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Evaluating the Theoretical Impact Force of Mike Tyson's Punch on Poultry: A Quantitative Analysis

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Abstract: This study applies thermodynamics and biomechanics to calculate the energy required to cook a chicken through kinetic impact. Starting from established models of thermal energy transfer, it determines the mechanical energy necessary to raise a chicken's temperature to a cooked state. The analysis then quantifies the force and energy output of Mike Tyson's punches to estimate how many impacts would achieve the same thermal result, as well as proposing a new unit of energy to better communicate what it feels like to be punched in the face by Mike Tyson.

1. Introduction

Nobody can possibly have sat through the recent fight between Tyson and Jake Paul without wondering: how many times would Mike have to punch a turkey before it was cooked? By focusing on energy transfer and conversion, this study aims to answer this question, building on previous works by Matthias Chickenslapper from the Institute of Poultry Pugilism in Prague.[1] In the process, we demonstrate the practical application of physical principles to unconventional scenarios, emphasizing the relationship between kinetic and thermal energy in a controlled system.

1.1 Background

Mike Tyson, known for his powerful punches, generates peak forces exceeding 1,600 joules per punch.[2] His physical attributes, standing at 1.77 m (5'10") and weighing approximately 100 kg (220 pounds) contribute to the significant kinetic energy of his strikes.[3]

Chickens and turkeys, both members of the poultry family, have distinct characteristics that influence their culinary preparation and broader uses. Chickens are smaller, weighing on average 2.6 kg,[4] with a mild flavour that adapts well to various cooking methods such as roasting, grilling, or frying. They have a shorter cooking time compared to turkeys, often requiring about 1-1.5 hours to roast a whole chicken at standard temperatures.

Figure. 1: A visual representation of size difference between a domesticated chicken (left) and turkey (right).

Turkeys, comparatively, are significantly larger, averaging 13.5 kg for domesticated birds.[5] Their meat has a richer and more robust flavour, especially the dark portions, which contain more fat. Cooking a turkey involves longer preparation and roasting times, ranging from 2-4 hours depending on size. Turkeys are often brined or seasoned extensively to enhance their flavour, and their tough texture benefits from slower or higher-temperature cooking techniques. They are typically associated with festive meals, such as Thanksgiving in North America.[5–7]

The two birds differ in their thermal properties and cooking requirements. The larger mass and different fat distribution in turkeys necessitate longer heat exposure for safe and thorough cooking, while chickens' smaller size and leaner composition allow for faster and gentler methods. Understanding these differences is crucial when comparing the energy transfer dynamics involved in their thermal processing.

2. Methodology

The thermal energy required to cook poultry is calculated using Equation 1:

$$\Delta E_{thermal} = m_b c \Delta T, \tag{1}$$

where m_b is the mass of the bird, c is the specific heat capacity of poultry tissue, and ΔT is the temperature increase needed for cooking. The change in temperature is defined as:

$$\Delta T = T_{final} - T_{initial} \tag{2}$$

The kinetic energy (KE) of a punch is expressed as:

$$KE = \frac{1}{2} m_h v^2 \tag{3}$$

where m_h is the mass of the striking hand, and v is its velocity at impact. Assuming all kinetic energy converts directly into thermal energy, we can combine Equations 1 and 3 to give us a method to derive the number of punches needed to cook poultry:

$$\text{Number of punches} = \frac{\Delta E_{thermal}}{KE} \tag{4}$$

3. Results and Discussion

The physical properties of the poultry species analysed are presented in Table 1, which includes the specific heat capacities (c), temperature changes (ΔT), and the required thermal energy ($\Delta E_{thermal}$) for cooking. The calculations assumed the mass of a chicken to be 2.6 kg and a turkey to be 13.5 kg, based on average values for commercially raised poultry.[4,5]

From the values in Table 1, we calculated the thermal energy ($\Delta E_{thermal}$) required to cook a chicken as 643.67 kJ and a turkey as 2803.40 kJ. These values were derived using Equation 1 from Section 2, where m_b, c, and ΔT are the known parameters.

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Using the average mass of a human hand (m_h = 0.4kg)[8] and the kinetic energy per punch (KE= 1, 600 J) as assumed for Mike

Parameters	Chicken	Turkey
$T_{initial}$ [K]	273	273
T_{final} [K]	346.9	346.9
m_b [kg]	2.6	13.5
c $[kJ \cdot kg^{-1} \cdot K^{-1}]$	3.35	2.81
ΔT	73.9	73.9
$\Delta E_{thermal}$ [kJ]	643.67	2803.40

Table 1: Physical Properties of Poultry.[4-7]

Tyson's strikes, the velocity required to cook a chicken or turkey in a single punch was calculated. The velocities derived were 1.794 km/s for chicken and 3.744 km/s for turkey. The total number of punches required to cook poultry was then determined by dividing the thermal energy required by the energy delivered per punch using Equation 4 from Section 2.

	Chicken	Turkey
Single Punch v $[\frac{km}{s}]$	1.794	3.744
Punches	402.29	1752.13

Table 2: The velocity of a single punch required to cook each bird (row 1) and the number of Tyson punches to achieve the same (row 2).

It was found that approximately 402 punches are required to cook a chicken, while 1,752 punches are needed to cook a turkey, assuming 100% energy transfer efficiency.

Figure 2: Artist rendition of Mike Tyson boxing a turkey.

3.1 Analysis of Mike Tyson's Career as a Unit

Extending this analysis to Tyson's professional career, we calculate the cumulative number of punches he delivered across 223 rounds,[2] with an average of 12.4 power punches per round. This yields a total of 2,765 power punches. Multiplying this by the KE delivered per punch, we find Tyson's total cumulative energy output is 4,424.32 kJ. This cumulative energy could theoretically cook 6.87 chickens or 1.58 turkeys over the course of his career, assuming perfect energy transfer.

4. Conclusion

This study explores the energy transfer dynamics between kinetic and thermal energy by calculating the number of punches required by a professional boxer, Mike Tyson, to cook poultry. By applying principles of thermodynamics and biomechanics, it was determined that approximately 402 punches would be necessary to cook a chicken, while 1,752 punches are required for a turkey, assuming 100% energy conversion efficiency. These findings are based on the energy calculations for both thermal and kinetic energy, using the specific physical properties of chicken and turkey, and Tyson's punch velocity.

The results highlight the considerable mechanical energy involved in Tyson's punches and provide a novel perspective on how everyday physical actions can be analysed through scientific principles. Extending this analysis to Tyson's career, we estimate that his cumulative energy output could theoretically cook 6.87 chickens or 1.58 turkeys, demonstrating the large-scale energy output in his professional career.

We will be submitting our proposal to the National Institute of Standards and Technology (NIST) of our proposed Tyson unit (1 Ty = 1.6 kJ). We believe that this will bring a better form of scientific communication with the general public by being able to convert units of energy to units of being punched in the face by Mike Tyson.

While the study assumes perfect energy transfer and neglects practical limitations such as energy dissipation, the results emphasize the intersection of biology, physics, and everyday phenomena. Further research could refine these models by incorporating real-world inefficiencies, such as heat loss, and exploring the practical implications of energy transfer in dynamic biological systems.

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