

Application of First Law of Thermodynamics in Merpati Putih Martial Art Practice to Develop Human's Inner Energy

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Abstract

Merpati Putih is one of Indonesian traditional martial art that had been practiced since the New Mataram Kingdom but still being exist at the present. It activates inner energy based on calmness. Inner energy is a living energy from human's cell that can be developed by anaerobic-hypoxic or breathing practice regularly. This research aims to discuss about application of First Law of Thermodynamics in Merpati Putih regular practice empirically. The applied method was based on the researchers' own experiences as member of Merpati Putih's practice group (Kelompok Latihan/Kolat) combined with descriptive qualitative method by observing existing researches and also mathematic calculations use First Law of Thermodynamics formulas to identify value of potential energy that can be developed by Merpati Putih regular practice. Result of the research is 50 kilograms human who practice regularly would have potential energy that can break 238 aerated concrete blocks (Hebel).

Keywords: First Law of Thermodynamics; Inner Energy; Merpati Putih

Introduction

Indonesia is a country with largest culture diversity in the world. The diversity is caused by large number of ethnics that reach 300 groups [1]. A shape of Indonesian culture diversity is shown by the martial arts inherited generations by generations. *Merpati Putih* is an Indonesian traditional martial art that had been practiced since the New Mataram Kingdom at Sultan Amangkurat II's era (1677-1703) but still being exist and inherited generations by generations until now. Phrase *Merpati Putih* officially is acronym in old java language of *Mersudi Patitising Tindak Pusakane Titising Hening* that means "find truly the right way by calmness" [2]. The calmness is base of inner energy activation in *Merpati Putih* practice.

Inner energy is a living energy Inner energy is a living energy from human's cell that can be developed by anaerobic-hypoxic or breathing practice regularly [3]. In *Merpati Putih* martial art, the anaerobic-hypoxic practice is practiced regularly by breathe practice that commonly devided into two groups, development (*Pembinaan*) and processing (*Pengolahan*). Each group contains of some practical motions with one main purpose to get inner energy through breath process. So that this research aims to to discuss about application of First Law of Thermodynamics in *Merpati Putih* regular practice empirically.

Materials and Methods

This research mainly was done empirically based on the researchers' own experiences as member of *Merpati Putih's* practice group (*Kelompok Latihan/Kolat*) combined with descriptive qualitative method by observing existing researches and also mathematic calculations use First Law of Thermodynamics formulas to identify value of potential energy that can be developed by *Merpati Putih* regular practice. The researchers' own experiences are to emphasize position of the researchers in qualitative method as key instrument [4]. The experiences then complied by observation to the existing researches that studied earlier about *Merpati Putih* Martial Art especially in connection with inner energy. The existing researches and the other resources was also shown the First Law of Thermodynamics formulas to calculate the value of potential energy by form of inner energy.

Result and Discussion

Result

The first result of the research is chemical reaction of cellular respiration that can write as:



This reaction binds inorganic phosphates and adenosine diphosphates (ADP) into adenosine triphosphate (ATP) as 'energy bank' compound that can save 33.5 kilojoules energy in each molecule [5]. According to the reaction (I), total number of saving energy by the ATP during each reaction is equal to:

$$38 \cdot 33.5 = 1,270 \text{ kilojoules} \dots\dots\dots(\text{II})$$

Glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) in the reaction (I) occurs from cracking of carbohydrate polymer named amyllum (starch) contained in some carbohydrate resources e.g. rice, wheat, peanut, etc. The carbohydrate has been saved in body muscle as glycogen before the reaction (I) start. Body muscle of the human who train physical practices regularly can contain ± 130 -230 millimoles glycogen of each kilogram body mass [6]. So that a 50 kilograms body mass of practical human will contain:

$$50 \cdot 180 = 9,000 \text{ millimoles} = 9 \text{ moles} \dots\dots\dots(\text{III})$$

180 is median of 130-230.

