REVIEW OF RESEARCH

INTERRELATION BETWEEN PHYSICS AND SPORTS

Shri Basavaraj Gurav[1] , Dr Parappa Ramateerth[2] and Dr. Devidas G. B.[3]

[1]Research scholar, Department of Physics, Kuvempu University Shankaraghatta.
[2] Physical Director, SPMS Arts and Commerce College Raibag.
[3] Associate professor, Department of Physics, Kuvempu University Shankaraghatta.

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ABSTRACT:

This study is aimed to know how physics and physical education are interrelated each other. In this way we should view on basic concepts of both disciplines. The physics of sports has broad applications, and is very useful for boosting performance level in a variety of athletic disciplines and other games. A lot of the time, good sportsman performance is highly based on proper control and well coordination of movements. Other times, it helps to have a good understanding of the physics taking place, and then using or applying of this knowledge to their advantage. Well knowing about basic physics concepts definitely helps to athletes off all events to increase their performance level in short time period of training. Main concepts of physics like equilibrium, levers, biomechanics, gravity, motion, force, acceleration will generally use in all games and all angles games so getting well knowledge about these all is very important to a sports person.

OBJETCIVES:

To know the interrelation between sport and physics and also to know the importance of physics knowledge in sports performance, sports coaching and in using sports equipments etc.

METHODS:

We described the both physics and sports concepts with suitable and scientific evidences which shows how both disciplines inter related each other. And with the help of suitable examples we explained the importance of physics knowledge in sports sector.

KEYWORDS : *sports, physics, equilibrium, levers, biomechanics, gravity, motion, force, acceleration.*

INTRODUCTION:

A lot of athletes may not know it but physics has a lot to do with the wonderful world of sports. So how physics is related to sports..? This study will help the people who do not know that physics can really help in understanding sports techniques. In schools students would complain because they do not know why they have to study all about physics. Some will say that they would not need it in the future for they do not dream to be a physicist someday or they just cannot see the reason why. They do not know that physics can be used in relation to sports. After discussing about fallowing elements we will know how sports and physics are interrelated and knowing basic physics is how important to a sports person.

1. BIOMECHANICS:

Biomechanics is derived from

Greek words, BIO + MECHANICS. Bio means living thing and mechanics is a field of physics. Thus, it is the section of science which deals with the forces related to the body movements. it is the systematic study human body movements which created by joints, bones muscles and other parts. And also Biomechanics is defined as systematic study of mechanics of body joints. According to Wikipedia, "Biomechanics is the study of the structure and function of biological system of humans."

ITS OUTWEIGH IN SPORTS

1. Biomechanics knowledge to a coach or himself to a sportsman helps to Improves performance level in their events.
2. It helps to Improvement in technique of game or their events. In sports technique means performing their skills with help of their body movements with right time sense and according to game situation. In every game adopting technique at right time will makes ahead than opponents.
3. It helps to improve in training techniques. With the help of biomechanical methods training will done by very effectively. If a player practices the game skills with his biomechanical knowledge he will be master in those skills in very short time.
4. It helps to Prevents sports injuries. In games injuries also happened because of improper or imbalanced movement. With the help of biomechanical knowledge definitely there is low possibility of injuries such game situations like diving, landing, changing directions etc.
5. Study of biomechanics Helps in understanding human body. It's a better way to a sports person to understanding his body and it will definitely create coordination between his mind and body. And it will bring best performance which level he wishes.
6. Important aim of this discipline is to know safety principles of our body movements. It will bring deep knowledge about all movements of our body and its mechanisms.
7. And also it Helps in research work, Creates confidence in player, Helps in maintaining healthy body, Increases the popularity of sports.

2. NEWTON'S LAWs OF MOTIONS AND SPORTS

Newton's laws of motion form the basis for principles used in sport movements. Methods of training that depart from these laws would not make sense mechanically. Tips for efficient sport performances are built around these laws and principles. First, it helps to know that there are two basic types of motion. These come into play in combination when applying mechanical principles to sport skills:

FIRST LAW OF MOTION OR LAW OF INERTIA:

According to first law of motion an object at rest will remain at rest or an object in motion will remain at motion at constant velocity unless acted upon by a force.

Ex: A moving football slows down and then stops often sometime. It comes to rest due to the fraction between the ground and the ball.

