

Study of Mucin Histochemistry in Developing Human Gastric Mucosa from 12 To 37 Weeks of Gestation

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Abstract

Materials & Methods: Thirty five developing gastric mucosa of human fetuses were studied from 12 week to 37 week of gestation. Gastric mucosa was examined by different mucin staining to characterize its pattern and topographical distribution. Mucin staining AB pH 2.5, AB pH 1, PAS, PAS AB 2.5, AF, AF AB 2.5 were used to differentiate between neutral and acid mucin and acid mucins further classified into sulphomucin and sialomucin.

Results & Conclusion: Neutral mucin in developing gastric mucosa progressively increases from 12th week to 37th week. Sialomucin increases significantly from 14th to 27th week. Sialomucin decreases in gastric mucosa in late stage of third trimester. Sulphomucin appear from 18th week to 26th week of gestation but absent after 26th week. Foetal mucin differ histochemically in many respect from their adult counterpart. Later stage of trimester shows neutral mucin in gastric mucosa which help in adaptation during postnatal life.

Key-words: Histochemistry, mucin, gastric mucosa, foetal development

Introduction:

Mucin are complex carbohydrate secreted by different types of epithelial cells and glandular tissues of alimentary tract. Epithelial mucins are classified into neutral mucin, sialomucin and sulphomucin.¹ In man gastric and colonic mucosa have been extensively investigated biochemically and histochemically and changes in their composition have been reported in disease.² The human foetal stomach undergo extensive morphological and histochemical changes during second and third trimester of gestation.^{3,4} Detailed data of mucin pattern changes in stomach in different gestational period is not available. Foetal mucin differ histochemically in many respect from adult counter parts.^{3,4,5} The present work is in foetal stomach from 12 week to 37 weeks. The understanding of both nature and significance of mucin changes in foetal development may be potentially useful in recognition of early neoplastic changes in adult and an early stage in histogenesis of carcinoma.^{6,7}

Materials And Methods :

A total of thirty five human fetuses were obtained

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from spotnaeous / induced abortions or caesarean section stomach obtained after dissection of fresh specimens. The tissue were fixed in fixative containing 2% calcium acetate in 10% formation. These tissue routinely processed after keeping 4 to 5 days in fixatives. Paraffin blocks were prepared. Sections of 6 μ thickness were taken. The sections were stained with following histological and histochemical staining.¹

1) Haematoxin and Eosin (H&E), 2) Per-iodic Acid Schiff (PAS), 3) Alcian Blue (8GX) pH1, 4) Alcian Blue (8GX) pH 2.5, 5) Combined technique AB 2.5 PAS, 6) Aldehyde fuschin (Gomori method) AF staining, 7) Combined AF Ab 2.5 staining. All these staining employed to differentiate between neutral mucin from acid mucin. It was further identified acid mucin were further classified into sulphomucin and sialomucin.

Results :

I) Mucin pattern in epithelial element at 12th, 13th, 14th, 15th and 18th week of gestation :

Mucin pattern in epithelial elements showed PAS +ve staining while alcinophalia with AB pH 2.5 was absent. Gastric glandular pits were observed at 12th week but less differentiated. Gastric pit showed week reactivity. Supranuclear surface staining showed neutral mucin while sulpho and sialomucins were

reactivity. Supranuclear surface staining showed neutral mucin while sulpho and sialomucins were absent (as shown in Fig.1). In 13th week surface epithelium of gastric mucosa showed PAS +ve staining and AB pH 2.5 showed alcinoiphilia but AF ve staining at glandular primordial. Small amount of sialomucin was observed.

In 14th and 15th week gastric mucosa showed prominent characteristic of gastric pit with deep penetrating glandular primordia. At 14th week surface epithelium showing alcinoiphilia at AB pH 2.5 and AB PAS but 15th week exhibit both sulphomucin and sialomucin with AF AB 2.5 (Fig. 2, 3). At 15th week predominance of sialomucin and small amount of sulphomucin but parital cells showed PAS +ve staining.

