

EFFECTS OF VARIATIONS OF THE MONTHLY MEAN MAX AIR TEMPERATURE ON THE POPULATION HEALTH OF KAKHETI REGION OF GEORGIA

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Summary: The relationship between the mean monthly maximum air temperature in Telavi and such indices of the health of population as the total number of emergency medical calls, cases of hospitalizations, deaths and the relation of cases of hospitalizations to number of emergency medical calls, have the form of a third power polynomial. In general, in the warm months there is a decrease of the total number of emergency medical calls, cases of hospitalizations and deaths. In the hot months, there is an increase of the cases of hospitalizations, comparable to the cold months of the year. Relation of cases of hospitalizations to number of emergency medical calls in hot months is the greatest.

Key words: Air temperature, bioclimate, health of population.

Introduction

In Georgia, as in many other countries, a long time ago the special attention has been paid to the analyses of the influence of the natural and anthropogenic factors of environment on the health of people which have a different scales - from minute, hour, day, decade and month to the seasonal and annual [1-9]. The survey of similar studies in Georgia in the last 15 years is given in [10].

One of the most important factors of this influence is the air temperature. This work is a continuation of the previous studies. The results of a study of the influence of the monthly average maximum air temperature on human health in the conditions of Kakheti are presented below.

Kakheti is a region in eastern Georgia. Telavi is its capital. The region comprises eight administrative districts. Kakheti is bordered by the Russian Federation (Dagestan and Chechnya) to the northeast, Azerbaijan to the southeast, and Mtskheta-Mtianeti and Kvemo Kartli to the west.

Popular tourist attractions in Kakheti include Georgian David Gareja monastery complex, Tusheti, Gremi, Signagi, Kvetra, Bodbe, Lagodekhi, Protected Areas, Alaverdi Monastery, etc. The most well-known **region for producing Georgian wine** is Kakheti.

Therefore, the study of indicated above bioclimatic factor is important for the development of the tourism industry in this region (as in other locations) and taking measures to protect the population under extreme temperature conditions.

Study area, Material and Methods

The study area (fig. 1) is Kakheti (<http://kakheti.gov.ge/geo/static/101>). Population of Kakheti is 312500 (2018 year), including in municipalities: Telavi - 56000, Gurjaani - 52600, Kvareli - 30300, Sagarejo - 52200, Dedoplistskaro - 30000, Signagi - 29500, Lagodekhi - 41300 and Akhmeta – 29600.

As indices of the health of population the total number of emergency medical calls (Em. Calls), cases of hospitalizations (Hosp.), deaths (Dead) and the relation of cases of hospitalizations to number of emergency medical calls (Hosp./Em. Calls, %) has used (<http://112.gov.ge/>).



Fig. 1. Kakheti region of Georgia (<http://geostat.ge/regions/#>)

The data of the Hydro meteorological Service of Georgia about the monthly values of maximum air temperature (Tmax, °C) in Telavi are used. Period of investigations – 2013, 2015 and 2017. In the proposed work the analysis of data is carried out with the use of the standard statistical analysis methods. The following designations, other than the above, will be used below: Min – minimal values, Max - maximal values, St Dev- standard deviation, Cv – coefficient of variation, St Err – standard error, R² – coefficient of determination, 99%_CONF-L and 99%_CONF-U - lower and upper levels of 99% confidence interval, α -significance level.

The relationship of these health indices with the average monthly maximum air temperature in Telavi was studied by averaging these indices for nine ranges of Tmax values: 6.2÷7.5, 8.4÷9.6, 9.8÷13.3, 13.4÷16.3, 17.4÷18.6, 18.8÷24.2, 25.9÷28.2, 28.7÷31.0 and 31.4÷34.0 °C.

Results and discussion

The results in the table 1 and fig. 2-5 are presented.

Table 1. The statistical characteristics of monthly mean max air temperature and data of emergency medical for Kakheti region of Georgia in 2013, 2015 and 2017.

Variable	Tmax, °C	Em. Calls	Hosp.	Dead	Hosp./Em. Calls, %
Min	6.2	3613	919	24	19.6
Max	34.0	9031	2506	96	33.6
Mean	19.1	6062	1617	53	26.6
St Dev	9.0	1386	478	17	4.2

Cv, %	47.0	22.9	29.5	32.5	15.6
St Err	1.5	234	81	3	0.7
99%_CONF-L	15.2	5458	1409	46	24.8
99%_CONF-U	23.0	6665	1825	61	28.4

As follows from table 1, the variability of the studied parameters occurs within the following limits: Tmax – 6.2÷34.0 °C (mean – 19.1°C), Em. Calls - 3613÷9031 (mean – 6062), Hosp. 919÷2506 (mean – 1617), Dead - 24÷96 (mean – 53), Hosp./Em. Calls -19.6÷33.6 % (mean – 26.6 %). The greatest variations are observed for the values of Tmax (Cv =47.0 %), the smallest for Hosp./Em. Calls (Cv =15.6 %).