According to principle of mass conservation (Lavoisier's Law), number of carbohydrates in body muscle will be equal to number of glucoses in the reaction (I). So that total number of saving energy during respiration will be equal to:

$$1,270 \cdot 9 = 11,430 \text{ kilojoules} \dots\dots\dots(\text{IV})$$

The number (IV) is internal energy (ΔU) contained by each human body cell. It must be distinguished with the total energy (energy gross product) produced by respiration itself because the internal energy means energy saved by the ATP (as reserve energy). So that in this research the internal energy also mentioned as potential energy of the human.

In this case of research, existing of the potential energy will be shown by the breaking of aerated concrete blocks commonly known as *Hebel*. Its dimensions are shown below:

Length = 600 millimeters

Wide = 200 millimeters

Thick = 100 millimeters

Young Modulus = 4 Newton/square millimeters

The energy needed to break a block is equal to:

$$\text{Energy} = 4 \cdot 600 \cdot 200 \cdot 100 = 48,000,000 \text{ Newton} \cdot \text{millimeters} = 48,000 \text{ joules} \dots\dots\dots (\text{V})$$

To make the number (V) equal with the number (IV), it was converted into 48 kilojoules. Then to know how many blocks can be break by the potential energy, the number (IV) is divided by the number (V):

$$11,430/48 \approx 238 \text{ blocks} \dots\dots\dots (\text{VI})$$

Finally, the number (VI) shows that the practice of *Merpati Putih* Martial Art can develop potential energy that equal to break 238 of aerial concrete blocks.

Discussion

The First Law of Thermodynamics explains that energy can neither be created nor be vanished during a process in spite of converted forms by forms [7]. It means that there is neither created energy because of respiration nor vanished energy because of work: the energy only transforms cyclically from a form into another form. By the First Law of Thermodynamics, it can be explained that works during a practice can generate heat, then the heat transformed into internal energy, and the internal energy will be potential energy to do another works (during a practice) or to do hard objects breaking (that usually practiced by *Merpati Putih* Martial Art).

Explanation of the First Law of Thermodynamics is started from that each gas (include Oxygen/ O_2) forms the thermodynamic cyclic. At ground phase (mentioned iso-thermic phase), the temperature is constant. The internal energy hasn't been formed so that reaction heat (calory/Q) will be equal to work (W). It means that works done during practices will generate heat which written as:

$$\Delta U = 0; -W = Q \dots\dots\dots (\text{VIII})$$

The next phase is iso-choric phase whose constant volume and increase temperature. During the practices, oxygen volume kept constant by anaerobic-hypoxic

practice that means keep the breathing rhythm tidy. Meanwhile, the body temperature will increase during increase of practices perform (with or without additional equipment). Because of constant volume, there isn't work done by gas so that heat will transform into internal energy. Those can be written as:

$$W = 0; Q = \Delta U \dots\dots\dots (IX)$$

The last phase is adiabatic phase which reach by holding the breath to stop oxygen supply into body cell. It will also stop the respiration reaction, so that there isn't reaction heat. Therefore, the internal energy will be equal to work as potential energy which can written as:

