



Effect of PRECEDE-PROCEED-Model-Based Health Education on the Life Quality and 5-HTT Gene Expression of Patients with Gastric Cancer after Surgery

Guifang Wang, Xueyan Jiang*

Department of Gastrointestinal, Surgery, the First People's Hospital of Wenling, Wenling, Zhejiang 317500, China

ARTICLE INFO

Original paper

Article history:

Received: August 21, 2021

Accepted: December 07, 2021

Published: December 30, 2021

Keywords:

PRECEDE-PROCEED-Model;
Health Education; Gastric
Cancer; Life Quality; Serotonin

ABSTRACT

This study aimed to investigate the effect of PRECEDE-PROCEED-Model-based health education on the life quality of patients with gastric cancer after surgery. Also, the effect of this model was evaluated on 5-HTT gene expression as a gene related to depression. For this purpose, a total of 32 gastric cancer patients who were hospitalized in this hospital between March 2019 and September 2020 were enrolled in this study after surgery and, according to the time of admission, were divided into the control group and observation group, with 16 patients in each group. Patients in the control group were nursed regularly, while those in the observation group, in addition to the regular nursing, would receive the PRECEDE-PROCEED-Model-based health education. Post-surgery life quality of patients in two groups was compared from the following aspects: Rehabilitation process, pain assessment, rate of complications and The Short-Form (SF-36) Health Survey. The expression of the 5-HTT gene was performed by the Real-time qPCR technique. The results of this study showed that after surgery, the extubation time and the time of hospital discharge of patients in the observation group were all earlier than those in the control group, while the score of pain assessment and rate of complication was much lower in the observation group, and the SF-36 score of patients was much higher (all $P < 0.05$). The results of 5-HTT gene expression showed that there was no significant difference between the control and observation groups before the intervention. But one month after the intervention, gene expression in the observation group was significantly reduced compared to the control group ($p < 0.01$). This significant decrease was also seen two months after the intervention ($p < 0.05$). As mentioned before, the expression of the 5-HTT gene increases during the depression, therefore improvement of the patient's condition and quality of life decreased the expression of this gene. Hence, PRECEDE-PROCEED-Model-Based Health Education plays an influential role in reducing the expression of this gene. However, the passage of time has not been ineffective in lowering 5-HTT expression. In general, PRECEDE-PROCEED-Model-based health education could help patients establish a good system of health knowledge, which could encourage the patients to avoid the negative mood, optimize the rehabilitation process, improve the post-surgery rehabilitation and, finally, ameliorate the life quality of patients after surgery.

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Introduction

For patients with gastric cancer in the early stage, surgical resection should be the most efficient protocol, which, however, is limited by the longer post-surgery rehabilitation process due to the massive trauma, anesthesia, post-surgery pain and drainage tubes (1). Meanwhile, long-term bedridden could increase the rate of complications (2, 3). Thus, appropriate nursing intervention is necessary to accelerate the post-surgery rehabilitation of patients (4-6). PRECEDE-PROCEED-Model assessment involves the 9 steps: social assessment, epidemiological assessment, ecological assessment,

organizing and educating assessment, administrative and policy assessment, implementation, process evaluation, impact evaluation and outcome evaluation (7, 8). These steps constitute a dynamic, consecutive, cycling and ascending process (9). PRECEDE-PROCEED model excels in comprehensiveness, systematicness and effectiveness, and this model, considering various factors, could divide the factors into the inclining factors, promoting factors and enforcing factors. Based on such a model, researchers could develop a multi-layer health intervention plan, which has been testified as a scientific and effective health-promoting pattern in various studies and

*Corresponding author. E-mail: jiangxueyansci@163.com
Cellular and Molecular Biology, 2021, 67(6): 242-248

adopted in various health management programs, with promising outcomes (9-13). As such, for patients after resection for gastric cancer, the implementation of PRECEDE-PROCEED-model-based health education is of great significance to shorten the rehabilitation process and gain the promising prognosis of patients.

Low serotonin levels in the brain are thought to be one of the possible causes of depression, and many antidepressants work by blocking a protein transporter that removes serotonin from nerve cells (14). An imaging study of the brain showed that the average level of serotonin transmitter was increased in a group of patients who improved after cognitive-behavioral therapy (15). 5-Hydroxy Tryptamine transporter (5-HTT) is an essential component of the body's serotonergic system (16, 17). It is present in the membranes of neurons, intestinal enterochromaffin cells, and platelets. The 5-HTT gene is located on the long arm of chromosome 17. (17q11.2). Assessing the expression of this gene plays a vital role in depression (17).

