Storchilo OV*

Odessa National Medical University, 2-Valyhovsky lane, Odessa, 65 082, Ukraine

***Corresponding author:** Storchilo O.V, Odessa National Medical University, 2-Valyhovsky lane, Odessa, 65 082, Ukraine, Tel: +38 (048)7255937; Fax: 063 308 50 29; E-mail: alena-61@mail.ru

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Abstract

Objectives and method: To determine the velocity of glycine absorption in the chronic experiments under physiological condition with no operation trauma, pain, narcosis and atrophy of the small intestine using and original method of surgical formation of the functioning fragment of the small intestine with 'living fistulas' in the presence of chime, all gastrointestinal secrets and natural innervations.

Results: The glycine absorption velocity increases during one hour of perfusion. Absolute parameters of absorptive activity of the small intestine in the chronic experiments *in vivo* are higher than in the isolated loop of the rats' small intestine. We observed no dissolution of perfusate with gastrointestinal fluids in the small intestine functioning part indicating that absorption of water in this fragment of small intestine prevails.

Conclusions: Formation and perfusion of the functioning fragment of the rats' small intestine is an adequate approach to the investigating the activity of the small intestine under physiological condition. It allows detecting the impact of the regulatory activity of chime (its exogenic and endogenic components).

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secured with standard metallic fistulas (Figure 1). Including “living” fistulas, the length of the investigated area was 10 cm. The isolated loop was prepared according to method described by Ugolev and Zaripov [8]. 4-5 days after the operation the animals were perfused by peristaltic pump "Zalimp"(Poland). Velocity of perfusion was 0.6 ml/ min. For the perfusion we used 25 mmol/l solution of glycine on the Ringer solution (pH=7.4, to of the perfusion solution=37°C). We added an unabsorbed marker polyethylene glycol (PEG – 400) to the perfusion solution to control possible dilution of perfusion solution with the liquids of digestive tract (saliva, gastric, intestinal and pancreatic juices, bile or reflux from the next part of intestine). The concentration of glycine was determined using method described in ref. [15] colorimetrically on photoelectrocolorimeter – CFC-2MP, λ=540 nm. The concentration of PEG was determined based on modified method [16] colorimetrically on CFC-2MP, λ=465 nm. All experiments were conducted in accordance with scientific/practical recommendations regarding animal care and work with them [17] and in compliance with the positions of "European convention about defense of the vertebrates used for experimental and scientific aims”. The statistical processing of the obtained data was conducted using "Primer Biostatistics" software.

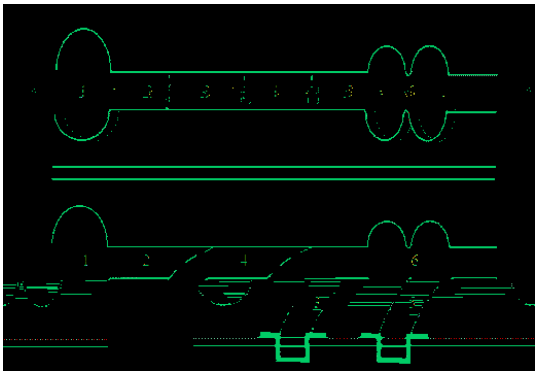

Figure 1: Scheme of the formation of the functioning fragment of the rats small intestine. 1-stomach, 2-5-small intestine, 3,5 - “living” fistulas, 6-large intestine.

Results

The research of the free glycine absorption in the functioning part of the small intestine of adult rats under physiological condition showed that rate of this process during first 60 minutes of perfusion had a trend to an increase (Figure 2). At the end of perfusion (after 55-60 minutes) velocity of absorption was for significantly higher, than

isolated loop an absorptive ability of the functioning fragment of the small intestine is much higher than isolated loop.

Therefore, the rate of the absorptive activity of the small intestine under physiological condition is in fact higher than in the experiments with the isolated loop. It proves the role of endogenic factors and exogenic substrates (natural gastrointestinal fluids, native food components and different levels of the regulation) in the functioning of a small intestine. Absence of these components leads to the atrophy of the small intestine and even regular daily one-hour 'feeding' of the isolated loop with glucose or glutamate solution cannot significantly change this situation [4,19]. This data leads to conclusion that use of the functioning fragment of the rats' small intestine to research its absorption rate is more physiological than the previous methods, including isolated loop.

The interesting results were received when comparing the mass of mucosa and muscle tissue in the functioning fragment and isolated loop of the small intestine: 1 cm of the functioning fragment contains 2.25 times more mucosa than isolated loop and 1.78 times more muscle (Table 1). It's worth noting that our result for isolated loop mucosa mass matches exactly the results of Gromova L.V. and Gruzdkov A. A. [19]: 44.0 ± 9.6 in our experiments with no additional loading and 46.6 ± 6.5 in their experiments after regular daily one-hour loading with glucose. As expected mass of 1 cm of functioning fragment was 1.75 times greater than the mass of isotopic intact intestine fragment, mainly due to the difference in the muscle amount (4 times) rather than mucosa (1.3 times). Similarly mass of 1 cm of isolated loop was 1.2 times (16 %) less than the mass of isotopic intact intestine fragment – owing to 2 times difference in muscle first and then – to mucosa (1.75 times) (Table 1). These results confirm that isolation of the loop of small intestine from normal digestion leads to the explainable hypotrophy of mucosa and unexpected hypertrophy of muscle. It means that surgery leads to increasing of the muscle tissue (possibly because of the partial replacing with the connective tissue as a result of operation). It comports to the data obtained by Ugolev et al. [20,21].

S.no	Type of the fragment	Total mass of the 1 cm of intestine	Mass of mucosa of the 1 cm of intestine	Mass of muscle of the 1 cm of intestine	n
1	Functioning	160.0 ± 22.0*	99.7 ± 10.5*	60.0 ± 12.0	3
2	Isolated	78.0 ± 10.0	44.0 ± 9.6***	33.7 ± 4.1***	4
3	Intact, isotopic to functioning	91.0 ± 14.0**	75.8 ± 9.4	15.5 ± 5.0**	4
4	Intact, isotopic to isolated	93.0 ± 8.0	77.0 ± 6.9	16.3 ± 2.4	4

Table 1: Mass of 1 cm of the humid tissue of the investigated fragment of the rats small intestine in 30 days later of the operation. Note: *p 1-2=0.013, **p 1-3=0.039, ***p 2-4=0.045, ****p2-4=0.011.

Conclusions

The method of the formation and perfusion of the functioning fragment of the rats' small intestine provides an adequate approach to the investigation of the functional activity of the small intestine under physiological condition. It allows detecting the effects of the regulatory activity of chime (its exogenic and endogenic components). The obtained data shows that higher velocity of the glycine absorption in the functioning fragment of the rat's small intestine comes from stimulating effect of chime on the transport system of separate enterocyte as well as the substrate regulation of the cellular pool.

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