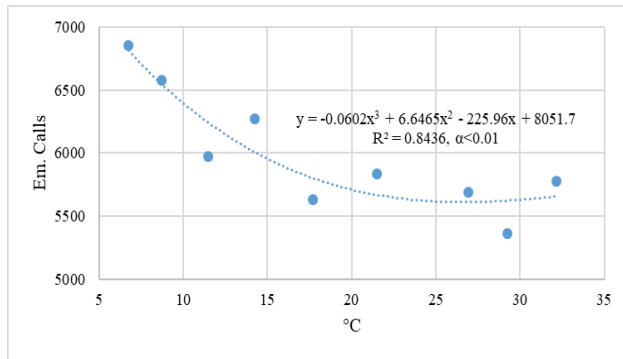


Fig. 2. The relationship between the number of ambulance calls in Kakheti region and the monthly average max air temperature in Telavi.

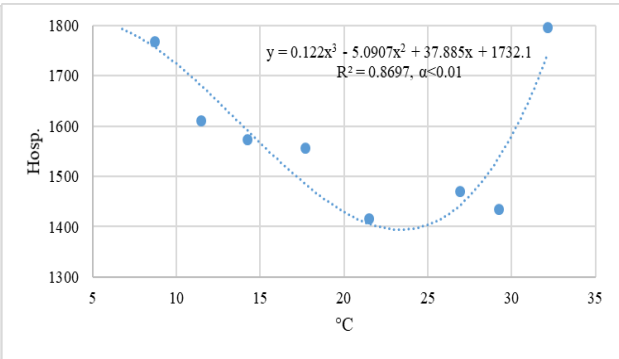


Fig. 3. The relationship between the cases of hospitalizations by ambulance in Kakheti region and the monthly average max air temperature in Telavi.

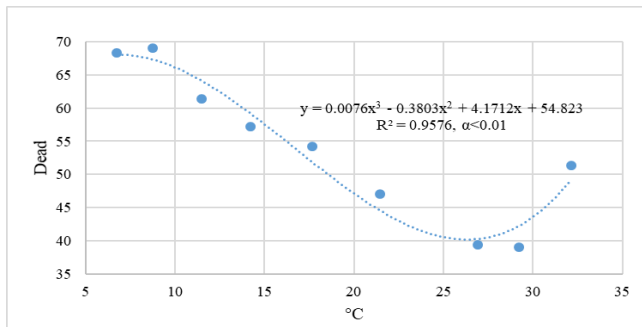


Fig. 4. The relationship between the cases of deaths fixed by ambulance in Kakheti region and the monthly average max air temperature in Telavi.

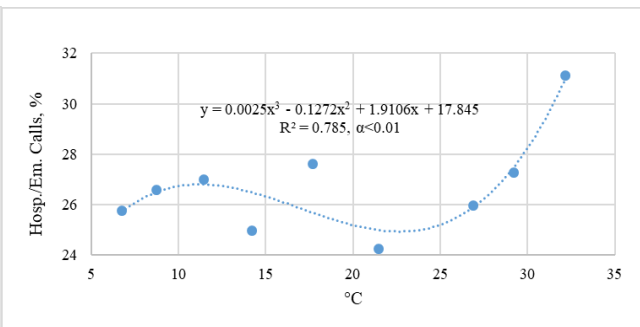


Fig. 5. The relationship between the ratio Hosp./Em. Calls and the monthly average max air temperature in Telavi.

As follows from fig. 2-5 the relationship between the mean monthly maximum air temperature in Telavi and the total number of emergency medical calls, cases of hospitalizations, deaths and the relation of cases of hospitalizations to number of emergency medical calls, have the form of a third power polynomial (values of R^2 respectively are 0.8436, 0.8697, 0.9576 and 0.785, which indicates the significance of these connections not worse 0.01).

In general, in the warm months there is a decrease of the total number of emergency medical calls, cases of hospitalizations and deaths. In the hot months, there is an increase of the cases of hospitalizations, comparable to the cold months of the year. Relation of cases of hospitalizations to number of emergency medical calls in hot months is the greatest.

It should be noted that similar results we obtained earlier for the Imereti region when comparing data on monthly mean air temperature with values of Em. Calls, Hosp. and Dead [8].

Conclusion

In the future, similar studies are planned for other regions of Georgia.

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