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### **Study of the influence of tonsillitis on other organs based on biophysical properties of skin biologically active points**

**Abstract:** One of the most frequently encountered, especially at the adolescents and students, respiratory disease is chronic tonsillitis. It emerges under the influence of infectious agents, such as bacteria, viruses and fungi. The main causes leading to the spread of this disease are changing climate conditions (more often in fall and winter) with increased humidity and cold, when the resistance of body to infection decreases. However, tonsillitis may occur during the summer. In summer, the main causes for the spread of tonsillitis are air recirculating conditioning systems, ice cream, cold drinks, humid and dirty air. 14 students aged 19-23 years old were enrolled into the experiment, divided into two groups by seven students each (with tonsillitis as test and healthy as control). Biologically active points (BAP) symmetrically located to the right and left sides of the human body served as object of the study and were studied by their temperature indicators. Temperature measurements were recorded with "Biotemp-2". The results were statistically calculated. There were no significant differences in the temperature data of points located on the right and left sides of the body in control group; seven points from five meridians were statistically reliable when considering the temperature indices ( $p < 0.05$ ). According to the seven BAP, for which statistical validity was calculated, physiological changes from chronic tonsillitis of these biologically active points indicate that they might be used as diagnostic markers.

**Key words:** biologically active points, biophysical properties, meridian, tonsillitis, temperature.

#### **Introduction**

Hundreds of millions of people suffer from chronic respiratory diseases; four million people die prematurely from chronic respiratory diseases each year. Acute respiratory infections are the leading cause of death in children in developing countries. Although the Global Burden of Disease Study 2020 revealed fewer deaths related to lower respiratory tract infections than 2 decades ago, too many people are still dying.

The "Kazakhstan-2030" Strategy outlined a long-term way of development of the Republic of Kazakhstan, in which one of the main priorities is "Health, Education and Wellness of Kazakhstani Citizens", which states that our citizens need to be healthy until the end of their lives and lead a healthy lifestyle.

Overall world statistics shows that more than half of the global population suffers from tonsillitis, which constitutes about 50 to 70% of the individual population in developed countries. 63% of patients

consulted with otolaryngologists in the Outpatient Center in 2017 were diagnosed with tonsillitis. Of them: 40% were women and 23% were men [1; 2].

When comparing the spread of the disease in our country to the world statistics, 29-30 thousand in 100 thousand people, namely 29-30% complained about the disease [3-5].

Chronic tonsillitis is one of the most common illnesses in the pathology. It emerges under the influence of infectious agents such as bacteria, viruses, fungi. For example, it can cause sore throat illness when catching cold [6; 7]. The main causes of the prevalence of these diseases are climate change, adverse environmental effects, increased urban and motor traffic, increased smoking and industrial wastes, prevalence of various viral diseases [8; 9].

The main reasons for tonsillitis are common or local cold, cold drinks. Tonsillitis spreads in cold weather (autumn, winter), when the air humidity elevates and the body's resistance to infection decreases. The main causes of tonsillitis in summer are

air recirculating conditioning systems, ice cream and cold drinks, humid and dirty air [10].

Air recirculating conditioning systems are placed everywhere, even in private homes. When entering the environment with temperatures below the ambient air temperature, there is a rather high chance for tonsillitis or lung inflammation. Decrease in temperature by 10 degrees is a major stress for the body. The immune system weakens and the body cannot resist the causative agents of infection [11].

During the summer, large number of people eat cold desserts, drink cold drinks in their attempt to quench thirst. However, there is a clear controversy, as firstly, "ice-cold" drinks do not quench thirst, and secondly, consumers of such might catch a cold, creating perfect conditions for the causative agent of tonsillitis – *Streptococcus pyogenes* [12; 13].