In this study, with patients who received the resection for gastric cancer, we implemented the PRECEDE-PROCEED-model-based health education, aiming to observe the value for the post-surgery rehabilitation of patients after surgery. Also, the effect of PRECEDE-PROCEED-model-based health education was evaluated on 5-HTT gene expression as a gene related to depression.

Materials and methods

General data

A total of 32 gastric cancer patients who were hospitalized in the first people's hospital of Wenling between March 2019 and September 2020 were enrolled in this study after surgery. Enrollment criteria: Patients with the diagnosis of gastric cancer via pathological test; patients who had fulfilled the resection for gastric cancer; patients who had no radiotherapy or chemotherapy before or after resection; patients behaving normally in cognition and communication. Exclusion criteria: Patients who were discharged or admitted by another hospital after surgery; patients complicated with other malignant tumors; patients with mental disorders. According to the time of admission, patients were divided into the control group and observation group, with 16 patients

in each group. The Control group consisted of 9 males and 7 females, aged between 30 and 75 years old, with an average of (42.05 ± 5.04) years old, and for the educational attainment, 4 patients were middle school graduates or less, 8 patients with high school graduates and 4 patients were college graduates or higher. The observation group consisted of 12 males and 4 females, aged between 32 and 78 years old, with an average of (43.27 ± 5.62) years old, and for the educational attainment, 3 patients were middle school graduates or less, 10 patients with high school graduates and 3 patients were college graduates or higher. Comparison of the general data, like age and sex ratio, between two groups showed no significant differences ($P > 0.05$), suggesting that the general data of patients were comparable between the two groups. This study had gained approval from the Ethical Committee of the first people's hospital of Wenling, and all patients and their families had signed the written informed consents.

Methods

All patients received regular medication after resection for gastric cancer, while those in the control group had a normal nursing intervention, including the education of gastric cancer-related knowledge, prophylaxis of complication and post-surgery precautions.

Patients in the observation group, in addition to the normal nursing interventions, would receive the PRECEDE-PROCEED-model-based health education. First, factors influencing the life quality of patients after surgery were categorized into the inclining factors, promoting factors and reinforcing factors. Inclining factors: Patients with gastric cancer, after resection, had less confidence or sense of safety for the damage of stomach functions and insufficient knowledge of the disease. Promoting factors involve external factors, like the rehabilitation environment in the hospital, positive attitude of nursing staff and treatment cost. Reinforcing factors included the attitudes of the third party, including the family or friends. Interventions were given according to the factors influencing the quality of rehabilitation. Interventions for inclining factors: Nursing staffs were required to monitor the condition of patients after surgery, including the pulse, respiration, urine amount and incision depth, and educate patients about the

knowledge for gastric cancer, including the protocols for combined chemotherapy, and the methods for adverse reactions, post-surgery precautions and common complications, aiming to help patients establish the comprehensive knowledge structure, overcome the fear and enhance the confidence to conquer the disease. Interventions for the promoting factors: Nursing staffs were required to perform the active post-surgery nursing, including fasting, gastrointestinal decompression and fixation of stomach tube, clean the mouth twice every day to prevent the infection, keep the abdominal drainage unobstructed and observe the amount and color of drainage liquid; besides, patients should be kept in a comfortable position to minimize the pain or discomfort after surgery; meanwhile, at 8 hours after surgery, patients were advised to perform the rehabilitation in bed with the help of family, while at 24 h, patients should perform the rehabilitation on the ground to restore the function of stomach and intestines; moreover, post-surgery of patients should be guided by the nurses to restrict the uptake of liquid during or after the diet and reduce the uptake of sugar, protein and fat; complications, like gastrorrhagia, gastric obstruction or retention, should also be observed closely, and appropriate measures should be taken for complications. Interventions for the reinforcing factors: Support from the family and friends was pivotal to the post-surgery rehabilitation of gastric cancer patients after surgery, so education for a family was also necessary to the restoration of confidence of patients; family should also be advised to encourage the patients but to avoid affecting the confidence of patients in rehabilitation.

Observation indexes

The rehabilitation process (extubation time and hospitalization duration) of patients in two groups was compared between two groups; at the 1st, 3rd and 7th days after surgery, a visual analogue scale (VAS) was utilized to evaluate the pains of patients in two groups; besides, rate of complications after surgery was also recorded for patients in two groups; finally, the post-surgery life quality of patients in two groups was compared by using The Short-Form (SF-36) Health Survey (SF-36).