Athletes can increase mass and/or velocity to realize proportional gains in momentum. For example, if a football player gains both weight and speed, it is more difficult for an opposing player to alter his path. When two or more motions are required, athletes must execute movements continuously in sequence. For example, if a javelin thrower hesitates or stops at the end of the approach just prior to the throw; the advantage of the approach is lost. To achieve skilled movements, athletes must effectively combine linear and angular motion. For example, a discus throwers body must move in a straight path from the back to the front of the ring while rotating with increasing velocity. Transfer momentum efficiently from each segment to the whole body. For example, a sprinter coming out of the starting blocks uses the driving action of his or her arms to contribute to the total momentum and direction of the body.

SECOND LAW OF MOTION OR THE LAW OFF ACCELERATION:

According to Newton's second law of motion, the rate of change of momentum of a body is directly proportional to the impressed force and takes place in the direction of force.

Ex: A cricket player while catching a ball moves his hands backward. Initially, the ball is moving with a certain velocity. The player has to apply a retarding force to bring the ballot rest in his hands.

Acceleration is proportional to force. For example, a sprinter increases acceleration by increasing the force that he applies against the track. Increasing force by 10% causes a 10% increase in acceleration. If he could lose fat weight but maintain the same level of force (power), acceleration would also increase. See Power Fitness. When rotating, lengthening the radius slows the rotation and shortening the radius increases rotation. For example, a diver rotates faster when the tuck is tightened, creating a shorter body radius. A pike produces slower rotation because the radius is longer. Maximum acceleration is achieved when all body forces are coordinated in the intended direction. Body actions that do not contribute to a skill should be minimized to prevent wasted energy or detract from productive movements. For example, a swimmer coordinates the body actions to generate maximum force while minimizing unnecessary movements that cause excessive bobbing or lateral deviations. When jumping, the path in the air is set upon take off. Once a long jumper is in the air, his or her arms or legs may cause body rotation, but the flight path is not affected.

THIRD LAW OF MOTION:

According to the Newton's third law of motion, to every action, there is always an equal and opposite reaction.

Ex: The swimmer pushes the water in the backward direction with a certain force. Water pushes the man forwards with an equal and opposite force.

To achieve maximum jumping height, push directly downward upon take off. The direction of counterforce is directly opposite that of the applied force, and the applied force is most effective when it is perpendicular to the supporting surface because "give" is minimized. Maximize counterforce with stable surfaces. If a surface is stable, it offers the same amount of force back as is generated against it. The less stable the surface, the less counterforce is returned. For example, sand does not offer a stable surface for running as compared to a concrete surface. Maximize total force. When batting (or for other striking skills), the total force at impact depends upon the both the momentum of the bat and the momentum of the ball. Stay in contact with the ground. In activities involving throwing, pushing, pulling, or striking, one or both feet should be kept in firm contact with the ground until the force application is complete.

3. LEVERS AND SPORTS

Lever is a rigid bar which is capable of rotating about a fixed point called the fulcrum. Lever systems where a greater force needs to be applied than the load to be moved is said to provide a mechanical disadvantage. However these levers are of use to us in sports as they allow us to move the load a large distance, with a large range of motions. Our arms, legs or any body part to move the appropriate muscles and bones must work together as a series of levers. A lever comprises three components.

Example: see-saw, scissors, pulley etc. Skeletal system also acts like lever.

CLASS I LEVER – A first class lever has the fulcrum located between the force and the resistance.
Ex: See-saw, a pair of scissors, bicycle brake.
CLASS II LEVER – A second class lever has the load or resistance located Between the fulcrum and the force.
Ex: wheel barrow, punching machine, Straight pushups, calisthenics etc.
CLASS III LEVER – A third class lever has the force located between the fulcrum and the resistance.
Ex: baseball bat, Tennis racket, boat-paddles.

4. EQUILIBRIUM OR STABILITY:

EQUILIBRIUM: is defined as a state of balance or a stable situation, where opposite forces cancel each other out and where no changes are occurring.

