

The Determination of Salivary Mucin Concentration among 12 years old Children, Mongolia

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ABSTRACT

Objective: The aim of this study was to assess the concentration of salivary mucin protein MUC5B and MUC7.

Design: The study population consisted of 190 children aged 12 years old, Ulaanbaatar, Mongolia. We obtained according to the informed consent No.2022/3-03-36 of the Ethical Committee. The oral examination was done according to the recommendation of WHO. Saliva samples were collected between 9:00 AM and 11:00 AM among selected 81 children. Selected children abstained from eating and drinking for 2 h. Salivary mucin protein was analyzed by Sunlong Biotech Co., Ltd. Human Mucin-5B, Mucin-7, ELISA Kit (SL1210Hu, SL1211Hu) in the Medical Pathology Laboratory of MNUMS.

Results: The prevalence and DMF/t score of dental caries were 88.6% and 2.79 among all children. The unstimulated salivary flow rate was 0.34 ± 0.2 ml/min among selected children, 0.41 ± 0.22 ml/min in control-I group, 0.36 ± 0.19 ml/min in control-II group and 0.26 ± 0.17 ml/min in the case group ($p < 0.05$). The mean concentrations of MUC7 and MUC5B amounted to 0.38 ± 0.22 ng/ml and 0.31 ± 0.09 ng/ml in the control I, 0.42 ± 0.19 ng/ml and 0.35 ± 0.11 ng/ml in the control II group, 0.45 ± 0.07 ng/ml and 0.38 ± 0.13 ng/ml in control group, respectively ($p < 0.001$).

Conclusions: Unstimulated salivary flow rate was significantly different between groups ($p = 0.018$), but concentration of salivary MUC5B ($p = 0.96$) and MUC7 ($p = 0.78$) proteins was not significantly different. There was a significantly weak and negative relationship between dental caries and unstimulated salivary flow rate ($p = 0.018$) and significantly weak and positive relationship between dental caries and concentration of salivary MUC5B and MUC7 proteins.

Keywords: ELISA, Schoolchildren, MUC5B, MUC7, Salivary flow rate

Introduction

The World Health Organization (WHO) has announced that dental caries is the leading oral disease in children, and it is a chronic infectious disease derived from multiple causes. The prevention of dental caries is higher effective results than treatment either clinically or economically¹. Saliva is the main test and biomarker of high research importance, which is an internal factor of dental caries. Human saliva is a complex secretive fluid that contains a mixture of inorganic and organic molecules of secretions released from each salivary gland. Saliva has many important roles in the prevention of dental caries, such as cleaning the teeth from food residues, creating a buffer environment, and protecting the teeth from the effects of bacterial acids by forming a protein shell². The buffer system of saliva is mainly formed by bicarbonate ions, but also the participation of phosphates, peptides and proteins is essential³. Saliva is the main test and biomarker of high research importance, which is an internal factor of dental caries⁴. Despite the fact that salivary proteins are a very small part of the composition, they play a role in inhibiting the growth of caries-causing bacteria and enamel demineralization and remineralization⁵. For example, salivary mucin accounts for 20-30% of the total protein in saliva and is the most commonly studied^{6,7}. There have been identified 11 types of mucin proteins in the human body, which are divided into 3 types: gel-forming (MUC2, MUC5AC, MUC5B, MUC6), soluble or secreted (MUC7), and membrane-associated (MUC1, MUC3, MUC4, MUC12). Mucin proteins could protect the dental caries and moisturize mucus by acting against the adhesion of microorganisms. In particular, MUC5B and MUC7 proteins are being studied in relation to dental caries^{8,9}. The salivary flow rate and MUC5B, MUC7 proteins were found to be related to the dental caries among 10-12 years old children in China and 9-11 years old children in Thailand^{10,11}. In Mongolia, Angar S et al noted in the study conclusion that the dental caries related to salivary MUC7 proteins among Mongolian adults in 2021. The study aim was to determine the concentration of salivary mucin protein of 12 years old Mongolian children.

Materials and Methods

The study was a case-control design. The study population consisted of 190 children aged 12 years old, studying at 84th secondary school, Ulaanbaatar city, Mongolia. We obtained according to the informed consent No.2022/3-03-36 of the Ethical Committee. We selected the children in the three different groups based on the DMFT and the inclusion criteria: caries free children (control I group), children with filled teeth and any decayed teeth (control II group), and children with more than 5 decayed teeth (case group). Each group has 27 children and the target sample consisted of 81 children. Before taking a saliva sample we gave to every child the demanded cautions and recommendations for saliva sampling activity. Saliva samples were collected between 9:00 AM and 11:00 AM and these children abstained from eating and drinking for 2 hours. Salivary mucin protein was analyzed in the Medical Pathology Laboratory of MNUMS by using ELISA Kit marked SL1210Hu and SL1211Hu manufactured in the Sunlong Biotech Co., Ltd. The statistical analysis was done by SPSS 23 software.