5-HTT gene expression

Depressed patients have lower levels of serotonin metabolites in cerebrospinal fluid and brain tissue (18). Therefore, in the current study, we provided cerebrospinal fluid from all participate. Total RNA Purification Kit (Norgen, Canada) was used to extract RNA from cerebrospinal fluid and RevertAid First Strand cDNA Synthesis Kit (Thermo Fisher Scientific, USA) was used to synthesize cDNA. HPRT gene was used as a reference gene. The sequences of primers are shown in Table 1.

Table 1. The Primers sequences for 5-HTT and HPRT genes

Gene		Primer Sequence
5-HTT	Forward	5'-TCTGAAAAGCCCCACTGGACT-3'
	Reverse	5'-AGCATAACCAGCGCCATGAA-3'
HPRT	Forward	5'-CCTGGCGTCGTGATTAGTGAT-3'
	Reverse	5'-AGACGTTTCAGTCTGTCCATAA-3'

All quantitative PCR reactions are performed in 25µl volume including 250ng cDNA and 10mg Real-time SYBR Green/Rox PCR Master, 1µl of primers, nuclease-free water with a total volume of 20µl. Each replicate was tested twice in the ABI step-one quantitative PCR system with this technique. The initial temperature for activating the polymerase enzyme was 35°C for 10 minutes, followed by 40 cycles consisting of 5 seconds at 95°C, 30 seconds at 57°C, then a melting curve to identify and determine Peaks related to a specific gene as well as the identification of the formation of primer-dimers were formed.

Statistical analysis

Data were analyzed by using the SPSS 22.0 software. Measurement data were expressed in form of mean ± standard deviation (SD) and compared between two groups by using the t-test. Enumeration data were expressed in form of n (%) and compared by using the chi-square test. P < 0.05 suggested that the difference had statistical significance.

Results and discussion

Comparison of the rehabilitation process (Extubation time and hospitalization duration)

In the observation group, the extubation time of the abdominal drain tube was earlier than that in the control group, while the hospitalization duration was also shorter than that in the control group (all P < 0.05) (Figure 1).

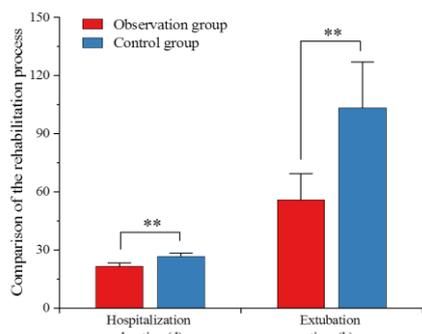


Figure 1. Comparison of the rehabilitation process (Extubation time and hospitalization duration); Note: Compared with the control group, **P<0.01.

Comparison of the post-surgery pain scores between two groups

Significant decreases were seen in the VAS scores of patients in two groups at post-surgery 1st, 3rd and 7th days (all P < 0.05), while the VAS scores of patients in the observation group at post-surgery 1st, 3rd and 7th days were much lower than those in the control group (all P < 0.05) (Figure 2).

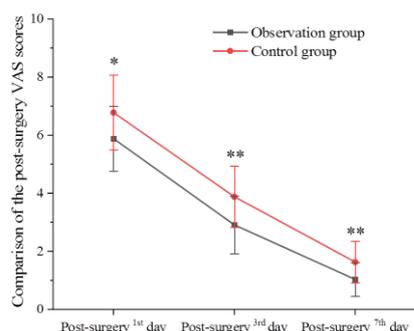


Figure 2. Comparison of the post-surgery pain scores between two groups; Note: Compared with control group, *P<0.05, **P<0.01

Comparison of the rate of post-surgery complication between two groups

After surgery, patients in the observation group had a lower rate of complication than that in the control group (P < 0.05) (Table 2).

Table 2. Comparison of the rate of post-surgery complication between two groups [n (%)]

Group	Case (n)	Incision infection	Deep vein thrombus	Stomal leak	Pulmonary infection	Total rate of complication
Observation group	16	1(6.25)	0(0.00)	1(6.25)	0(0.00)	2(12.5)
Control group	16	1(6.25)	0(0.00)	2(12.5)	2(12.5)	5(31.25)
<i>t</i>						4.320
<i>P</i>						<0.05

Comparison of the post-surgery life quality of patients via SF-36

As the intervention was implemented, increases were observed in the SF-36 scores of patients in two groups, while the SF-36 score in the observation group had a much more significant increase than that in the control group (P < 0.05) (Figure 3).

