A.T.P. and Calories: The Chemistry of the Body

Javed Hassan
Parkland College

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**INTRODUCTION**

Adenosine Triphosphate, also referred to as ATP, is the pure energy of life. This molecule is the essential source for all of the activities our body must do. We ultimately receive this energy from what our body takes in. More than 100 trillion (2.0 x 10^14) ATP molecules are produced every day totaling over 352 pounds. Of course we are only one of the creatures that use it. Within the body, the amount of energy released is referred to as the Caloric content of a substance. This is the energy that people "eat" while on a diet and that are on diets and are on the go. This process begins by synthesizing the energy of ATP and the use of ATP in the form of Calories.

**BODY**

The body produces ATP through a process called cellular respiration. This reaction is called glycolysis, the Krebs cycle, and the electron transport chain (ETC). Through these processes, large molecules, primarily glucose, are broken down and a total of 36 to 38 ATP are produced.

2. Krebs Cycle

Once the two molecules of Acetyl-CoA are produced, they undergo a process called the Krebs Cycle. This process involves the removal of the acetate and the production of ATP through phosphorylation.

2 Acetyl-CoA + 2 NAD^+ + 2 FAD^+ → 2 Acetyl-CoA + 6 NADH + 2 FADH_2

The net reaction of the Krebs Cycle results in four carbon dioxide and two ATP. The reaction also produces two NADH and two FADH_2, which will be used in the ETC. After the Krebs cycle the body has produced four net ATP.

3. Electron Transport Chain (ETC)

The final stage of the production of ATP takes place in the cristae of the mitochondrion. The NADH and FADH_2 molecules bring their energy to the ETC. The energy released from the reduction of electron carriers is used by ATP synthase to produce ATP and convert the energy into ATP. Each NADH can produce two ATP and each FADH_2 can produce two ATP. Once this has happened the left over electrons and protons are used by ATP synthase to produce ATP.

2 NADH + 2 H^+ + 2 FADH_2 → 2 ATP + 2 H^+ + 2 FADH_2

The net result for cellular respiration is therefore 36 to 38 ATP to each molecule of glucose. The variance is due to imperfections in the ETC.

**REFERENCE**

- Adenosine Triphosphate: Metabolism and Role in Energy Transfer (2021)
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- Energy Balance and ATP Production (2023)