Research article
Role of Q-heterochromatin and thermal conductivity of the human body in the development of obesity

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ABSTRACT

Introduction and Aim: Obesity, commonly known as a complex multifactorial disease, has emerged as a significant medical and societal issue in recent decades. The objective of this study is to assess if there is a significant impact of Q-heterochromatin (Q-HR) and thermal conductivity (k) in the body on the risk of obesity.

Methods: This prospective analytical cohort study included 300 individuals from both genders aged 35.24±4.21 years who do not have oncological, hormonal, or other forms of diseases that predispose to morbid obesity.

Results: In obese individuals, the temperature distribution in the peripheral and central parts of the body has a high level of variability relative to the control. In the main group, Q-HR has a clear gradient from 0 to 2, and the average numerical parameter is 1.21±0.11, which is more than twice as low as in the control group (2.94±0.14). In obese individuals, the chromatin concentration decreased with increasing temperature gradient ($\chi^2 = -16.8; p<0.001$).

Conclusion: The level of Q-HR is considerably lower in obese people compared to the control group. When compared to the control, obese people had a higher k between the central and peripheral sections. The level of Q-HR and k were shown to be inversely correlated.

Keywords: Q-heterochromatin; thermal conductivity; obesity; temperature gradient; chromosome.

INTRODUCTION

Obesity, commonly known as a complex multifactorial disease, has emerged as a significant medical and societal issue in recent decades. Although the principles of etiology, pathophysiology, diagnosis, and treatment are well understood, the subject of the potential genetic predisposition of an individual to these types of diseases is still unclear (1-6).

There is currently no conclusive scientific reason for why certain individuals in a population have a higher probability to be overweight than others, all other factors being equal. The 2001 Human Genome Project, which signified the completion of the physical mapping of the human genome (7-9), failed meeting the expectations of scientists and the public (10). The organizations and investors that provided funding for this mega project, which cost over 3 billion US dollars, aimed to investigate almost every unresolved issue in biology and medicine. Unfortunately, the complete mapping of the human genome has not yet resulted in the resolution of any significant medical and biological problems, including the treatment of such complex multifactorial diseases that, because they primarily affect people of working age, have become serious economic problems rather than just being medical and social problems (10). It has been unsuccessful to identify hypothetical genes or gene complexes that predispose to obesity.

The three transfer phenomena that occur in nature are thermal conductivity (k), diffusion, and internal friction, or viscosity. All substances, including gases, liquids, and solids, have k. Since convection cannot occur in solids, unlike in gases and liquids, thermal conduction is the only way to transfer heat (11-16).

In contrast, the key components of organ-based physiological thermoregulation have undergone significant study, and current scientific efforts are focused on examining their complex interactions at the cellular and molecular levels. Macroscopic organisms should differ in their k of the body to maintain body temperature homeostasis under varying situations in the external or internal environment (13, 16).

Assuming that there may be a connection between the k of the human body and its ability to maintain a relatively constant body temperature, we decided to conduct a study to determine a possible role for the k of the body of individuals in the norm and in the development of some complex multifactorial diseases, such as obesity. The objective of this study is to assess if there is a significant impact of Q-heterochromatin (Q-HR) and k in the body on the risk of obesity.

MATERIALS AND METHODS

This prospective analytical cohort study included 300 individuals from both genders aged 35.24±4.21 years who do not have oncological, hormonal, or other forms of diseases that predispose to morbid obesity. 100 individuals from the study were allocated to the
main group (individuals with obesity) with a body mass index over 30.0 and an average age of 36.72±3.92 years, both sexes. The control group included 200 individuals aged 34.88±5.42 years of both genders, with a body mass index of 21.63±0.84. The dispersion value in the studied group tended to be equal ($\chi^2 = 1.24$).

As parameters, they used the amount of $Q$-HR in the chromosomes (cytogenetic technique with quinacrine mustard stain), the temperature of the palm, the temperature of the armpit, and the value of temperature gradient between the palm and the armpit.

Statistical analysis was performed using Statistica v8.0 (StatSoft Inc., Tulsa, USA). The obtained data are presented as the mean±standard deviation. The Student's t-test was used to compare continuous variables, while Pearson's chi-squared test was used to evaluate associations between categorical variables. Differences were considered statistically significant at $p<0.05$. Confidentiality was maintained concerning the data collected, and this study was approved by the Bioethics Committee of the International Higher School of Medicine (Protocol No. 11 dated May 05, 2022).

RESULTS

As shown in Table 1, the palm temperature of obese individuals is significantly lower relative to the control group. Armpit temperature is relatively equal between study groups. The variables governing the temperature gradient between the palm and armpit are of particular interest. Table 1 shows the values at which the temperature gradient in the main group is 1.5 times higher than the control. Thus, in obese individuals, the temperature distribution in the peripheral and central parts of the body has a high level of variability relative to the control. In conclusion, we believe that obesity worsens the temperature regime in various parts of the human body.

