strength	Strength / Power	Peaking	Maintenance	
Intensity	Low to Moderate	High	High	Very High	Moderate	Recreational Activity
	50-75% of 1 Repetition Max (1RM)	80-90% of 1RM	87-95% 1RM* 75-90% 1RM^{X}	>93% 1RM	~80-85% of 1RM	
Volume	High to Moderate	Moderate	Low	Very Low	Moderate	
	3-6 Sets	3-5 Sets	3-5 Sets	1-3 Sets	~2-3 Sets	
	10-20 Repetitions	4-8 Reps	2-5 Reps	1-3 Reps	~6-8 Reps	

* is recommended to induce Strength adaptations

^{X} is recommended to induce Power adaptations

Adapted from 'The Periodization Model for Resistance Training' in NSCA's Essential's of Strength Training & Conditioning 2nd Ed.

Table 3.0

2007-2008 NCAA Division IA American Football Full Year Periodized Training Model

January			February			March			April				May					June				July				August					September				October				November				December			
Week			Week			Week			Week				Week					Week				Week				Week					Week				Week				Week				Week			
1	2	3	4	5	1	2	3	4	1	2	3	4	1	2	3	4	5	1	2	3	4	1	2	3	4	1	2	3	4	5	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
			MacroCycle 1			MacroCycle 2												MacroCycle 3													MacroCycle 4															
	III	IV	Phase I	II	III	Phase I	Phase II		Phase III	IV			Phase I	II	III	Phase IV														Phase I												Phase II			
offs	T	R	H	BS	R	H	BS		S / P	P	R/T		S / P	P	R	T	Football Specific Drills													14 Week Regular Season Schedule												Play-Offs			
			Winter Conditioning			Off-Season Conditioning												Pre-Season								Training Camp / Exhibition					Rehabilitation and Maintenance Conditioning															
→	cleanse		← Protein & Amino Acid Supplementation →						←Creatine Cycle→				← Protein & A.A →					cleanse				← Branched Chain Amino Acid & Protein Supplementation →																									
← Multi-Vitamin and Essentail Fatty Acid Supplementation →																																													

S / P = Strength and Power Phase

P = Power Phase

H = Hypertrohphy Phase

BS = Basic Strength

T = Testing

Bowl Championship Games

R = Rest / Transition Period

Table 4.0

1 Week MicroCycle Segment of MesoCycle 1

Phase I - Hypertrophy - January 20 - February 9

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Strength	Upper Body	Lower Body	Upper Body	Lower Body	Upper Body	Lower Body
Training Rest	Strength	Strength	Strength	Strength	Strength	Strength
Day	Form Running	Form Running	Long Dist. Run	Off Run Training	Form Running	Form Running
Long Dist. Run	Flexibility	Flexibility	Flexibility	Flexibility	Flexibility	Flexibility

Table 5.0

Winter Conditioning Phase I MesoCycle I & 2 Weight & Run Training Session Schedule

Time of Day	Type of Training
3:30pm	Start of Weight Training
5:00pm	End of Weight Training
5:05pm	Report to 'Form' Running Coach
5:10pm	Start 'Form' Running Session
5:16pm	End of 'Form' Running Session
5:20pm	Report to Interval Running Coach
5:25pm	Start of Interval Running Session
5:40pm	End of Interval Running Session
5:45pm	Report to End of Practice Meeting and Stretch / Flexibility Session
6:00pm	End of Training Day

Table 6.0

Interval Running Training Schedule

Work to Rest Intervals

5 - 20m sprint to 23sec rest
5 - 30m sprint to 32sec rest
5 - 36.6m sprint to 38sec rest
2 - 100m sprint to 80sec rest