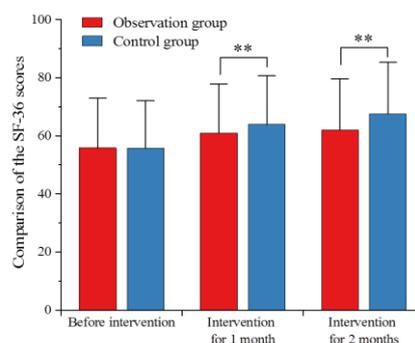


Figure 3. Comparison of the post-surgery life quality of patients via SF-36; Note: Compared with control group, **P<0.01.

Comparison of the rate of 5-HTT gene expression between two groups

The results of 5-HTT gene expression showed that there was no significant difference between the control and observation groups before the intervention. But one month after the intervention, gene expression in the observation group was significantly reduced compared to the control group (P < 0.01). This significant decrease was also seen two months after the intervention (P < 0.05) (Figure 4).

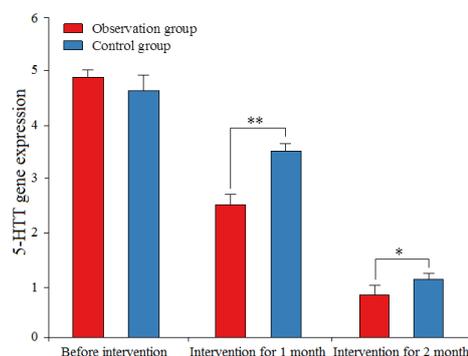


Figure 4. Comparison of 5-HTT gene expression between two groups; Note: Compared with control group, *P<0.05, **P<0.01

Gastric cancer is the abnormal growth of stomach cells. Gastric cancer can occur in any part of the stomach (19). Treatment usually includes surgery to

remove the cancerous mass (20). Other treatments may be recommended before and after surgery (21, 22). For gastric cancer patients after resection, PRECEDE-PROCEED-model-based health education can accelerate the post-surgery rehabilitation process, with significant relief in the post-surgery pain and a decrease in the post-surgery complications. PRECEDE-PROCEED model emphasizes the comprehensive evaluation for the targeted population to find out and integrate the factors that may affect the life quality and then divided these factors into the inclining factors, promoting factors and reinforcing factors, based on which individualized protocols could be developed (23, 24). In this study, we established the health education protocols for gastric cancer patients after resection based on the PRECEDE-PROCEED model and performed the corresponding health intervention measures for patients. Consequently, we found that patients in the observation group excelled in the extubation time and hospitalization time when compared to their counterparts in the control group (all $P < 0.05$); significant decreases were seen in the VAS scores at the 1st, 3rd and 7th days after resection in two groups, while those in the observation group had a more significant decrease than patients in the control group (all $p < 0.05$), and the rate of complication after resection in the observation group was also lower than that in the control group ($P < 0.05$). As such, PRECEDE-PROCEED-model-based health education could facilitate the recovery, alleviate the pains and reduce the risk of complications of patients after surgery, which, as we analyzed, may owe to the following reasons: 1) For the inclining factors: Patients in the observation group have a deep understanding on the disease, and a corresponding negative attitude could be corrected in time to help them to establish the confidence in overcoming the disease; 2) For the promoting factors: Medical staffs performed the active and positive post-surgery nursing, cared the patients and helped them dissolve the concerns; 3) For the reinforcing factors: Accompany and comprehension of the family are more conducive to the rehabilitation of patients, and since we had well performed the health education for the family, the family provided spiritual support for the patients to overcome the disease. In addition,

patients were encouraged to share their condition with other patients and the doctors, nurses and family.