At 18th week foetal stomach showed complete differentiation of glandular pits in to fundic and pyloric glands of stomach. (Fig.4) Neutral mucin was observed in deep foveolar cells and mucous neck cells. Pyloric gland at 18th week showed mixture of acid and neutral mucin which is contrary to adult mucin which showed only neutral mucin. Acid mucin at 18th week was showed to be sialomucin and sulphomucin. Purple staining at 18th week showed mixture of acid and neutral mucin with AB pH 2.5 - PAS.

II) Mucin pattern in epithelial element at 19th and 22nd week and 23rd to 26th week of gestation :

Gastric mucosa from 19 to 22 weeks showed many morphological and histochemical changes. Increased amount of all types of mucins were observed. Pyloric gland showed purple staining with AB 2.5 PAS indicating presence of mixture of acid and neutral mucin (Fig.5). From 19th to 22 pyloric gland also showed sialomucin and small amount sulphomucin. Mucins at 23rd and 26th showed progressively increased neutral mucin in surface epithelium with sialomucin and sulphamucin component in deep foveolar and pyloric gland. Predominance of sialomucin and small amount of sulphomucin observed by AF AB 2.5 staining as shown in Fig.6.

III) Mucin pattern in epithelial element at 27 and 28th week, 29 to 32 week and 33 to 37 week of gestation :

At 27th week of gestation gastric mucosa showed alcinoiphilia with AB PH 2.5 in surface epithelium, foveolar cell and mucous neck cells indicating presence of acid mucin and neutral mucin. It showed

AB PH1 negative staining and absence of AF positive staining indicating absence of sulphomucin.(Fig. 7). But blue staining with combined AF AB 2.5 showed the presence of sialomucin. With 29 to 32 week also showed neutral mucin and sialomucin but absence of sulphomucin. As it approaches to 37 week it showed only neutral mucin in fundic and pyloric part of stomach. Mucin changes in composition in third trimester may be showed its role in adaptation during postnatal life.⁸(Fig. 7).

Discussion :

Study of gastrointestinal mucin during human development and its relationship with morphological and histochemical changes in foetal life is subject of interest still today. Detailed mucin pattern in developing gastric mucosa is not available as scanty work was carried out. Foetal mucin differ histochemically in many respect from their adult counterpart.^{3,4,5} In present work the composition, secretion and topographical characteristics of foetal stomach studied extensively and systematically in different gestational period.

Morphological and morphochemical changes in development of foetal stomach are important in understanding the evaluation of mature gastrointestinal processes. Surface epithelial cells at 12 week of gestation showed neutral mucin which may play important role in cytoprotection.^{9,10} Increase in sialomucin in 14th and 15th week of gestation was observed.

The presence of acid mucin in second trimester was also observed by Gad et al and Caccambo et al. Progressive increase in sialomucin was observed from 14 week to 27 week but marked decrease in sialomucin after 28 week. Role of sialomucin in foetal life was not known. But they are thought to have role in cell protection and maintenance of viscosity in secretion and regulation of cell growth.^{9,10}

Neutral mucin progressively increases from 12th week to 37th week which is consistant in maintaining foetal homeostasis.^{5,11} This increase may have role in adaptation towards the postnatal life and to maintain foetal homeostasis.^{5,11} Our finding correlate with Staffer et al and Gad et al. In third trimester as neutral mucin increased and acid mucin decreased as the gestational age advances. In role of neutral mucin in cytoprotection is postulated by many authors.^{9,10} One must accept that mucus in early foetal life must