Interval Running Schedule

5 - 20m's at 23seconds	5 - 36.6m's at 38seconds
1:20 Whistle	7:20 Whistle
1:30 Horn	7:30 Horn
1:43 Whistle	7:58 Whistle
1:53 Horn	8:08 Horn
2:06 Whistle	8:36 Whistle
2:16 Horn	8:46 Horn
2:29 Whistle	9:14 Whistle
2:39 Horn	9:52 Whistle
2:52 Whistle	10:02 Horn
3:02 Horn	10:30 Whistle
3:15 Whistle	**80 seconds Rest**
45 seconds Rest	1 - 100m's at 80seconds
5 - 30's at 32seconds	11:40 Whistle
3:50 Whistle	11:50 Horn
4:00 Horn	13:00 Whistle
4:22 Whistle	13:10 Horn
4:32 Horn	14:20 Whistle
4:54 Whistle	
5:04 Horn	Total Time Spent in Sprint
5:26 Whistle	Training
5:36 Horn	14.5 minutes
5:58 Whistle	
6:08 Horn	
6:30 Whistle	
60 seconds Rest	

Running Back has both hands on line - a whistle will blow 10 sec. before each sprint - when the horn goes the athlete sprints the full distance - they ***walk*** back to startline.

Table 7.0

2 Week MicroCycle of Phase II of MesoCycle 3 'Pre-Season / Training Camp'

Phase II - Power - June 30 - July 13

1st Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Power Training Rest Day	Power Training	Power Training Rest Day	Power Training	Power Training Rest Day	Power Training	Power Training Rest Day
		Agility Training		Agility Training		
	Long Run	Form Running		Form Running	Long Run	

2nd Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Power Training	Power Training Rest Day	Power Training	Power Training Rest Day	Power Training	Power Training Rest Day	Power Training
	Agility Training		Agility Training		Agility Training	
	Form Running	Long Run	Form Running	Long Run		

Table 8.0

Schedule for Full-Season Phase I MesoCycle 2 Agility Training Session

	Report to Agility Training Coach
	Go to Assigned Agility Session
0:00mins	Whistle blows signalling start
	of Agility Session (1)
	1. Down Agilities
	a) Quarter Eagle
	b) 2 Point Seat Roll
	c) Grass Drill
	d) 4 Point Wave Drill
8:00	Horn Blows - 45 sec to get to
	next station
8:45mins	Whistle blows start next station (2)
	2. Jumping Drills
	a) Bags (4 ways)
	b) 13.7m (15yard) Shuttle Run
	c) Standing Long Jump
16:45mins	Horn Blows - 45 sec to get to
	next station
17:30mins	Whistle blows start next station (3)
	3. Up Agilities
	a) Wave Drill
	b) 9.15m (10yard) Shuttle Run
	c) Big S
25:30mins	Horn Blows - 45 sec to get to
	next station
26:15mins	Whistle blows to start last station (4)
	4. Quick Cals
	a) Side Straddle Hop
	b) Right Hand-Left Toe
	c) Tail Gunner
	d) Quarter Turns
	e) Jump Rope
34:15mins	Horn Blows to signal end of Session

Table 9.0

Agility Session Drill Description and Training Purpose

Drill	Drill Technique Description	Purpose
5.1.1a) Quarter Eagle	On 'set' command, athlete explodes and breakdowns into a Football Athletic position - coach directs left of right, the athlete quickly makes a quarter turn in that direction and moves back	To develop and improve quickness and reaction to visual stimuli.
5.1.1b) 2 Point Seat Roll	On set command, athlete assumes Football position, with rapid foot taps. The coach directs left or right, and upon direction from the coach breaks down to the 'right' side, by exploding off the right leg, breakdown the left ankle, throwing the right arm over the body in the direction of the roll to provide momentum to complete the roll. The left hip, butt, and right hip hit the floor as the player pops up back into the Football position	To develop the quickness and ability to react. Teaches a player the ability to roll and come up quickly in a Football position
5.1.1.c) Grass Drill	On set command, athlete assumes Football position with rapid foot taps. Coach give the signal for Front or Back, and the player drops down and pops up back into Football position	To develop the ability to hit the ground and get up quickly
5.1.1.d) 4 Point Wave Drill	On set command, players jump on to mat with good football position, coach will give command 'hit it' and direct the athlete to one of 4 points - front/back/left/right	To develop Footwork and quickness
5.1.2.a) Bags (4 ways)	Do 4 things with the bags 1) run the bags forwards one foot in each hole (a ring or tire) 2) both feet in each hole, 3) Cross over start, 4) running parallel both feet in each hole	Quickness, Change of Direction, explosive ability
5.1.2.b) 13.7m Shuttle Run	Start in 3-point Football Stance, Sprint 5 yards touch line, turn to the start line, pivot, sprint to the 10 yards, touch line, sprint to start, tum, sprint to 15 yard line, sprint back to start	Short distance sprinting ability
5.1.2.c) Standing Long Jump	Start in a 2 point stance with toes on the line, explode and jump as far as possible	Explosive ability
5.1.3.a) Wave Drill	Start in Football position, sprint forward 5 yards and break down with rapid toe taps, upon direction from coach, and sprint in that direction until next command	Develop quickness while changing directions
5.1.3.b) 9.15m Shuttle Run	Start on line in football position, sprint 5 yards, turn 180 degrees, sprint 10 yards, pivot 180 degrees, and sprint last 5 yards.	Develop quickness while changing directions.
5.1.3.c) Big S	Set-up cones (6 total) in a 5m width, 15m length rectange - starting at one end, sprint to top cone, shuffle to cone to the right, back peddle to opposite cone, shuffle to cone on the right sprint through the last cone.	To develop fast foot speed and control
5.1.4 Quick Cals	On command, players assume a football position. Exercises will be performed in sharp, quick motion with one move executed per command. Side Straddle Hops - Side Straddle hop, hands move from middle to head to thigh Right Hand - Left Toe - Right hand to left toe, right hand to knee and back, left hand, Tail gunner - Toe touch, front squat, back to start Quarter Turns - Full quarter turnto left back to middle right and back to middle	

