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# Pharmacology and Exercise: An Essential Discipline and Research Area in Health Courses

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Since a long time ago, medicine was used to treat many humans and animal diseases. Sometimes, the knowledge about health effects of some substances are only in popular domain, empiric experienced information without methodological and scientific tests certifications of security and safety application [1].

Although the pharmacological treatment not always result in better clinical outcomes, around 50-70% about medical consults result in drug prescription. This procedure is a common practice because the patient and medical intention converge to satisfy one point: the resolution of a problem with a magic dose or treatment with medicine. Moreover, self-medication represents a possibility to multiply the options in health care [2]. However, adverse drug events causes clinically significant morbidity and mortality and are associated with large economic costs, mainly in elderly population [3]. In this way is essential to cite that the prevalence of inappropriate medication usage can range from ~5% to ~40% [4].

The rational use of chemical substances, the actual information about molecular structure and experimental animal models made remarkable progresses in the pharmacology field, which only in 1847 was called as an independent discipline. Today, in pharmacology field there are some disciplines, such as pharmacodynamics (effects and mechanism of drugs), pharmacokinetic (absorption, distribution and clearance of drugs) and toxicology (adverse effects of substances) that elucidates the drug efficiency and safety [1].

On the other hand of the science, physical exercise is a phenomenon that was observed inside the medicine, physical education, and Olympic Games context. Although of being practiced, the term 'exercise', as an adjunct to good health, was cited early as around 400 B.C. Some contrasts about the training approaches were observed, however, very important observations listed that exercise is as a condition that the human body has important functional modifications, in both acute and chronic (training) situations. In this way, beneficial effects of exercise were listed as better conditioning to war and longevity gains [5].

Curiously, the exercise research field had the initial activities together to the chemistry and food research fields. Since 1900, the human metabolism (mainly in physical activity) was observed as a complex system capable to use the chemistry (oxygen) as an essential part of the energy function in synergism with the micronutrients metabolization to generates the energy coin to the organism: the ATP [5]. After that, extraordinary pharmacological research were published in medical area, with optimization of active proprieties, metabolization, interaction among drugs, adverse effects (e.g.), as well as exercise physiology field published information about oxygen consumption, strength gain process, energy sources of different exercise situations and both acute and chronic adaptation in the whole body, from the cell to the entire systems.

Additionally, nowadays there is much evidence associating the exercise prescription benefits: the prescription of exercise with drugs to treat or to prevent diseases. However, what do we know about the kinetics of one drug in an organism that is submitted to an exercise? Could exercise modify (increase or decrease) the effect of the pharmacological treatment (improve health or cause adverse effects)? In the other side of this crosstalk phenomenon, what do we know about the impact of an exercise challenge in pharmacologically treated individuals? Could one medication affect positive or negatively the adaptations of exercise prescription? Therefore, with this scenario listed above, we believe that urges the necessity of the implementation of a new regular discipline in health graduation courses, such as physical therapy, physical education and medicine: the "Pharmacology and Exercise" discipline.

Pharmacology and exercise studies might illustrate changes in biotransformation, distribution and excretion of drugs that one exercise session is able to produce. The pharmacokinetics and pharmacodynamics of drugs could be modified by the exercise. Variables as pH, temperature, cardiac output, renal flux, hormones are some of exercise critical points to direct or indirectly affect the drug effects. In the other hand, influences in the autonomic control, hemodynamic response, source of micronutrients in during the exercise, dehydration, fatigue and weakness are effects of some drugs that could be studied by the pharmacology of exercise field. Pharmacology of exercise as discipline may introduce students to the basic principles of pharmacology with an emphasis on the interaction of drugs and exercise. For health professionals, it will provide an understanding of the principles of drug action, in terms of drug chemistry, drug-receptor interaction, receptor signaling and dose-response relationship, without forgetting the impact of treatment on acute and chronic responses to exercise [6-8].

Some data are important to remember: Worldwide, 31% of adults are physically inactive, (ranging from 17·0% to 43%) and inactivity rises with age, it is higher in women than in men, and it is increased in high-income countries [9]. In parallel, there is a growth in pharmaceutical consumption (range from 18% to 29%) within the non-hospital sector occurred (2000-2008 data) and low-income countries total pharmaceutical expenditure constituted around 30% on average of total health expenditure (range 7.7% to 62.9%). There is a growing global epidemic of noncommunicable diseases–primarily cardiovascular diseases, diabetes, cancer and chronic respiratory diseases. These are responsible for two thirds of the 57 million deaths worldwide each year, with 80% of deaths occurring in low- and middle-income countries. There are projections of deaths

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from noncommunicable diseases to rise from 36 million in 2008 to 52 million in 2030 [10]. Furthermore, the synergism among several factors, such as obesity, diabetes and cardiovascular diseases, all diseases that exercise might fit as therapy combined to pharmacologic agents; represent a relevance to study exercise and pharmacology together.

As many drugs, dosage is extremely important to obtain the beneficial effects of exercise. A real comprehension from the professionals has great importance about has great importance to prescribe exercise properly [11]. It is important to point out that various studies, papers and books refer the exercise as a pharmacologic agent, but are also necessary to advance this knowledge. The combination of exercise and drugs requires a new format of both prescriptions: drug and exercise prescription for chronic diseases. In this way some examples may be listed, such as the combinations: between exercise and hypoglycemiant drugs (risk inducing hypoglycemia or potential adjuvant for glycemic control?); between exercise and anti-hypertensive drugs (similar prescription of exercise to people who utilizes beta-blockers? Risk of dehydration for diuretic agents combined to exercise?); between anti-inflammatory treatment and acute exercise response (impaired pro-inflammatory response?) and chronic exercise adaptation (impaired anti-inflammatory response?), in other words, the effect of drugs and exercise in immune responses. The last one may be relevant to know about HIV individuals that combine antiretroviral drugs with exercise to improve life quality [12].

Thus, is clear and actual the necessity to increase research and detailed teaching of combination of exercise and pharmacological therapy responses in several diseases. The public health requires a professionalism and optimal knowledge about this common interaction. Summarizing is essential to increase the quality and quantity of the studies in this field: “Pharmacology and exercise”.

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