

STUDENTS' MISCONCEPTION ABOUT ENERGY-YIELDING METABOLISM: GLUCOSE AS THE SOLE METABOLIC FUEL

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Energy-yielding metabolism is a subject that is particularly important, because energy production is a fundamental requirement for cells even though they execute many other processes simultaneously. An integrated view of metabolism is essential for understanding how the whole organism functions, including activities of students' daily life, such as eating, dieting, and physical exercise. In fact, the media constantly exert pressure on young people, stimulating students to undergo countless diet and exercise programs. Additionally, diabetes mellitus and obesity, which are diseases with close ties to metabolism, have been increasing among adolescents.

In Brazil, the education system is organized in 12 grades. Until the 9th grade (~14-15 years old), physics, chemistry, and biology are taught as one discipline, called "sciences." From 10th to 12th grade (~17-18 years old), physics, chemistry, and biology are taught as separated disciplines. "Metabolism" is traditionally taught in the 10th grade. Although the role and the general structure of macromolecules are taught in the 10th grade, 8th grade deals for the first time with these subjects.

To assess students' knowledge of the integration of human metabolism, we have presented questionnaires to be answered by students at the beginning of their first year at one of the largest and most prestigious Brazilian universities, the Federal University of

Rio de Janeiro. The first questionnaire (Q1) contained two objective questions: 1) What happens to the overall ATP production in an individual fed a low carbohydrate diet? 2) What happens to the overall ATP production in an individual undergoing prolonged (many days of) fasting?

The students had the choices of answering "I do not know" or that ATP production "remains the same," "increases," or "decreases." In addition, after their answers for each question were selected, three lines were available for the students to briefly explain their answers. Students who did select an option but did not explain their answers were excluded from the sample.

Figure 1A summarizes the pattern of answers obtained from Q1. From the 304 students who answered the questionnaire, 175 came from biomedical-, 55 from technology-, and 74 from humanities-related courses. Although there was some diversity among the answers given by the students in each group, the pattern was found to be very similar (not shown). The proportion of students who presented correct answers to the questions was remarkably small, and a great proportion of them chose to answer "I do not know" or did not explain their answers. These proportions indicate that a significant number of students do not know how that metabolism is regulated in relatively common situations of their daily lives (diets,

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