Table 10.0

Performance Test Battery

Test Day 1	Test Day 2
Strength	***Power / Speed***
Body Fat %	36.6m (40yrd) sprint
Fat Free Mass (kgs.)	9.15m (10yrd) sprint
5 Rep Max Hang Clean	12.7m (15yrd) sprint
1 Rep Max Bench Press	ProAgility
1 Rep Max Back Squat	60 yard Shuttle
225lb Bench Press	100m Sprint
	Vertical Jump
	Broad Jump
	3 Cone Drill

Table 11.0

1 Week MicroCycle Training Segment of Marcocycle 4

In-Season Weekly Training Schedule

Sunday		Monday		Tuesday		Wednesday		Thursday		Friday		Saturday	
Time	*Requirement*	*Time*	*Requirement*	*Time*	*Requirement*	*Time*	*Requirement*	*Time*	*Requirement*	*Time*	*Requirement*	*Time*	*Requirement*
10am - 12pm	Review game Film as team	8:30 12pm	Mod to Heavy Weight Training		No Weights	8:30am- 12pm	Mod to Heavy Weight Training		No Weight		Travel Day	7:30-9	Team Breakfast
												10:00a	Arrive @ Field
	No Physical Training	2-4p	Study Hall	2-4p	Study Hall	2-4p	Study Hall	2-4p	Study Hall	p.m.	Helmet's only game plan practice on game field	11:30a	Pre-Game Meal
		4-4:45	Position Meeting	4:30	Full	4-5p	Game Strategy Mtg	4:30p	Full			12:30p	Game
1pm- 10pm	NFL Homework	5:00 8:30p	Team Practice	to 8:30p	Contact Practice	5:00p- 9:00p	Helmets and Shoulder Pads	to 8:30	Contact Practice			pm	Travel Home

PERFORMANCE TRAINING SYSTEMS

NCAA Division IA Football - Winter Conditioning Phase II - 3 Week Lower Body Basic Strength Cycle (March 31 - April 27)

Athlete Name:

Outline

5 min. of cardio warm-up
5 min. of Dynamic Warm-up
40 -50 Minutes of Strength Training

Training Notes

Phase II of your Winter Conditioning Program is designed to develop and increase you overall 'basic' strength.
It is recommended that you work through 5 set of 8 reps for each exercise - if you cannot complete 8 reps, record reps completed.
It is recommended that you work your 5 sets through a 'Pyramid' Style cycle, where your set intensity is structured at -
Set 1 - 80% of your 1RM strength, Set 2 - 85% 1RM, Set 3 - 90% 1RM, Set 4 - 85% 1RM, Set 5 - 80% 1RM.
Your IRM weights will be established during Fitness Testing - if an exercise is not tested, speak with your conditioning coach.

