

# Effect of Exercise on Drug Absorption

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Dear Editor,

Exercise is the systematic execution of physical activity for a specific purpose. At rest, in humans, skeletal muscle receives between 15% and 20% of the cardiac output, while during maximal exercise, this percentage reaches values of 80% to 90%.<sup>[1]</sup> Exercise places great demand on circulation.

For drugs administered orally, Drug absorption majorly takes place in the small intestine, with gastric emptying as a limiting step.<sup>[2]</sup> Exercise influences several physiological functions which may affect the absorption of drugs from small intestine, it as well redistributes cardiac output away from the splanchnic region, most likely due to increased sympathetic nervous activity.<sup>[1]</sup> Throughout the exercise period, there is decrease in pH of blood and muscle due to formation of lactic acid and this may alter drug ionization and polarity.<sup>[3]</sup> Increased sympathetic tone and the release of catecholamine's during vigorous exercise are responsible for the inhibition of gastric emptying and this depends on the exercise conditions.<sup>[4]</sup> Regular exercise that last more than 1 hr will significantly delays gastric emptying and increases the frequency and amplitude of contractions in the duodenum.<sup>[5]</sup>

For drugs administered intramuscularly and subcutaneously, when administered, blood takes up the drug constituents and circulate round the body to its active site. Exercise increases the blood flow to active tissues, in non-exercising organs, the blood flow decreases to about 20% to 40% of the resting values as a result of competing vasoconstrictor and vasodilator drives.<sup>[6]</sup> Therefore, drug absorption from sites in actively exercising tissue may be increased during exercise, while absorption from inactive tissues may be reduced during exercise. For instance, the absorption of insulin is increased in the active leg after its subcutaneous injection into thigh muscle during moderate and intensive leg exercise.<sup>[7]</sup> Plasma insulin concentrations are increased by 12% to 25%<sup>[7]</sup> or unchanged<sup>[8]</sup> during leg exercise.

Several factors affect the absorption of drugs that are administered transdermally during exercise. These factors include skin temperature, skin blood flow and the hydration state of the skin.<sup>[9]</sup> Higher skin temperature during exercise enhance the kinetic energy of drugs as well as increase skin blood flow, which may increase the transdermal absorption rate of drug. Moreover, the sweating that is produced during exercise increases skin hydration and therefore increases the transdermal absorption of drugs with diffusion rate-limited absorption.<sup>[10]</sup>

Absorption of inhaled drugs from the lung through the trachea to the systemic circulation depends on the physiochemical properties of the drug and the physiologic properties of the lung surface area. it is also recommended to

increase the frequency of drug administration rather than increase the dose in order to prevent or ameliorate the development of exercise-induced asthma.<sup>[11]</sup> This statement was supported by documented study<sup>[1]</sup> that inhalation of terbutaline just prior to a bout of ergometric cycling caused an increase in the rate of appearance of the drug in plasma ( $t_{max}$  from  $53 \pm 8$  to  $26 \pm 7$  min) and an increase in peak plasma concentrations of this drug ( $C_{max}$  from  $11.4 \pm 3.7$  to  $17.3 \pm 7.1$  nmol/L).

In conclusion, it was shown that exercises influence several physiological factors that may affect the absorption of drugs in human body for action. This may depend on the duration, type and intensity of the exercise and also depend on the route of administration of the drugs given.

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