The humidity of air also has a significant effect on the heat exchange of the organism with the external environment. During the low temperature and high humidity time, the heat transfer process increases and the human body cools down [14]. Winter and summer time in Almaty are characterized as highly humid. Frequent precipitation and snow melting increase the air humidity. Lack of ventilation in the buildings sums up the development of this process in the city. Prevailing number of youngsters studying at the higher education institutions often suffer from respiratory diseases due to such environmental factors [15].

Tonsils is an organ that is a part of the lymphatic system, which together with the other organs of the immune system forms immunity. Has many functions: first is protective – tonsils produce a large number of macrophages, which have the ability to "absorb" viruses and bacteria. Secondly, they participate in the process of blood formation, forming the lymphocytes – blood cells responsible for the immune response. The infected tonsils plays a major role in childhood as the protective processes in it lead to the formation of acquired immunity in the future.

During the development of tonsillitis, patient has difficulty in drinking and swallowing, elevated body temperature and general weakness. Upon inspection, it is possible to observe the reddening of the mucous membranes of the mouth and throat, inflammation of the mucous membranes, and 1-3 times escalation in the size of the tonsils. According to the literature sources, tonsillitis may lead to brain damage, rheumatism and kidney disease [16; 17].

BAP are specifically activated points in the body. They are not characterized by certain anatomical

structure. However, they have spectral potential of areas of their localization, own metabolism, high heat, low electrical resistance and they are extremely sensitive to varying temperatures [18; 19].

700-1000 BAP are located in the human body [20]. Irritation of each one may cure the illness due to a special feeling and can be used as a preventive measure for diagnostic purposes. In order to affect BAP silver, vanadium, and bone needles, ultrasounds, electromagnetic fields and laser beam are used [21; 22]. On areas around them, the temperatures are higher in comparison to the surrounding skin and in the pathological state this difference increases. In some of the pathological conditions, BAP temperature may be less than that of the surrounding skin [23; 24].

Due to the increased incidence of tonsillitis in recent years, it is interesting to study BAP effects on the body. Study of the temperature data of skin BAP in students suffering from tonsillitis has been made for the first time and reflects the relevance of the work.

### Materials and methods

The study of the BAP temperature indicators (Figure 1) in the skin was performed at the Laboratory of Chronobiology and Ecological Physiology, Department of Biophysics and Biomedicine, Faculty of Biology and Biotechnology, Al-Farabi Kazakh National University. 14 students aged 19-23 years old were enrolled into the experiment, divided into two groups by seven students each (with tonsillitis as test and healthy as control).

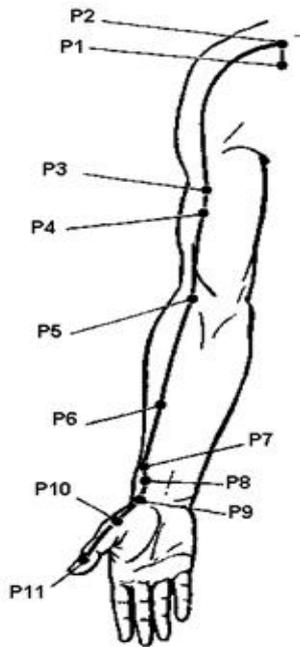
During the experiment 24 BAP were taken from the standard meridians, on the right and left sides of the body [25, 26], associated with tonsillitis: *P9 Tai-Yuan*, *P11 Shao-Shan* from the lung meridian; *GI4 He-Gu*, *GI5 Yan-Si* from the large intestine meridian; *E41 Tsze-Si*, *E45 Li-Duy* from the stomach meridian; *RP2 Da-Du*, *RP5 Shan-Tsyu* from the spleen-pancreas meridian; *C7 Shen-Men*, *C9 Shao-Chun* from the heart meridian; *IG1 Shao-Tse*, *IG19 Tin-Gun* from the small intestine meridian; *V1 Tsin-Min*, *V2 Tsuan-Chzhu* from the bladder meridian; *R1 Yun-Tsyuan*, *R6 Chzhao-Hai* from the kidney meridian; *MC7 Da-Lin*, *MC8 Lao-Gun* from the pericardium meridian; *TR21 Er-Men*, *TR23 Sy-Chzhu-Kun* from triple heater meridian; *VB14 Yan-Bai*, *VB44 Tszu-Tsao-Yin* from the gallbladder meridian; *F1 Da-Dun*, *F2 Sin-Tsyan* from the liver meridian.