This work-out is to be completed 3 times a week - For progressions, speak with your conditioning coach
Attemp to complete this workout through a 1:2 work to rest ratio
Attemp to follow a 1-2-1-3 lift to lower tempo through each repetition

Targeted Muscle Groups: Lower Body

Progression Tracking Chart

		Date:						Date:						Date:						Date:						Date:						Date:						Date:					
		Workout 1						Workout 2						Workout 3						Workout 4						Workout 5						Workout 6						Workout 7					
	Rps	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S5
Dynamic warm-up																																									
Body Squats	15																																								
Forward Body Weight Lunges	15																																								
Strength Training Exercises																																									
Olympic Bar Front Squats	8																																								
Hack Squat	8																																								
Deadlifts	8																																								
Romanian Lifts	8																																								
Olympic Bar Plyo' Box Step Ups	8																																								
Single Leg Hip Sled	8																																								
Core Exercises																																									
Prone lying leg raises	20																																								
Stability Ball Crunches	30																																								
Roman Bench Back Extensions	15																																								
Rehabilitation Exercises																																									

Appendix 2.0

PERFORMANCE TRAINING SYSTEMS

NCAA Division IA Football - Winter Conditioning Phase II - 3 Week Upper Body Basic Strength Cycle (March 31 - April 27)

Athlete Name:

Outline

5 min. of cardio warm-up
5 min. of Dynamic Warm-up
40 -50 Minutes of Strength Training

Training Notes

Phase II of your Winter Conditioning Program is designed to develop and increase you overall 'basic' strength.
It is recommended that you work through 5 set of 8 reps for each exercise - if you cannot complete 8 reps, record reps completed.
It is recommended that you work your 5 sets through a 'Pyramid' Style cycle, where your set intensity is structured at -
Set 1 - 80% of your 1RM strength, Set 2 - 85% 1RM, Set 3 - 90% 1RM, Set 4 - 85% 1RM, Set 5 - 80% 1RM.
Your IRM weights will be established during Fitness Testing - if an exercise is not tested, speak with your conditioning coach.

This work-out is to be completed 3 times a week - For progressions, speak with your conditioning coach
Attemp to complete this workout through a 1:2 work to rest ratio
Attemp to follow a 1-2-1-3 lift to lower tempo through each repetition

Targeted Muscle Groups: Upper Body

Progression Tracking Chart

		Date:						Date:						Date:						Date:						Date:						Date:						Date:					
		Workout 1						Workout 2						Workout 3						Workout 4						Workout 5						Workout 6						Workout 7					
	Rps	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S4	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S5
Dynamic warm-up																																									
Dumbbell Push-Ups	15																																								
5lb Weight Plate Shoulder Dynamic ROM	15																																								
Tricep Dips	15																																								
Strength Training Exercises																																									
Bench Press	8																																								
High Lat Pull-Down	8																																								
Standing Dumbbell Shoulder Press	8																																								
T-Bar Back Row	8																																								
Incline Dumbbell Chest Press	8																																								
Single Arm Cable Lateral Shoulder Raise	8																																								
Close Grip Pull-Ups	15																																								
Low Cable Chest Flye's	8																																								
Dumbbell Shoulder Shrugs	8																																								
Core Exercises																																									
Stability Ball Crunches	30																																								
Bird Dog	15																																								
Superman's	20																																								
Rehabilitation Exercises																																									

Appendix 3.0

PERFORMANCE TRAINING SYSTEMS

NCAA Division IA Football - Off-Season Conditioning Phase I - 3 Week Upper Body Hypertrophy Cycle (March 3 - March 30)

Athlete Name:

Outline

5 min. of cardio warm-up
5 min. of Dynamic Warm-up
40 -50 Minutes of Strength Training

