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CONTEMPORARY METHODICAL APPROACHES TO ATHLETES' HEART RATE MEASURING

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Topicality. Heart rate is one of the most spread physiological measurements used for the body physical activity control. This rate is also widely used in medical practice, in the physical culture sector and physical rehabilitaion. For this reason the search of heart rate registration methods is the pressing issue for today, which would fully meet the needs of doctors, sportsmen and the people who train using the means of recreational physical culture. For this purpose it`s reasonable to supply them with the information about peculiarities of the available and up coming methods of heart rate measurement.

Goal of the research – to analyse the modern approaches to heart rate measurement.

Methods and organisation of the research – the study was carried out by means of theoretical analysis and library sources generalization and modern technical description means available in the Internet.

Statement of basic material. Methods which are used for registration of heart rate: palpatory method, sphygmography, electrocardigraphy, impedance plethysmograhy, photoplethymograpy, phonocardiography, bioechoranging. Heart rate measurement methods are based on the phenomenon of different physiological nature. Historically the first methods of HRM were based on a pressure pulse of the wall of the arteries for certain time. The name of this effect comes from the Latin word "pulsas" that is "beat" and a unit of measurement: beats per minute. The analysis of pulse beats lies in the basis of palpatory method of HRM and sphygmography. The sphygmography method is based on the registration of arety wall deformation during pulse beats. A piezo sensor is used for this procedure in modern means of HRM. This approach is first realised in the sound bracelet "Heal Be Go".

In modern sports pulsemeters and heart rate monitors the methods of electrocardiography, impedance plethysmograhy, photoplethymograpy are used.

In sports practice a simplified diagram of electrocardiogram registration is used by two points means. The most famous variant of this approach realization

is sports chest sensors in the form of belt-cardiomonitor (mady by Garmin, Polar and others). The other variant is the separation of electrodes on two arms without constant connection with one of them. In this case one electrode is attached on the wrist in the form of the back wall of the watch or bracelet, another one is put on the front part of the equipment. This approach is realised in the bracelet (Phyode W/Me) The third variant (with constant electrodes connection) is realised in the case of electrodes fixed in the sports machine.

In the project Fly Shark SmartWatch a capacitive sensor of electric field is EPIC used. The sensor doesn`t demand direct electric contact with the body. This decision is very advanced for different equipment, in particular for electrocardiogram registration during the car movement (project Ford ECG Seat)

Plethysmography method is based on the registration of the change of the organ blood filling or a part of the body. There are two methods of registration: impedance (rheography) and optical (photoplysmography). Reography is based on the registration of the changes of full electric resistance for high voltage alternating current (20 to 150 khz). This method of registration is realised in pulsemeter bracelet Jawbone Up 3.

During the photoplysmography method a change of signal range received from photosensitive device is registrated. The method is widely used in the clinic, as compact pulse oximeter. There are variants of ear clips and a headset with built-in sensors – Jabra Glow Headphones. An interesting direction of development of this technique is to measure heart rate based on video recording vibrations of face colour.

Heart Rate based on phonocardiography lies in the detection of acoustic phenomen that occur in the heart. This principle is built in digital stethoscopes and created software for smartphones, such as a program for iStethoscopePro IPhone.

When measuring heart rate based on bioradiolocation, classical radar technology based on UWB (Ultra-Wide Band) signals is used. This method offers extremely broad prospects for including remote monitoring of heart rate.

Conclusions. Modern devices of pulse measurement methods are based on different physiological phenomena of nature – changes biopotential heart blood flow volume modulation of arteries and capillaries, mechanical vibrations of their walls, acoustic phenomen bioradiolocation. The most popular methods are based on electrocardiography and plethysmography.

References

1.How smart watches, sports trackers and other gadgets measure the pulse?(https://m.geektimes.ru/company/darta_systems/blog/246856/)