The results of many researches show that there is no real BAP anatomical structure, only the places

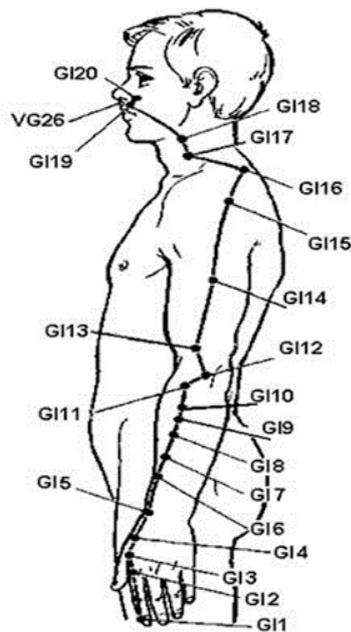
where the points have good nerve endings, blood vessels and loose tissues are known [27; 28].

“Biotemp-2” (modeled on the basis of BA Biotemp, Research Institute of Medical Cybernetics and Biophysics, Novosibirsk, 2006) apparatus for recording BAP temperature indices of two groups of students was produced by the special order at the experimental production center of our University.

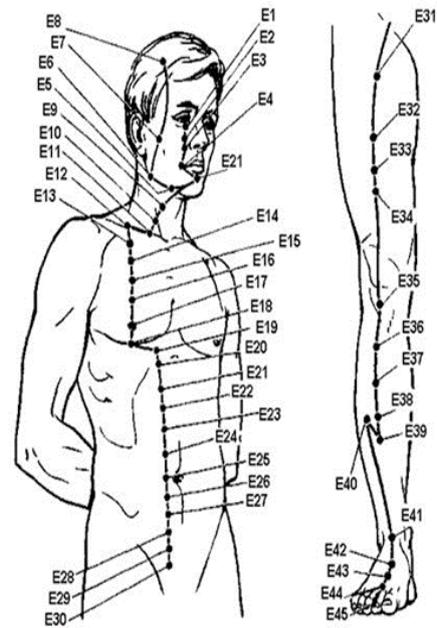
Apparatus consists of plastic cover, front panel indicator, light-emitting diode (LED) and a sensor. It includes two sources of power supply, a digital unit, an indication block, a voltage amplifier, two currents generator and a temperature sensor, active and passive electrodes. The results obtained were statistically calculated; Student’s t-test was used to examine the validity of the data.