Training Notes

This program represents Phase II of your Off-Season Conditioning Program - It is designed to induce Increases in Muscle Size
When selecting weight to be lifted for each exercise select a weight that is equal to 70% of your 1RM for that exercise. The results from your March 4th & 5th testing will provide you with your 1Rep Max values. If exercise was not tested - speak with your Conditioning Coach
You are to complete each exercise through a 5 set 12 rep ratio - Allow for 60 seconds rest between sets on Mon & Fri, 45 secs on Wed.
Attempt to follow a 1-2-1-4 repetition tempo - Lift/Push the weight in a 2 count, pause for 1, lower for a 4 count, pause for 1, next rep.
This Work-Out is to be completed 3 time per week
Monday & Friday complete this work-out as a 'Heavy' Work-Out - Full 5 sets before moving to the next exercise.
Wednesday complete this work-out as a 'Circuit' - complete one set of each exercise separated by the solid black line, before compltng a 2nd set.
Track your workouts - in the Traingle boxes in the Set columns (S1,S2 etc.) record the weight you pushed/lifted in the top box, and the reps in the bottom box. Tracking the volume of work you complete in your workout will allow the Strength & Conditioning Team to assess your progress as you move through this phase of the Off-Season Conditioning Program. When this tracking card is full - get a new one

Targeted Muscle Groups: Upper Body

Progression Tracking Chart

		Date:						Date:						Date:						Date:						Date:						Date:						Date:					
		Workout 1						Workout 2						Workout 3						Workout 4						Workout 5						Workout 6						Workout 7					
	Rps	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S4	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S5
Dynamic warm-up																																									
BOSU Push-Ups	15																																								
Wide Grip Pull-Ups	10																																								
Chin-Ups	15																																								
Hypertrophy Training Exercises																																									
Hammer Strength Chest Press	12																																								
Hammer Strength Jammer	12																																								
Standing on Inverted BOSU Squat Back Row	12																																								
Hammer Strength Military Press	12																																								
Bench Press	12																																								
Complex Multiplaner Dumbbell Shoulder Raises	12																																								
Deadlifts	12																																								
Seated Reverse Shoulder Pulls on Chest Flye Machine	12																																								
Single Arm Dumbbell Back Row	12																																								
Core Exercises																																									
Seated Balance on Hips Medicine Ball Torso Twists	20																																								
Decline Bench Crunches	30																																								
Pike Crunches	15																																								
Rehabilitation Exercises																																									

PERFORMANCE TRAINING SYSTEMS

NCAA Division IA Football - Off-Season Conditioning Phase I - 3 Week Lower Body Hypertrophy Cycle (March 3 - March 30)

Athlete Name:

Outline

5 min. of cardio warm-up
5 min. of Dynamic Warm-up
40 -50 Minutes of Strength Training

Training Notes

This program represents Phase II of your Off-Season Conditioning Program - It is designed to induce Increases in Muscle Size
When selecting weight to be lifted for each exercise select a weight that is equal to 70% of your 1RM for that exercise. The results from your March 4th & 5th testing will provide you with your 1Rep Max values. If exercise was not tested - speak with your Conditioning Coach
You are to complete each exercise through a 5 set 12 rep ratio - Allow for 60 seconds rest between sets on Mon & Fri, 45 secs on Wed.
Attempt to follow a 1-2-1-4 repetition tempo - Lift/Push the weight in a 2 count, pause for 1, lower for a 4 count, pause for 1, next rep.
This Work-Out is to be completed 3 time per week
Monday & Friday complete this work-out as a 'Heavy' Work-Out - Full 5 sets before moving to the next exercise.
Wednesday complete this work-out as a 'Circuit' - complete one set of each exercise separated by the solid black line, before complting a 2nd set.
Track your workouts - in the Traingle boxes in the Set columns (S1,S2 etc.) record the weight you pushed/lifted in the top box, and the reps in the bottom box. Tracking the volume of work you complete in your workout will allow the Strength & Conditioning Team to assess your progress as you move through this phase of the Off-Season Conditioning Program. When this tracking card is full - get a new one

Progression Tracking Chart

		Date:						Date:						Date:						Date:						Date:						Date:						Date:					
Targeted Muscle Groups: Lower Body		Workout 1						Workout 2						Workout 3						Workout 4						Workout 5						Workout 6						Workout 7					
	Rps	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S5
Dynamic warm-up																																									
Rapid Single Leg Knee Cross Body to Hip Raises	15																																								
Body Squats	10																																								
Forward Stationary Lunges	15																																								
Hypertrophy Training Exercises																																									
Back Squats	12																																								
Dumbbell High Knee Step-Ups	12																																								
Hip Sled	12																																								
Olympic Bar Split Squat Lunges	12																																								
Bulgarian Squats	12																																								
Multi-Hip Machine Hip Adduction	12																																								
Multi-Hip Machine Hip Abduction	12																																								
Core Exercises																																									
Stability Ball Crunches	30																																								
Bird Dog	15																																								
Superman's	20																																								
Rehabilitation Exercises																																									