PRECEDE-PROCEED-model-based health education could improve the life quality of gastric cancer patients after resection. With the continuous update in the medical pattern and health concept, people will no longer concern the control of the features of the disease, but also emphasize the improvement in the life quality. Cancer patients usually face tremendous physiological and psychological challenges, with significant deterioration in the life quality. Thus, simple treatment for them is inadequate. As such, we developed the health education protocols for gastric cancer patients after resections based on the PRECEDE-PROCEED model. Through effective health education, we educated the patients about the disease-related knowledge to encourage them to actively fight against the disease and alleviate the mental burden. This model emphasizes the evaluation, i.e. feedback and opinions should be collected from the patients, family and team staff after the implementation of the study, and corresponding problems should be adjusted to guarantee the launch of the study (25, 26). The results of this study indicated that as the intervention was implemented, significant increases were found in the SF-36 scores of patients in two groups, while those in the observation group had a much higher score ($P < 0.05$), which coincided with the conclusion of Miller *et al.* (27) who argued that health education should be a key part of prophylaxis and treatment of disease and also critical to the comprehension of health, attitude transition and behavior correction to improve the life quality. The results of 5-HTT gene expression showed that there was no significant difference between the control and observation groups before the intervention. But one month after the intervention, gene expression in the observation group was significantly reduced compared to the control group ($p < 0.01$). This significant decrease was also seen two months after the intervention ($p < 0.05$). As mentioned before, the expression of the 5-HTT gene increases during the depression (28), therefore improvement of the patient's condition and quality of life decreased the expression of this gene (29-33). Hence, PRECEDE-PROCEED-Model-Based Health Education plays an influential role in reducing the expression of this gene.

However, the passage of time has not been ineffective in lowering 5-HTT expression.

In conclusion, PRECEDE-PROCEED-model-based health education gained a promising effect for gastric cancer patients after resection by facilitating the rehabilitation, relieving the pains, reducing the risk of complications and improving the life quality of patients. Therefore, PRECEDE-PROCEED-model-based health education can be promoted and applied in the clinical treatment for gastric cancer patients after resection.

Acknowledgements

None.

Interest conflict

None.

References

1. Afshar J, Mehrzad J, Mehrad-Majd H, Goshayeshi L, Saeidi J. Prognostic Significance of Tripartite Motif Containing 16 Expression in Patients with Gastric Cancer. *Asian Pac J Cancer Prev* 2021; 22(8): 2445-2451.
2. Nema R, Patel P, Kumar A. Prognostic Role of Receptor Tyrosine Kinase–Like Orphan Receptors in Intestinal-Type Gastric Cancer. *Asian Pac J Cancer Prev* 2021; 22(7): 2125-2134.
3. Ercisli MF, Kahrizi D, Aziziaran Z. Environmental factors affecting the risk of breast cancer and the modulating role of vitamin D on this malignancy. *Cent Asian J Environ Sci Technol Innov* 2021; 2(4).
4. Zhu Y-j, Wu X-y, Wang W et al. Acupuncture for Quality of Life in Gastric Cancer Patients Undergoing Adjuvant Chemotherapy. *J Pain Symptom Manag* 2021.
5. Andrzejewski S. *The Role of Mitochondrial Metabolism and PGC-1 α on Breast Cancer Bioenergetics and Metastasis*: McGill University (Canada); 2018.
6. Taleghani F, Ehsani M, Farzi S et al. Nutritional challenges of gastric cancer patients from the perspectives of patients, family caregivers, and health professionals: a qualitative study. *Support Care Cancer* 2021; 29(7): 3943-3950.
7. Nutbeam D. Health education and health promotion revisited. *Health Educ J* 2019; 78(6): 705-709.
8. Cole RE, Horacek T. Applying precede-proceed to develop an intuitive eating nondieting approach to weight management pilot program. *J Nutr Educ Behav* 2009; 41(2): 120-126.
9. Glanz K R, Viswanath K. *Health Educ Behav* 2008.
10. Moshki M, Atarodi BA, Moslem A, Taheri M. Applying an Educational-participatory Program based on the PRECEDE Model for Promoting Self-esteem and Mental Health of Students in Iran. *Int J Prev Med* 2012; 3(4): 241.
11. Yan C, Yun C. Development of behavioral intervention program protecting clinical nurses from occupational hazards using the Precede-Proceed model. *J Nurs Sci* 2012; 9.
12. Fu X, Zhang W. Application of Green's model in the protection of surgical smog. *Nurs Res Chin* 2019; 33(8): 1440-1442.
13. Azar FE, Solhi M, Nejhaddadgar N, Amani F. The effect of intervention using the PRECEDE-PROCEED model based on quality of life in diabetic patients. *Electron Physician* 2017; 9(8): 5024.
14. Wang K, Zhao X-h, Liu J, Zhang R, Li J-p. Nervous system and gastric cancer. *Biochim Biophys Acta Rev Cancer* 2020; 1873(1): 188313.
15. Lissemore JI, Sookman D, Gravel P et al. Brain serotonin synthesis capacity in obsessive-compulsive disorder: effects of cognitive behavioral therapy and sertraline. *Transl Psychiatry* 2018; 8(1): 1-10.
16. Licht CL, Mortensen EL, Hjordt LV et al. Serotonin transporter gene (SLC6A4) variation and sensory processing sensitivity—Comparison with other anxiety-related temperamental dimensions. *Mol Genet Genomic Med* 2020; 8(8): e1352.
17. Li J, Chen Y, Xiang Q, Xiang J, Tang Y, Tang L. 5HTTLPR polymorphism and postpartum depression risk: A meta-analysis. *Medicine* 2020; 99(39).
18. Davison AS, Strittmatter N, Sutherland H et al. Assessing the effect of nitisinone induced hypertyrosinaemia on monoamine neurotransmitters in brain tissue from a murine model of alkaptonuria using mass spectrometry