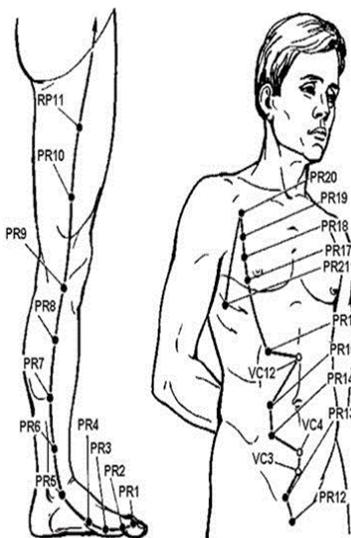
Lung meridian



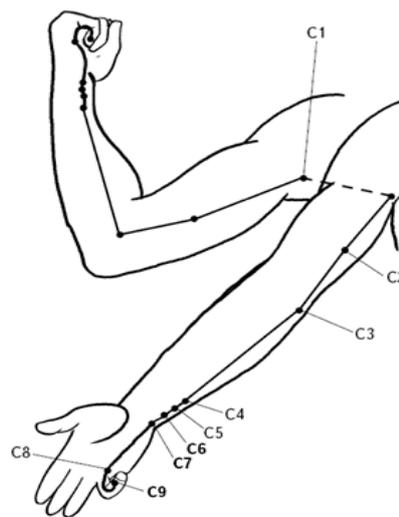
Large intestine meridian



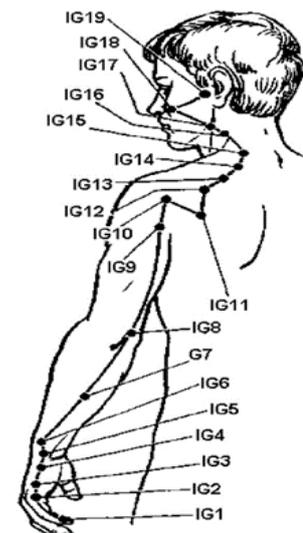
Stomach meridian



Spleen-pancreas meridian



Heart meridian



Small intestine meridian

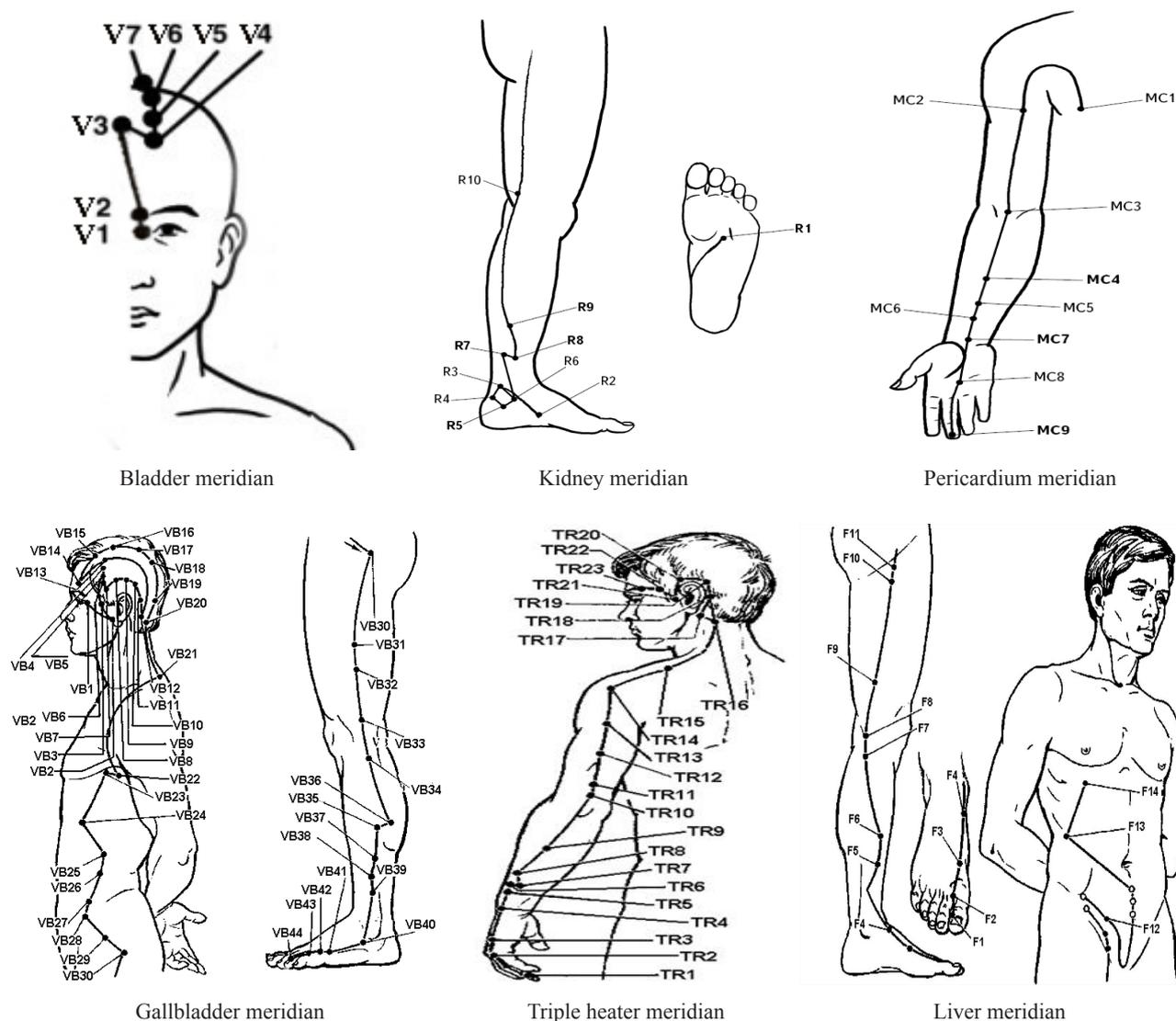


Figure 1 – Localization of the biologically active points of the skin on the body

## Results and discussion

In the normal condition and in students with chronic tonsillitis, in the right side of the body the temperature indicators from the biologically points is equal to  $24.9 \div 5.4^\circ\text{C}$  and  $30.8 \div 35.1^\circ\text{C}$ .

In the normal condition and in students with chronic tonsillitis, in the right side of the body the temperature indicators from the biologically points *P9 Tai-Yuan*, *P11 Shao-Shan* from the lung meridian; *G14 He-Gu*, *G15 Yan-Si* from the spleen-pancreas meridian; *E41 Tsze-Si* from the stomach meridian, *C7 Shen-Men*, *C9 Shao-Chun* from the heart meridian; *IG1 Shao-Tse*, *IG19 Tin-Gun* from the small intestine meridian are in between  $30.0\text{--}35.0^\circ\text{C}$  (Figure 2).

As can be seen from the Figure 2 in normal condition the temperature of *E45 Li-Duy* biologically point from the stomach meridian is  $25.2 \pm 1.0^\circ\text{C}$ , during tonsillitis it is increased by  $33.0 \pm 0.5^\circ\text{C}$  ( $p < 0.05$ ), in normal condition the temperature of *RP2 Da-Du* from the spleen-pancreas meridian is  $26.8 \pm 0.6^\circ\text{C}$ , during tonsillitis increases up to  $32.1 \pm 1.0^\circ\text{C}$  ( $p < 0.05$ ), in normal condition the temperature of *RP5 Shan-Tsyu* from the spleen-pancreas meridian is  $28.7 \pm 0.9^\circ\text{C}$ , during tonsillitis it is changed to  $32.6 \pm 1.1^\circ\text{C}$  ( $p < 0.05$ ).

As can be seen from the Figure 3 *V1 Tsin-Min*, *V2 Tsuan-Chzhu* from the bladder meridian; *R6 Chzhao-Hai* from the kidney meridian; *MC7 Da-Lin*, *MC8 Lao-Gun* from the pericardium meridian; *TR21 Er-Men*, *TR23 Sy-Chzhu-Kun* from the triple