Stability principles give athletes rules about holding positions and staying on balance when running. They guide training for improving firmness of positions both for static balance and dynamic balance. An athlete's center of gravity is the exact middle of the body around which it can rotate freely in any direction and where the weight balanced on all opposite sides. It exists at a point along the midline of the body at about 55% of the athlete's height. To maintain balance when still, the athlete's center of gravity must remain over the base of support. For example, beginning a free weight lifting movement, such as the squat, requires the lifter to hold a standing position. To regain balance when lost, an athlete can enlarge the base of support and reposition the center of gravity over it. Example: Placing the feet wider to prevent falling after being pushed helps recover balance. When lifting or carrying an object, shift the body weight in order to maintain balance. Example: Lean in the opposite direction when carrying a heavy equipment bag. An athlete can become more stable by lowering the center of gravity. Example: A shot-put follow-through involves bending the knees to prevent fouling. The greater the friction between the supporting surface and the athlete's body, the greater the ability to maintain balance. Example: Wearing shoes that prevent excessive sliding on a playing surface.

5. CENTRE OF GRAVITY AND SPORTS

Centre of gravity is that point in a body or system around which it's mass or weight is evenly distributed or balanced and through which the force of gravity acts. The Centre of gravity is fixed, provided the size and shape of the body do not change. Every single body and thus the athletes themselves, is made up of individual components each of which has its own Wight. So our Wight is just the sum of individual weights, of components of such as our arms, legs, etc. the point, about which the distribution of these individual weights is symmetrical, is the center of gravity of the body. Thus, if a body has more mass distributed in this upper part, as the center of gravity of an average person is located approximately at a higher of one meter, thus being above the waist. Throw a ball in the air and gravity pulls it straight back down. Not everything moves like this when gravity acts on it. Most of objects are not nice, neat shapes like balls. That means gravity acts on them in more complex ways. Even so all objects behave as thought their mass is concentrated at a point called their center of gravity.

6. FORCE:

Force can be defined as a push or pull by one body acting upon another. Force is a product of mass and acceleration of an object or person. Principles of force offer guidance for teaching sport techniques and leveraging training strategies that require the development of force--pushing or pulling. Force is the product of the mass (weight) and acceleration of an object or person. These principles and examples concern (a) general applications, (b) athlete-produced force, and (c) force dissipation. All forces should be applied in the intended direction. Deviations from the required line of force waste energy. For example, a runner who points his toes outward or bounces excessively exerts wasted force and energy. Greater velocity is generated if force is applied over a longer distance. For example, an outfielder can generate greater force for throwing to home plate by using a long winding up, rotating the trunk, shifting body weight from the back leg to the front, and following through.

If You Understand Physics You Can Be Better At Sportsman:

After knowing about relation between sports and physics we definitely decides that one who had the knowledge of all basic concepts of physics he will become better one sports person than anyone. In physics there are laws that were defined by physicists like Sir Isaac Newton and Albert Einstein. Such laws can be made related to all sports today. Like Newton's first law that pertains to inertia can be related to bowling. In Sir Isaac Newton's first law, he concluded that an object would remain in its resting state when it is not moved by a force and will eventually stop because there is friction. So no matter how long or never ending the bowling alley is, the ball will lessen its motion and

will finally stop. Track and Field also has a relation to Newton's laws. Did you ever notice that when a runner reaches the finish line, instead of suddenly stopping at the end, they will still be running for a few steps and then eventually stop. What you are seeing during that event is the law of inertia or also the first law of Newton. Also in this type of sport, the second law of Newton can also be applied.

You may also hear a sportscaster shout out the words, "That player is now accelerating" without knowing what acceleration really means. It is not merely moving fast but rather it is how much you change while moving fast. A person may not be told to be accelerating if there is no change in position. Momentum is also a much-used term when it comes to sports and what better way to understand it is through physics. Momentum means that it is the amount of motion that an object has. Meaning, the more momentum, and the harder it is to stop something suddenly.

CONCLUSION:

These are just some of the things that you need to learn and understand when relating physics to sports. Now, after reading this study, you will notice yourself suddenly interested with what your physics teacher is saying because now you know that it will really be a big help for you especially once you enter into the world of sports.

REFERENCES:

1. https://www.real-world-physics-problems.com/physics-of-sports.html
2. https://aapt.scitation.org/doi/abs/10.1119/1.5055336?journalCode=pte
3. https://www.elsevier.com/connect/the-physics-of-sports
4. https://www.physio-pedia.com/Biomechanics_In_Sport
5. Bucher charles A.FOUNDATIONS OF PHYSICAL EDUCATION. saint Louis the C.Vmosby company. 1975