- imaging. *Metabolomics* 2019; 15(5): 1-10.
19. Jafari E, Safinejad S, Dabiri S, Naghibzadeh-Tahami A. Study of the Relationship between MMP-2 and MMP-9 and Her2/neu Overexpression in Gastric Cancer: Clinico-Pathological Correlations. *Asian Pac J Cancer Prev* 2021; 22(3): 811-817.
 20. Trujillo-Rivera A, Sampieri CL, Morales L, Montoya A, Lamadrid-Figueroa H. Prognostic Factors for Survival in Patients with Gastric Cancer Treated at Two Public Health Institutions in Mexico. *Asian Pac j cance care* 2021; 6(4): 429-440.
 21. Pittayanon R, Uedo N, Praipisut T, Tounai Y, Rerknimitr R, Kullavanijaya P. Factors Associated with High Mortality of Gastric Adenocarcinoma in Thailand Versus Japan. *Asian Pac j cance care* 2018; 3(2): 29-29.
 22. Bilal I, Xie S, Elburki MS, Aziziaran Z, Ahmed SM, Jalal ST. Cytotoxic effect of diferuloylmethane, a derivative of turmeric on different human glioblastoma cell lines. *Cell Mol Biomed Rep* 2021; 1(1): 14-22.
 23. GreenLW K. *Health program planning: An educational and ecological approach*. New York, NY: McGraw-Hill; 2004.
 24. Handyside L, Warren R, Devine S, Drovandi A. Utilisation of the PRECEDE-PROCEED model in community pharmacy for health needs assessment: A narrative review. *Res Social Adm Pharm* 2021; 17(2): 292-299.
 25. Glanz K, Rimer BK, Viswanath K. *Health behavior and health education: theory, research, and practice*: John Wiley & Sons; 2008.
 26. Cheung MF, To WM. An extended model of value-attitude-behavior to explain Chinese consumers' green purchase behavior. *J Retail Consum Serv* 2019; 50: 145-153.
 27. Miller WR, Moyers TB. Motivational interviewing and the clinical science of Carl Rogers. *J Consult Clin Psychol* 2017; 85(8): 757.
 28. Kao W-T, Chang C-L, Lung F-W. 5-HTT mRNA level as a potential biomarker of treatment response in patients with major depression in a clinical trial. *J Affect Disord* 2018; 238: 597-608.
 29. Kazemi E, Kahrizi D. Lack of association between gastric cancer and hopq alleles in *Helicobacter pylori*. *Genetika*. 2016;48(3):893-902.
 30. Kazemi E, Kahrizi D, Moradi MT, Sohrabi M, Amini S, Mousavi SA, Yari K. Association between *Helicobacter pylori* hopQI genotypes and human gastric cancer risk. *Cell Mol Biol* 2016 ;62(1):6-9.
 31. Kazemi E, Kahrizi D, Moradi MT, Sohrabi M, Yari K. Gastric cancer and *Helicobacter pylori*: impact of hopQII gene. *Cell Mol Biol* 2016;62(2):107-10. 32.
 32. Ismaili A, Yari K, Moradi MT, Sohrabi M, Kahrizi D, Kazemi E, Souri Z. IL-1B (C+ 3954T) gene polymorphism and susceptibility to gastric cancer in the Iranian population. *Asian Pac J Cancer Prev* 2015;16(2):841-4.
 33. Tourang M, Fang L, Zhong Y, Suthar R. Association between Human Endogenous Retrovirus K gene expression and breast cancer. *Cell Mol Biomed Rep* 2021; 1(1): 7-13.