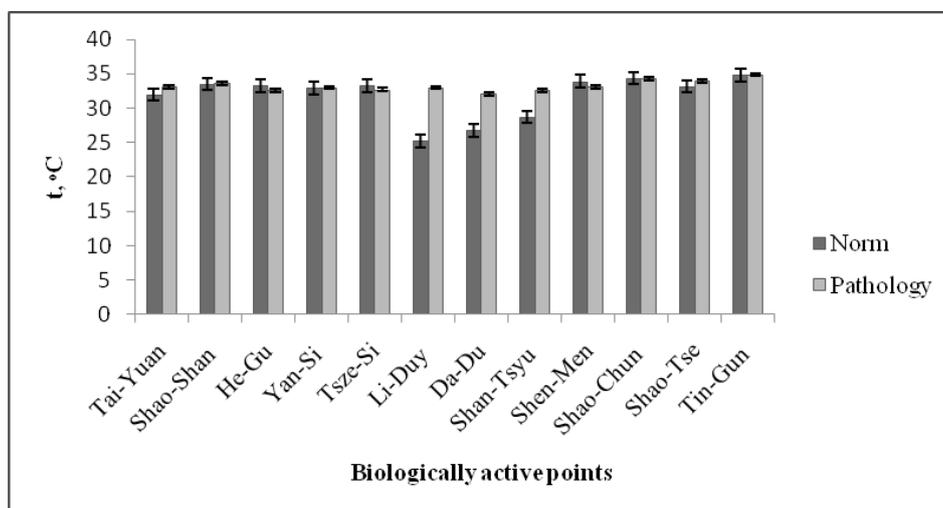
heater meridian; biologically point *VB14 Yan-Bai* the gallbladder meridian are in between 30.0-35.0°C. But in normal condition the temperature of biologically point *R1 Yun-Tsyuan* from the kidney meridian is 28.4±0.9°C, during tonsillitis it is increased by 33.1±0.7°C ( $p<0.05$ ), in normal condition the temperature of biologically point *VB44 Tszu-Tsao-Yin* from the gallbladder meridian is 25.6±0.5°C, during tonsillitis showed a high indicator of 31.8±1.1°C ( $p<0.05$ ), in normal condition the temperature of biologically point *F1 Da-Dun* from the liver meridian is 24.9±0.6°C, under pathology it is increased by 31.1±1.0°C ( $p<0.05$ ), in normal condition the temperature of biologically point *F2 Sin-Tsyuan* is 27.5±0.6°C, but during tonsillitis it increases up to 33.4±0.3°C ( $p<0.05$ ).

In the normal condition, the temperature of the BAP in the selected skin from the left side of the body of students is 24.7÷35.4°C, in chronic tonsillitis – 31.4÷34.7°C (Figure 4).

As can be seen from the Figure 4 in the normal condition and in students with chronic tonsillitis, in the left side of the body the temperature indicators from the biologically points *P9 Tai-Yuan*, *P11 Shao-*

*Shan* from the lung meridian; *GI4 He-Gu*, *GI5 Yan-Si* from the spleen-pancreas meridian; *E41 Tszze-Sifrom* the stomach meridian; *C7 Shen-Men*, *C9 Shao-Chun* from the heart meridian; *IG1 Shao-Tse*, *IG19 Tin-Gun* from the small intestine meridian are in between 30.0-35.0°C. But in normal condition the temperature of *E45 Li-Duy* biologically active point from the stomach meridian is 24.7±0.7°C, during tonsillitis increases up to 32.5±1.0°C, in normal condition the temperature of *RP2 Da-Du* point from the spleen-pancreas meridian is 26.6±0.7°C, during tonsillitis it increases up to 32.6±0.7°C, in normal condition the temperature of *RP5 Shan-Tsyu* from the spleen-pancreas meridian is 29.0±0.7°C, under pathology it increase up to 32.8±0.9°C. Statistically significant increase in these three biologically active points in tonsillitis compared to control ( $p<0.05$ ) is noted.