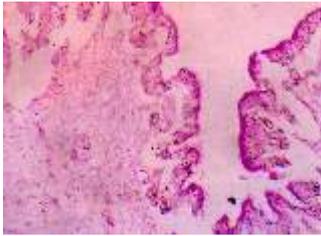


Fig. 1

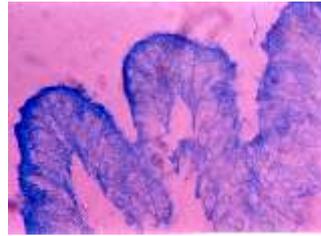


Fig. 2

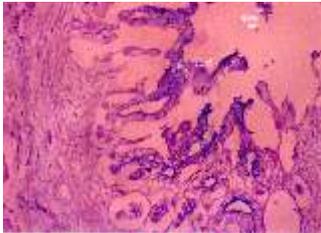


Fig. 3

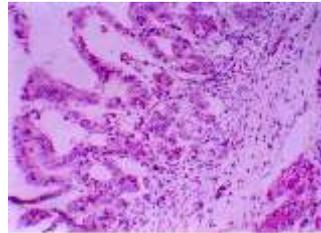


Fig. 4



Fig. 5

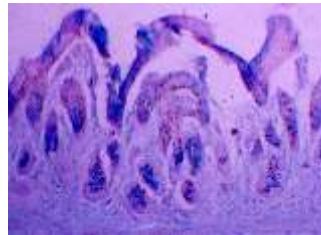


Fig. 6

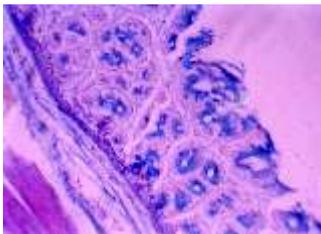


Fig. 7



Fig. 8

Fig.1 : 12 week foetal gastric mucosa stained by PAS. Surface epithelium PAS positive, glandular primordial negative staining. PASx100

Fig. 2: 14th week gastric mucosa showing acid mucin in supranuclear with AB 2.5 PAS x 150.

Fig. 3 : 15 week foetal gastric mucosa showing sulphomucin and sialomucin in surface epithelium, foveolar cell and mucous neck cell with AF AB 2.5 x 100.

Fig. 4 : 18 weeks foetal stomach with HE showing surface epithelium, foveolar cells and differentiation of clumps of parietal cell at base of gland x 100.

Fig. 5 : 20 week foetal pyloric stomach showing marked increase in neutral and acid mucin with AB 2.5 PAS x 100.

Fig. 6 : 23 week foetal gastric mucosa of pyloric region showing sulphomucin and predominantly sialomucin. AF AB 2.5 x 100.

Fig.7 : 28 week of foetal pyloric stomach showing sialomucin in surface epithelium and deep foveolar cells and absence of sulphomucin AF AB 2.5 x 100.

Fig. 8 : 35 week pyloric stomach showing surface epithelium, deep foveolar and pyloric gland neutral mucin and trace amount of sialomucin with AB 2.5 PAS x 100.

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foetal life must limit the permeability of noxious substance.¹⁰ Glycogen was observed from 12 to 18 weeks in gastric mucosa may be significant as a source of carbohydrate for energy requirement, in early stage also serve as precursor of glycoprotein.³ Progressive increase in sulphomucin in surface epithelium, deep foveolar cells and mucous neck cell from 18 to 26 weeks, small amount of sulpo and sialomucin present at 15th and 16th week. There is reciprocal relationship between sulphomucin concentration and cellular proliferation in foetal life.¹¹

Although sulphomucins have gained reputation as antiulcerogenic, through its inhibitory action in adult life its exact role in foetal life is not known. Peptic activity has been demonstrated in foetal stomach as early as 16th week of gestation.⁸ Study of mucin pattern in foetal developing stomach may help in understanding cellular differentiation and morphochemical development.

Study of mucin secretory pattern in foetal life may help in understanding disease process and mucin changes in premalignant lesion.

Conclusion :

Surface epithelium of gastric mucosa showed neutral mucin while sialomucin were present in 13th week and significantly increased from 14th week to 27 week. Progressive increase in sulphomucin, in surface epithelium; deep foveolar and mucous neck cell from 18 to 26 weeks. Neutral mucin increases from 12 week to 37 week but sialomucin and sulphomucin decrease in 3rd trimester in foetal life. Significance of foetal mucin was discussed.

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