$$Q = 0; \Delta U = W \dots\dots\dots (X)$$

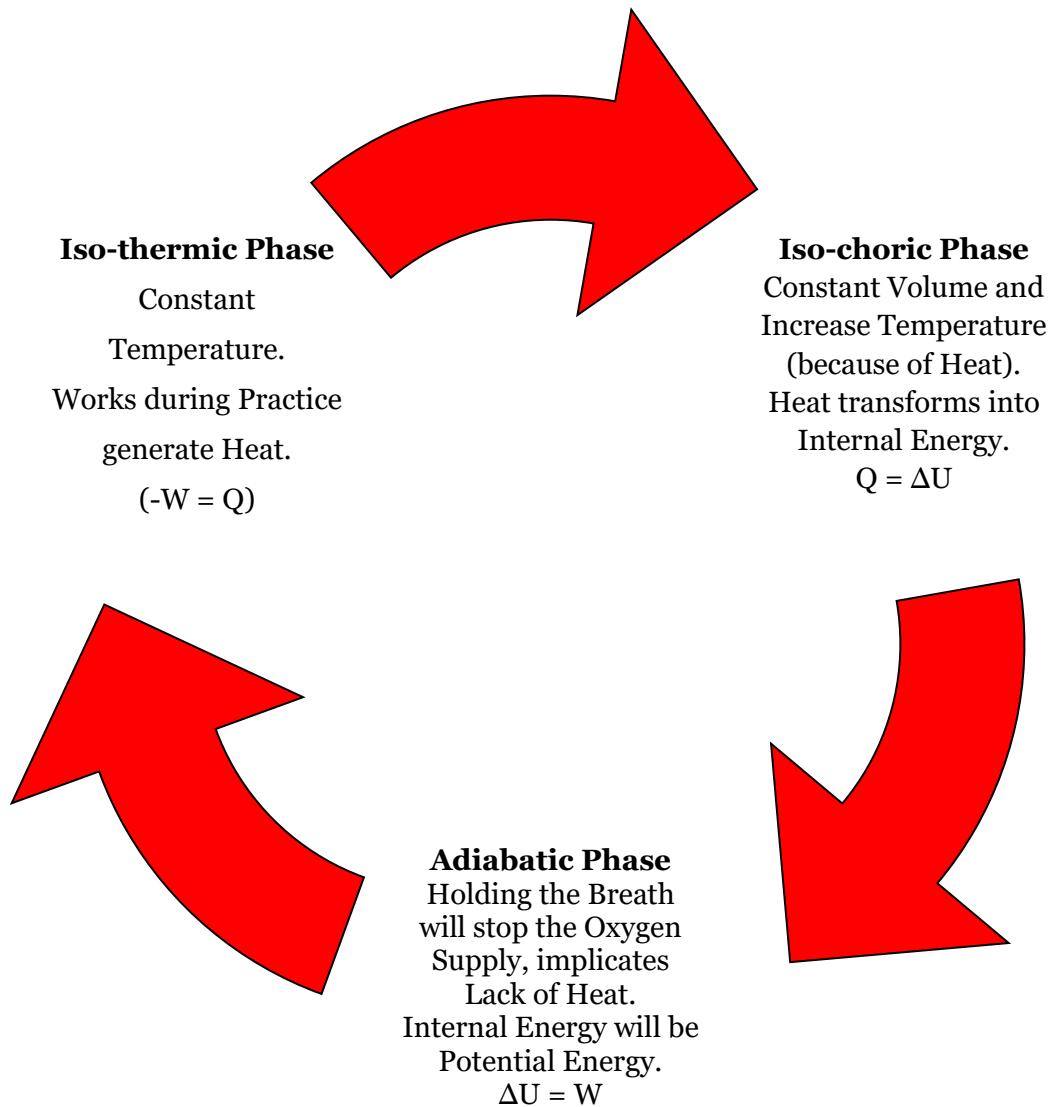


Figure 1. Summary of The Energy Cycle during Practice of *Merpati Putih*

The potential energy can be shown by the breaking of hard objects, which according to the research result (number VI) is equal to the energy that needed to break 238 of aerial concrete blocks. Generally, summary of the entire cycle is shown by the Figure 1.

Conclusion

Main finding of the research is the regular practice of *Merpati Putih* Martial Art can generate the potential energy which equal to the energy needed to break 238 of aerial concrete blocks. The generation was explained scientifically by the First Law of Thermodynamics. The research basically only studied and discussed about utilization of reserve energy saved by the ATP which explained as potential energy. It didn't study about comparison between the energy saved by the ATP and the whole energy produced during respiration reaction.

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The research is fully dedicated by the researchers to the *Merpati Putih* Martial Art as an Indonesian traditional martial art that practiced regularly by the Republic of Indonesia Defense University's students. The research also aims to show scientific side of traditional martial art as a way to utilize potential energy of the human from the respiration reaction.

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