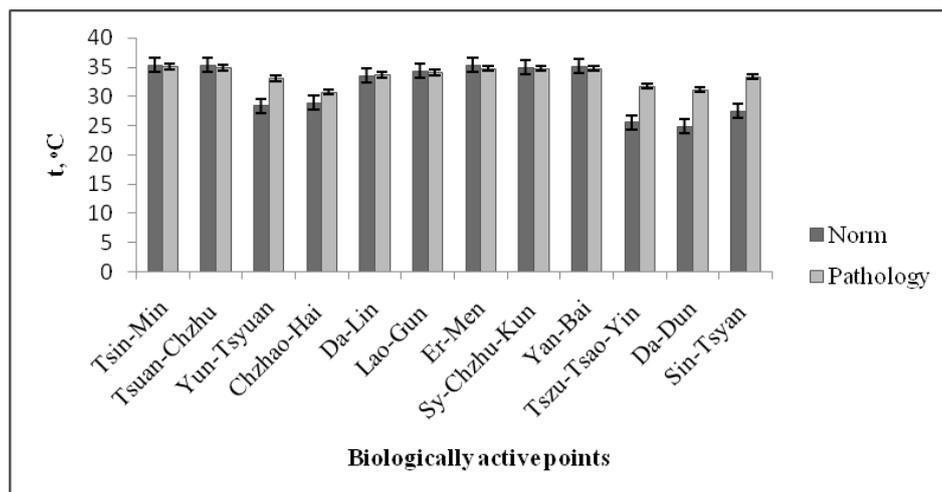
Biologically active points *V1 Tsin-Min*, *V2 Tsuan-Chzhu* from the bladder meridian; *R6 Chzhao-Hai* from the kidney meridian; *MC7 Da-Lin*, *MC8 Lao-Gun* from the pericardium meridian; *TR21 Er-Men*, *TR23 Sy-Chzhu-Kun* from the triple heater meridian; *VB14 Yan-Bai* from the gallbladder meridian the temperature is in between 30.0-35.0°C (Figure 5).



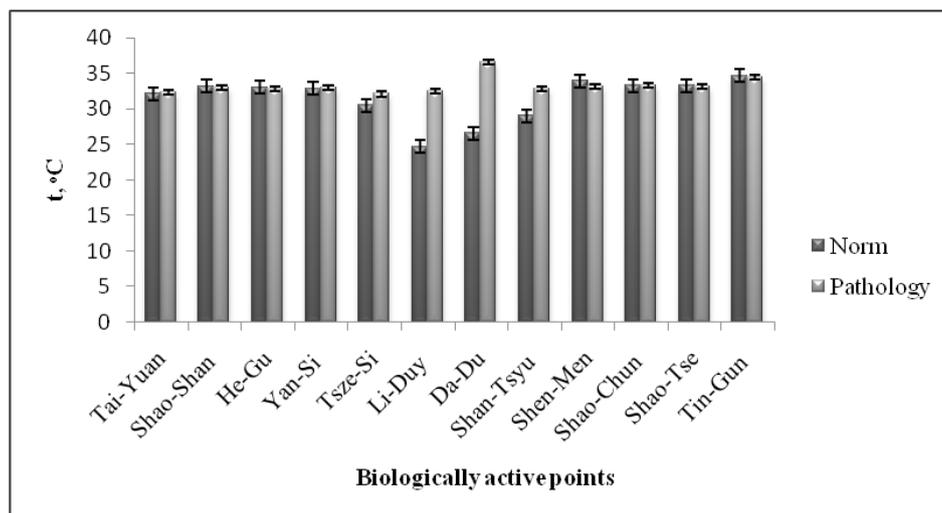
**Figure 2** – Temperature in normal and pathological conditions of the BAP located on the right side of the organism (t, °C)

According to the literature sources, pain in the stomach leads to illness throat. The acid in the gastric juice causes irritation of the mucous membranes and thereby the disease of the throat. Sometimes this feeling of pain also causes ear disease. At tonsillitis, there is an increase in the spleen pancreas and liver. Tonsillitis is often accompanied by kidney insufficiency.

The gallbladder system at the tonsillitis deteriorates and from the gall bladder of a sick person the allocating agents of tonsillitis – *Streptococcus pyogenes*. It means in case of sore throat microbes get into the system of the gallbladder. The results obtained in the experience have proven the conclusions in literary data [29; 30].