Results

When we determined the unstimulated salivary flow rate was 0.34 ± 0.2 ml/min among all 12 years old Mongolian

children, 0.41 ± 0.22 ml/min in control I group, 0.36 ± 0.19 ml/min in control II group and 0.26 ± 0.17 ml/min in case group, significantly ($p < 0.05$).

Then we analyzed the concentration of salivary MUC5B proteins among study three groups, there were 0.31 ± 0.09 ng/ml in control I group, 0.35 ± 0.11 ng/ml in the control II group and 0.38 ± 0.13 ng/ml in the case group ($p < 0.001$) significantly (Table 1).

Table 1: The concentrations of salivary MUC5B proteins among 12 years old Mongolian children by study groups.

Groups		Mean (ng/ml)	Std. Deviation	Std. Error Mean	p value
MUC5B	Control I	.31	.09	.01	0.001
	Control II	.35	.11	.02	
	Case	.38	.13	.02	

When we determined the concentration of salivary MUC7 proteins among selected children of study three groups, there were amounted 0.38 ± 0.22 ng/ml in control I group, 0.42 ± 0.19 ng/ml in the control II group and 0.45 ± 0.07 ng/ml in the case group ($p < 0.001$) significantly (Table 2).

Table 2: The concentrations of salivary MUC7 proteins among 12 years old Mongolian children by study groups.

Groups		Mean (ng/ml)	Std. Deviation	Std. Error Mean	p value
MUC7	Control I	.38	.07	.01	0.001
	Control II	.42	.63	.12	
	Case	.45	.07	.14	

Table 1 and 2 had shown that the concentration of salivary MUC5B and MUC7 proteins were higher in the caries free children than the children affected by dental caries, significantly.

We assessed the correlation between the dental caries and salivary flow rate, salivary MUC5B and MUC7 proteins (Table 3).

Table 3: The correlation between dental caries and the salivary flow rate, MUC5B, MUC7 proteins among 12 years old Mongolian children.

		Salivary unstimulated flow rate	Concentrations of MUC5B	Concentrations of MUC7
Dental caries	Correlation coefficient (r)	-.20	.02	.07
	p value	.06	.86	.51

There were negative correlation between dental caries and the salivary unstimulated flow rate ($r = -0.2$, $p = 0.06$) and the positive correlation between dental caries and the salivary MUC5B proteins ($r = 0.02$, $p = 0.86$) and MUC7 proteins ($r = 0.07$, $p = 0.51$).

Discussion

We assessed the salivary flow rate and the concentrations of salivary mucin MUC5B and MUC7 proteins among 12-year-old Mongolian children by the three study groups.

WHO recommends that 12-year-old children undergo an oral examination, which is the most likely age for permanent teeth to be fully erupted and have healthy teeth. Among the 12-year-old children in our study, the prevalence of dental caries was 88.6%,

and the DMF/t was 2.79. However, the DMF/t score of 12-year-old children was 1.58 ± 2.03 in Indonesia (2019), 4.62 ± 3.2 in Qatar (2014) and 2.5 ± 2.2 in Mongolia (2018). We considered that different results DMF/t of dental caries are depended on country's development, socio-economic status, geographical location, life habit and cultural difference¹²⁻¹⁴.

Mucin proteins and immunoglobulin A (secretory immunoglobulin sIgA) are mainly involved in the role of saliva in protecting oral diseases. There are many types of mucins in saliva, but MUC5B and MUC7 are the most abundant and easy to identify proteins. In our study, the MUC5B and MUC7 proteins in the saliva were different, or the concentration of proteins increased with the number of decayed teeth. A meta-analysis conducted in Brazil in 2020 found that MUC5B protein increased with the severity of dental caries, which is similar to our results. Also, in Germany (2021), it was found that MUC5B and MUC7 protein levels were higher in children with 5-6 decayed teeth than in children with any decayed teeth^{15,16}.

Conclusion

There was negative correlation between dental caries and the salivary unstimulated flow rate ($r = -0.2$, $p = 0.06$) and the positive correlation between dental caries and the salivary MUC5B proteins ($r = 0.02$, $p = 0.86$), MUC7 proteins ($r = 0.07$, $p = 0.51$).

Abbreviations

WHO World Health Organization

MUC5B mucin 5B protein

MUC7 mucin 7 protein

ELISA enzyme-linked immunosorbent assay

MNUMS Mongolian National University of Medical Science

DMF/t Decayed Missed Filled-teeth

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