LECTIN- AND IMMUNO-HISTOCHEMISTRY ON MUCOUS SUBSTANCES OF THE TASTE BUDS AND LINGUAL GLANDS IN SOME MAMMALS

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The ABO blood group antigens were discovered at the beginning of this century. Although the biochemical and molecular-biochemical nature of the ABH and related antigens is now quite well characterized and it is presumed that they are concerned with oncodevelopmental and/or cell recognition phenomena(1), no clear explanation of the biological significance of these antigens has been proposed. Characterization of cells with regard to their surface and secretory glycoconjugates is important in order to understand the basis of their physiological and interactive behaviour. The taste buds of vertebrates are covered by mucous substances and it has been suggested that the carbohydrate residues of the mucous substances are essential for chemoreceptor processes in the function of taste buds. Therefore, in the present study, we examined the distribution of different types of carbohydrate antigens in the taste buds cells and lingual glands using monoclonal antibodies(MoAb) against blood group antigens and lectins conjugated with horseradish peroxidase(HRP).

Materials and Methods

Tissue specimens of tongue from mammals including man ,japanese monkey, rat, rabbit and dog were used in this study. Tissues from these animals were obtained from the Institute for Experimental Animals of Shiga University of Medical Science. Human tissue specimens were obtained at autopsy. Tissues were fixed in 10% formalin, embedded in paraffin and serially sectioned at 5μm. The experiments were performed as previously described using MoAb, A, B, H, Le^a, Le^b, Le^x and Le^y, and a battery of lectins conjugated with HRP(2). MoAbs against A,B, Le^a and Le^b antigens were purchased from Biotest,Germany, anti-H(type 1 and 2 specific) from Chembiomed, Canada, anti Le^x and Le^y from Signet, England. Helix pomatia agglutinin(HPA), Dolichos biflorus agglutinin (DBA), Ulex europaeus agglutinin I(UEA), Arachis hypogaea agglutininn(PNA), Triticum vulgaris agglutinin (WGA), Glycine max agglutinin(SBA), and Erythrina cristagalli agglutinin(ECA) were purchased from E.Y. Laboratories, USA.

Results

The ABO blood type of individuals examined in this study could be determined by the reactivity of anti A, B, and H MoAb with secretory cells of lingual glands. The serous cells of von Ebner's glands from all the rats examined reacted with anti A and B MoAb. The rabbits were grouped into A(+) and A(-) individuals. Secretory cells from A(-) individuals showed no reactivity with anti A, B and H antibodies. The dogs were typed into blood group A or O. The japanese monkeys were typed into blood group B or O. Although the reactivity of each reagent with the tissue sites of the tongue, such as taste buds, von Ebner's glands, posterior lingual glands, epithelial cells, and vascular endothelial cells were different and varied, the tissues from individuals belonging to the same species and blood groups showed similar reactivity with these reagents apart from the staining intensity. The reactivity of blood group specific lectins with the taste buds from each mammal was dependent on the ABO blood group of the donor. The Le^y antibody showed clear reactivity with the taste buds from all mammals, except the non-secretor human individuals. The anti-Le^x showed weak reactivity with the taste buds from the rabbits and humans, and moderate reactivity with serous cells of von Ebner's gland, as well as the mucous cells of posterior lingual glands from non-secretor human donors.

Numerous nuclei in the serous cells of von Ebner's glands from nearly all the individuals of japanese monkeys were unexpected stained by anti Le^a. This antibody showed clear reactivity the nuclear cell membrane and chromatin of von Ebner's glands and no reactivity with the nucleus in other tissue sites and organs even from the same donor.

ABH antigens in tissues from non-secretor individuals were not recognized in this study except some human donors.

The results obtained in this study are summarized in Table 1. The results described in Table 1 were obtained from the following blood group donors; Rat: blood goup AB, Rabbit: blood group A+, Dog: blood group A, Japanese monkey: blood group B, Human: blood group A (secretor and non-secretor).

Discussion

Taste buds consist of neuroepithelial cells with secretory and/or taste receptor functions. The significance of salivary secretion for taste perception has been pointed out by Gurkan and Bradley(3).

Mucous substances, which are secreted by the taste cells themselves and by vonEbner's glands or by salivary glands of the oral cavity, have been implicated in the taste stimulation process. Gurkan and Bradley(3) described that secretions from von Ebner's glands may influence the response of the taste receptors by controlling access of the taste stimuli to the taste buds, by changing the transepithelial resistance as a consequence of secretory mechanisms, and by changing the ionic or macromolecular composition of the micro-environment in which the initial events of taste transduction take place. Schmale et al.(4) found a glycoprotein in the mucous of von Ebner's glands, which was chemically related to the order binding protein that may play a key role in olfactory reception. The finding of ABH related antigen in the taste buds and von Ebner's glands may provide an important clue to the role of these antigens and carbohydrates in the chemoreceptor systems, since the taste buds are tissues that possesses a limited function as the taste receptor.