PERFORMANCE TRAINING SYSTEMS

NCAA Division IA Football - Off-Season Conditioning Phase III - 2 Week Total Body Power Cycle (May 19 - June 1))

Athlete Name:

Outline

5 min. of cardio warm-up
5 min. of Dynamic Warm-up
40 -50 of Power Training

Training Notes

This 2 week 'Total Body Power' Program is designed to be completed 8 times over the next 14 days - allowing for a days rest between each work-out.

Attempt to follow a 5 Set, 5 Repetition ratio across all exercises. Your rep weight will be established as a function of your March 4&5 test 1RM results - Repetition weight will be set between 80-90% of your 1RM. If the exercise wasn't tested, speak with your Conditioning Coach to have your training weight set.

Keys to Maximal Results

Treat every rep as the last rep.

Focusing on Technique and Control, Explode through ervery Rep.

We Finish as Strong as we Start

We are trying to work within a 1:6 work to rest ratio - Allow a full 80 seconds before initiating the next set.

Complete all sets of 1 exercise before moving to the next.

Power = Speed + Weight + Distance - Control that push, hit it hard, Train for Power, Train for Success!

Progression Tracking Chart

Targeted Muscle Groups: Total Body

		Date:						Date:						Date:						Date:						Date:						Date:						Date:					
		Workout 1						Workout 2						Workout 3						Workout 4						Workout 5						Workout 6						Workout 7					
	Rps	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S4	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S5
Dynamic warm-up - allow 45 seconds rest b/n sets																																									
Rapid Single Leg Knee Cross Body to Hip Raises	15																																								
Split Squat Stance, Rapid Forward Knee Raises	15																																								
Rapid Push-Ups	20																																								
Power Training Exercises																																									
Power Snatch	5																																								
Hang Cleans	5																																								
Smith Machine Bench Throws	5																																								
Smith Machine Jump Squats	5																																								
Olympic Bar Squat to Triple Extension Power Press	5																																								
Bent-Over Olympic Bar Explosive Back Row	5																																								
Single Leg Kneeling Explosive Med Ball Chest Passe	5																																								

NCAA Division IA Football - In Season Maintenance Conditioning Program (Start to End of Season)

Athlete Name:

Outline

5 min. of cardio warm-up
5 min. of Dynamic Warm-up
40 -50 Minutes of Strength Training

Training Notes

This program is designed to be completed 2 times a week throughout the duration of the competitive season.
It is recommended that this workout be completed every Tuesday and Thursday, however, this is subject to change based on coach demands.

It is recommended that you complete 8-12 repetitions across 3 sets of each exercise.
We are going to attempt to work within progressively loaded sets - Set 1 - 75%1RM, Set 2 - 80%1RM, Set 3 - 85%1RM
Complete this work-out within a 1:2.5 work to rest ratio completing 3 sets of each exercise before moving to the next.
Speak with your conditioning coach about integrating in progressions if you think you're ready.

Progression Tracking Chart

Targeted Muscle Groups: Lower Body

		Date:						Date:						Date:						Date:						Date:						Date:						Date:					
		Workout 1						Workout 2						Workout 3						Workout 4						Workout 5						Workout 6						Workout 7					
	Rps	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S4	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S5	W	S1	S2	S3	S4	S5
Dynamic warm-up																																									
Body Squats	15																																								
Forward Body Weight Lunges	15																																								
Strength Training Exercises																																									
Olympic Bar Back Squats	10																																								
Dumbbell Chest Press	10																																								
Seated Cable Back Row	10																																								
Seated Dumbbell Military Press	10																																								
Incline Bench Dumbbell Chest Flye's	10																																								
Dumbbell Plyo Box Step-Ups	10																																								
Bent-Over Olympic Bar Back Row	10																																								
Barbell Pull-Ups	10																																								
Core Exercises - Complete 5 core exercises of your choice																																									
Rehabilitation Exercises																																									

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