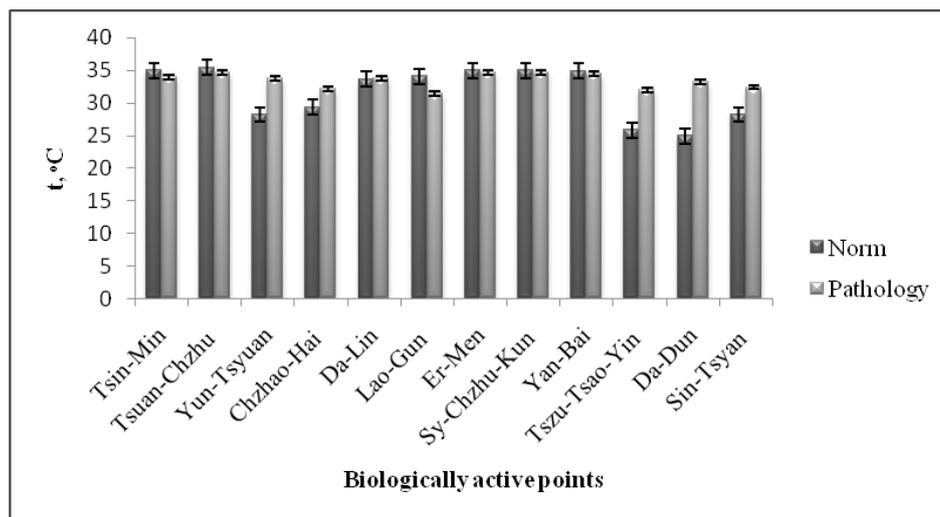
**Figure 3** – Temperature in normal and pathological conditions of the BAP located on the right side of the organism ( $t$ , °C)



**Figure 4** – Temperature in normal and pathological conditions of the BAP located on the left side of the organism ( $t$ , °C)

As can be seen from the Figure 5 the temperature of biologically point *R1 Yun-Tsyuan* from the kidney meridian in normal condition is  $28.2 \pm 0.4^\circ\text{C}$ , during tonsillitis it increases up to  $33.8 \pm 0.5^\circ\text{C}$ , in normal condition the temperature of *VB44 Tszu-Tsao-Yin* from the gallbladder meridian is  $25.8 \pm 0.3^\circ\text{C}$ , during tonsillitis it increases up to  $31.9 \pm 0.5^\circ\text{C}$ , in normal condition the temperature of biologically point

*F1Da-Dun* from the liver meridian is  $24.9 \pm 0.3^\circ\text{C}$ , under pathology it increases up to  $33.2 \pm 0.7^\circ\text{C}$ , in normal condition the temperature of biologically point *F2 Sin-Tsyuan* is  $28.2 \pm 0.2^\circ\text{C}$ , but during tonsillitis  $32.4 \pm 1.0^\circ\text{C}$  it is equal to the high temperature indicator. Statistically significant increase in these four biologically active points in tonsillitis compared to control ( $p < 0.05$ ) is noted.



**Figure 5** – Temperature in normal and pathological conditions of the BAP located on the left side of the organism (t, °C)

## Conclusion

According to our studies the temperature indices on the right and left sides of the body with statistical validity of  $p < 0.05$  was obtained for seven points from five meridians. They are: *E45 Li-Duy* from the stomach meridian, *RP2 Da-Du*, *RP5 Shan-Tsyu* from the spleen-pancreas meridian, *R1 Yun-Tsyuan* from the kidney meridian, *VB44 Tszu-Tsao-Yin* from the gallbladder meridian, *F1 Da-Dun*, *F2 Sin-Tsyuan* from the liver meridian. Temperature indicators were high. According to seven BAP, which statistical validity was calculated, physiological changes from chronic tonsillitis in these meridian organs of these biologically points indicate that these points might further be studied and potentially used as diagnostic markers.

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