Summary

The localization of the ABH and related antigens in the taste buds and the lingual glands was examined by means of immmuno- and lectin-histochemical methods. The ABO blood type of each mammalian individual was determined by the reactivity of anti A, B, and H antibodies with secretory cells of lingual glands. The serous cells of von Ebner's glands of all the rats examined reacted with anti A and B antibodies. The rabbits were grouped into A(+) or A(-) individuals. The dogs were typed into blood group A or O, and the japanese monkeys were typed into blood group B or O. Although the reactivity of MoAbs against ABH related antigens and blood group specific lectins with the tissue site of tongue, such as taste buds, von Ebner's glands, posterior lingual glands, epithelial cells, and endothelial cells of blood vessels were different and varied among the animal species, the individuals belonging to the same species and the same blood group showed similar reactivity with each reagent apart from the staining intensity.

The finding of ABH and related antigens in the taste buds and von Ebner's glands may provide an important clue to elucidating the role of these antigens in the taste receptor systems.

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References

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Table 1. The expression of ABH antigens and lectin reactivities of taste buds and secretory cells in tongue from some mammalian species.

Rat	TB	EG	LG	RBC	End	Epi	Rabbit	TB	EG	LG	RBC	End	Epi
Reagents							Reagents						
A	+	+	W+	-	-	+	A	+	+	-	-	-	+
B	+	+	-	-	-	-	B	W+	-	-	+	-	-
H	-	+	W+	-	-	-	H	W+	W+	-	-	-	+
Le x	-	-	-	-	-	-	Le x	W+	-	-	-	-	-
Le y	W+	+	-	-	-	-	Le y	+	+	-	-	-	-
Le a	-	+	-	-	-	-	Le a	W+	-	-	-	-	-
Le b	-	+	-	-	-	-	Le b	W+	-	-	-	-	-
HPA	+	+	+	-	-	+	HPA	+	+	W+	-	-	+
DBA	-	+	+	-	-	+	DBA	W+	M+	-	-	-	+
UEA-I	+	W+	+	-	-	-	UEA-I	-	-	-	-	-	-
PNA	-	+	-	-	-	-	PNA	-	W+	+	-	-	-
ECA	-	+	-	-	-	-	ECA	-	+	+	-	-	-
WGA	W+	+	+	+	+	+	WGA	+	+	+	-	-	-

Dog	TB	EG	LG	RBC	End	Epi	Monkey	TB	EG	LG	RBC	End	Epi
Reagents							Reagents						
A	+	+	+	-	-	+	A	-	-	-	-	-	-
B	-	-	-	-	-	-	B	+	M+	M+	-	+	+
H	W+	+	-	-	-	+	H	W+	+	+	-	-	+
Le x	-	+	-	-	-	-	Le x	-	W+	-	-	-	-
Le y	+	+	M+	-	-	+	Le y	-	M+	+	-	-	-
Le a	+	+	-	-	-	-	Le a	+	+	-	-	-	-
Le b	+	+	M+	-	-	-	Le b	W+	+	+	-	-	-
HPA	+	+	+	-	-	+	HPA	-	-	-	-	-	-
DBA	-	-	+	-	-	+	DBA	-	-	-	-	-	-
UEA-I	-	-	M+	-	-	+	UEA-I	+	+	+	-	-	-
PNA	-	-	-	-	-	-	PNA	-	-	-	-	-	-
ECA	-	-	+	-	-	-	ECA	-	+	+	-	-	-
WGA	+	-	+	-	-	+	WGA	+	+	+	-	-	-

Human*	TB	EG	LG	RBC	End	Epi	Human**	TB	EG	LG	RBC	End	Epi
Reagents							Reagents						
A	+	+	+	+	+	+	A	+	+	+	+	+	+
B	-	-	-	-	-	-	B	-	-	-	-	-	-
H	+	+	-	-	-	+	H	-	+	-	-	-	-
Le x	W+	+	W+	-	-	-	Le x	W+	+	W+	-	-	-
Le y	W+	+	W+	-	-	+	Le y	-	+	-	-	-	-
Le a	+	+	+	-	-	-	Le a	+	+	+	-	-	-
Le b	+	+	+	-	-	-	Le b	-	+	-	-	-	-
HPA	+	+	+	+	+	+	HPA	+	+	+	+	+	+
DBA	+	+	+	-	-	-	DBA	+	-	-	-	-	-
UEA-I	+	+	+	-	-	+	UEA-I	-	-	-	-	+	+
PNA	-	-	-	-	-	-	PNA	-	-	W+	-	-	-
ECA	-	-	-	-	-	-	ECA	-	-	W+	-	-	-
WGA	+	+	+	+	+	+	WGA	-	+	+	+	+	+

EB;taste buds, EG;von Ebner's glands, LG;posterior lingual glands,
RBC;red blood cells, Ebd;Endothelial cells, Epi;Papillary epithelia.
+;positive reaction, w+;weak reaction, M+;mosaic distiribution,
-;negative reaction.
*;blood group A secretor, **;blood group A non-secretor.