International Journal of Medical Sciences And Clinical Research (ISSN – 2771-2265)
VOLUME 03 ISSUE 02 PAGES: 39-43
SJIF IMPACT FACTOR (2021: 5. 694) (2022: 5. 893) (2023: 6. 184)
OCLC – 1121105677
Publisher: Oscar Publishing Services

Journal Website: https://theusajournals.com/index.php/ijmscr



Research Article

# FEATURES OF THE SUCTION MECHANISMS IN EARLY POSTNATAL ONTOGENESIS THROUGH THE PRISM OF THE MORPHOGENESIS OF THE SMALL INTESTINE

Submission Date: February 18, 2023, Accepted Date: February 23, 2023,
Published Date: February 28, 2023
Crossref doi: https://doi.org/10.37547/ijmscr/Volume03Issue02-08

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## ABSTRACT

The morphofunctional specificity of the digestive system organs, the integration of the regulatory systems of the body is the result of the development, formation and formation of the organs of the digestive and other systems, adaptation to breastfeeding and definitive nutrition, the formation of a functional system for the breakdown of biopolymers and the absorption of monomers. The structural foundations of this complex process are not well understood. The article shows the patterns of formation of the digestive-transport conveyor and the mechanisms of homeostasis regulation in early postnatal ontogenesis.

## KEYWORDS

Mechanisms, absorption, morphogenesis, small intestine.

## INTRODUCTION

The morphofunctional specificity of the digestive system organs, the integration of the regulatory systems of the body is the result of the development, formation and formation of the organs of the digestive and other systems, adaptation to breastfeeding and definitive nutrition, the formation of a functional

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system for the breakdown of biopolymers and the absorption of monomers. The structural foundations of this complex process are not well understood.

**The purpose of this study:** to establish, on the basis of general morphological, electron microscopic, histochemical studies, the patterns of formation of the digestive transport conveyor and the mechanisms of homeostasis regulation in early postnatal ontogenesis.

Material and methods. White outbred rats of both sexes on the 1st, 3rd, 7th, 14th and 21st days of embryonic development under standard vivarium conditions. The terms of the study were chosen by us on the basis of ideas about the structural and functional features of internal organs and types of nutrition in postnatal ontogenesis and age periodization of laboratory animals.

For general morphological and electron microscopic studies, tissue pieces of the fundus of the stomach, pancreas, duodenum, jejunum and ileum were used. The cytophysiology of the process of absorption in the mucous membrane of the small intestine, the cellular mechanisms of its regulation were studied electron microscopically in dynamics after a single feeding of newborn, 3-, 7- and 14-day-old rats with breast milk; protein solution (7% bovine or egg albumin).

To synchronize the process of absorption in the jejunum, rat pups fasted for 3 hours before feeding. The slaughter of animals was carried out in accordance with the rules of the European Convention on Experimentation with Animals for Scientific Research at 10, 30, 60 minutes, 3,6,9 and 24 hours after feeding. Decapitation was carried out after anesthesia with Nembutal. At least 3 animals were used for each period.

Protein specificity identification, administered to rat pups per os and absorbed by the mucous membrane of the jejunum was carried out by the immunofluorescent method. The tissue for general morphological and electron microscopy studies was fixed in Carnoy's fluid and 1% OsO4 solution, respectively. After passing through alcohols of increasing concentration, they are embedded in paraffin or araldite. Viewing of sections stained with hematoxylin and eosin or counterstained with uranyl acetate was carried out, respectively, in microscopes MIKMED-6 (Russia) or JE M-100 S (Japan).

Results and discussion. At birth, in rat pups, the resulting shallow gastric pits are lined with highly prismatic mucus-secreting epithelium. They contain numerous electron-dense secretory granules in the supranuclear region. At the bottom of the fossae, very short glands are revealed without a lumen or with a narrow lumen forming. The epithelium that forms them is low-prismatic, consists mainly of cambial cells, with initial signs of differentiation of accessory and parietal cells.

In the mucosa of the jejunum, villi of various generations are detected: from formed to barely outlined. Their surface is lined with highly prismatic epithelium, the apical part of which has numerous typical microvilli 1.0 μm high and 0.1 μm in diameter. The plasmalemma between their bases forms tubulo-vesicular endocytic formations. In the supranuclear region there is a well-developed Golgi complex, a smooth and rough endoplasmic reticulum and mitochondria; lysosomes are single, small. Between the villi, short depressions of the resulting crypts are found. The lamina propria of the jejunal mucosa consists of intensively developing blood and lymphatic capillaries, blast cells, and lymphoblasts that form rare clusters.