Table 2 reflects the data on $Q$-HR concentration in the studied groups. In the main group, $Q$-HR has a clear gradient from 0 to 2, and the average numerical parameter is $1.21\pm0.11$, which is more than twice as low as in the control group ($2.94\pm0.14$). The distribution in the control group showed higher $Q$-HR concentrations in the range of 3 to 5. The difference between the studied groups was a significant value ($p<0.0001$).

Considering the percentage distribution of $Q$-HR concentration in the studied groups, we found that in the main group, the absence of HR was observed in 16% of the observed, while in the control group, it was 3%, respectively. Single chromatin in the first group was 34%, and in the control, it was 9%. Two chromatin units are noticeably higher in the main group, at 38% versus 28% in the control. Three chromatin units were observed in only 4% of those observed in the main group. Subsequently, in 4, 5, 6, and 7, $Q$-HR was not observed in the main group, while in the control, it was 26.5%, 6%, 1%, and 0.5%, respectively.

Table 1: Distribution of palm, armpit temperature parameters and temperature gradient in the studied groups

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Main group (n=100)</th>
<th>Control group (n=200)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palm t°C</td>
<td>30.56±0.129</td>
<td>32.9±0.237</td>
<td>0.001</td>
</tr>
<tr>
<td>Armpit t°C</td>
<td>35.87±0.257</td>
<td>35.31±0.216</td>
<td>0.1</td>
</tr>
<tr>
<td>Temperature gradient between</td>
<td>5.44±0.164</td>
<td>3.28±0.097</td>
<td>0.001</td>
</tr>
<tr>
<td>palm and armpit</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All data are expressed as $M\pm m = mean\pm standard deviation.$

Table 2: Dispersion series of $Q$-heterochromatin concentration distribution in the studied groups

<table>
<thead>
<tr>
<th>Q-heterochromatin</th>
<th>Main group (n=100) I</th>
<th>Control group (n=200) II</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>0</td>
<td>16</td>
<td>6</td>
</tr>
<tr>
<td>1</td>
<td>34</td>
<td>18</td>
</tr>
<tr>
<td>2</td>
<td>38</td>
<td>56</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>52</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>53</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>M±m</td>
<td>$1.21\pm0.11$</td>
<td>$2.94\pm0.14$</td>
</tr>
<tr>
<td>T-student</td>
<td>$T=9.72$</td>
<td></td>
</tr>
<tr>
<td>p</td>
<td>$p&lt;0.0001$</td>
<td></td>
</tr>
</tbody>
</table>

All data are expressed as $M\pm m = mean\pm standard deviation.$
The results of this study suggest that Q-HR is a genetic predictor of the development of obesity. This means that a low concentration in the range (1.21±0.11) may be important in the future as a prognostic indicator in the structure of how obesity develops.

The dependence of the temperature gradient on the amount of Q-HR in the observed groups is shown in Fig. 1. We noticed that the temperature gradient is inversely correlated with the concentration of Q-HR. In other words, the higher the value of the temperature gradient, the lower the chromatin concentration ($\chi^2 = -16.8; p<0.001$) in obese individuals and in the control group ($\chi^2 = -9.45; p<0.001$). Fig. 1 also shows that in people with obesity, the correlation is more pronounced relative to the control group.

DISCUSSION

However, several years of clinical practice have demonstrated that it is still hard to rule out the possibility that individuals may have a hereditary predisposition to obesity. Certain physical characteristics of the human body may be one of the causes of an individual or population’s propensity towards obesity. This refers to the disparities between people in a population in terms of the level of $k$ in their bodies. However, no one has ever examined the heat conductivity of the human body as a form of physical feature of the human body, even though, from a physical standpoint, this possibility cannot be ruled out (17).

The finding of genetic variation at the chromosomal level is one of the significant outcomes of the study of chromosome morphology in higher eukaryotes, including humans. It has been found that the high variability of chromosome HR is the cause of this type of hereditary variability (18-21).

Numerous theories exist about the potential biological role of chromosomal HR in evolution and ontogeny. Unfortunately, none of them have been validated experimentally yet. However, one of these possibilities gained our interest since it claimed that people may differ from one another in the degree of their bodies, the degree of which might be related to the amount of chromosomal HR in the human genome (17). Basically, depending on climatic zones, thermoregulation and $k$ of the body should have been related. A study showed a significant difference between the values of $k$ among the students of India and China, Kyrgyzstan and China (22). Variation was observed in the $k$ of various national groups in comparison to one another. The Kyrgyz and Indian students have a similar distribution of $k$ values, but the Chinese students have a distinct pattern (22).

The results obtained indicate a significant correlation between the $k$ and Q-HR without a significant correction for both groups. The findings suggest that the hypothesis about cell thermoregulation and $k$ in the Q-HR structure is correct (17). It is possible that the concentration of Q-HR has a direct effect on the development of obesity or that low $k$ affects the level of catabolism (decrease) and causes an energy metabolism imbalance. This is possible because one part of our study, finding the first factor that causes obesity, has not yet been studied.

CONCLUSION

The level of Q-HR is considerably lower in obese people compared to the control group. When compared to the control group, obese people had a higher $k$ between the central and peripheral sections. The level of Q-HR and $k$ were shown to be inversely correlated.

CONFLICT OF INTEREST

No conflicts of interest declared.
REFERENCES