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Thus, at birth along the digestive tube, the mucous membrane of the small intestine is the most structurally and functionally formed . The limbic epithelium of the villi and the vasculature in the jejunal mucosa can carry out absorption by endocytosis.

When breastfeeding, the tubulo-vesicular formations between the bases of the microvilli very quickly separate and transfer the ingredients of breast milk to the cytoplasm of the limbic enterocytes. According to our data [1,2,5,7] as well as the data of other researchers [6,8,13,15,16,17], transport is carried out by receptor-mediated endocytosis. The length of the membranes of endocytic formations and receptors determines the volume and amount of the substrate transported into the cells from the intestinal lumen.

A new generation of endocytic formations and receptors appears by the time of the next feeding and depends on the metabolic capabilities of the cell. As a result of the unique organization of the digestion process and the cyclic activity of the absorbing cells, the transport of breast milk ingredients is regulated and carried out in a dosed and optimal manner, contributing to the harmonious formation of the functional systems of the body [1,2,3,7,8,13,14,15].

If , instead of breast milk, rats are given a 7% solution of albumin 1.3 and 7 days after birth, then its absorption by the limbic enterocytes of the villi of the jejunum is carried out with the help of tubulo-vesicular formations without change (the identity of the absorbed protein was established by the immunofluorescence method). After 20 minutes, when the bulk of the albumin absorbed by the enterocytes is deposited inside the structures of the Golgi complex, the vesicles of a certain part of it transport the primary lysosome formed in the supranuclear region, the other part is unloaded into the expanding space between adjacent enterocytes and the lamina propria of the mucous membrane of the jejunum.

As a result, after 30 min. after the first signs of the process of protein absorption in the enterocytes of the jejunal villi, the epithelium is infiltrated by single monocyte-like cells, in the macrophages of the lamina propria of the jejunal mucosa, large secondary lysosomes are detected. Along with this, some of the transported albumin from the interstitium of the lamina propria moves towards the lymphatic capillaries and enters their lumen through the interendothelial spaces.

With evolutionarily established natural feeding with breast milk in rat pups 1,3,7 and 14 days after birth, the total duration of the absorption process in the mucous membrane of the villi of the jejunum lasts an average of 5-6 hours, while the duration of the intracellular stage in enterocytes is 2-3 hours. It should be noted that by the time the ingredients of breast milk are unloaded into the intercellular space, the zone of the Golgi complex occupies a significant volume, but consists only of the smallest vesicles without content.

During the transport of a foreign protein (albumin), a secondary lysosome over the nucleus of enterocytes of the villi of the jejunum is detected from 6 to 9 hours after the start of the absorption process. During this time, either one large and a group of small ones, or only groups of small and medium secondary lysosomes with heterologous contents, are detected above the nucleus of villus enterocytes. Around them, mitochondria with a moderately dense matrix and oriented cristae are constantly detected.

Conclusions: Thus, in the early postnatal period of life, the homeostasis of the internal environment is regulated by several interconnected and interacting functional systems. In the jejunum, its components are

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the intestinal cavity with microorganisms, receptor-mediated endocytosis, intracellular transport from the base of the microvilli to the structures of the Golgi complex, from the Golgi complex to the interepithelial space and interstitium (if the absorbed substrate is homologous) or to primary lysosomes and interstitium (if the substrate is heterologous). ); from the interstitium, the absorbed ingredients of breast milk are transported to the blood and lymphatic capillaries (depending on its chemical nature); when the protein is heterologous, it is digested in the secondary lysosomes of macrophages and transported only by the lymphatic capillaries.

As noted by K.A. Zufarov, A.Yu. Yuldashev [3,4,5,6], A.Yu. Yuldashev et al. [9,10,11,12], during the first year of life in children, 3 weeks in rats (in other mammals - in other periods of time), a regular, interconnected structural and functional formation of the salivary glands, stomach, pancreas, liver, endocrine and immune systems of the mucous membrane of the gastrointestinal tract. Consolidation and integration of heterochrono-developing structures before and early after birth is completed by the time of transition to definitive nutrition with the formation of a perfect functional system of digestion, absorption and regulation of homeostasis.

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