Pessimism is related to Increased Changes over Our DNA

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Abstract:
116 persons were asked if they were a pessimist about the future. They voluntarily and consensually participated in blood collection for DNA analysis of BDNF exon I promoter gene. DNA was extracted from whole peripheral blood, and after bisulfite conversion, the samples were amplified and qualitatively analyzed. From those who related no pessimism, 26% of the BDNF exon I promoter gene was methylated, while from those who related pessimism, 48% presented the epigenetic perturbation. This is an unprecedentedly finding describing the correlation between this mental status and an epigenetic alteration in this crucial gene for brain maintenance.
Keywords: *pessimism, epigenetics, BDNF gene, DNA methylation, health.*

INTRODUCTION

An optimistic person can see right things everywhere, is confident and very hopeful of what the future holds. From the optimist's point-of-view the world is full of potential opportunities. On the other hand, the pessimist observes mainly the negative aspects of everything around. Contemplating all the potential hazards and dangers on the way, the pessimist is likely to have little hope or expectancy for the future (Hecht 2013). This mental characteristic can affect not only mental health but also physical health (Petersen, Clark, et al. 2008, Pankalainen, Kerola, et al. 2016). Now, we decided to investigate the risk of pessimism in molecular level, searching for alterations over our genome, what we call epigenome.

Epigenetics has been an issue extensively explored in the last years as a molecular mechanism involved in adaptive (or maladaptive) processes of the human being in the environment (Wiwanitkit 2014, Zilbauer 2014, Skinner 2015, Junien, Panchenko, et al. 2016, Ajonijebu, Abboussi, et al. 2017). While the genome defines the potential genetic information, the epigenome defines which genes are expressed. This regulation over the gene expression without altering the sequence of the DNA is possible by epigenetic modifications including DNA methylation (Bird 2002). Neurotrophic factors are known to be essential regulators of neuronal survival, development, function, and plasticity at both central and peripheral nervous system (Altar, Cai et al. 1997, Huang and Reichardt 2001).

METHOD

The study included one hundred sixteen (n = 116) volunteers aged 18 to 65 years (mean ± SD, 40 ± 11) included by convenience. All participants are residents from the southeast Brazil. This survey was conducted according to the ethical principles of the Declaration of Helsinki, which are equivalent to those established by the Ethics Committee for Research at the Center for Health Sciences, Federal University of Espírito Santo, Brazil. All subjects signed informed consent forms. This research is part of a project approved by this ethics committee under registration #1.634.021.

DNA was extracted according to manufacturing instructions (QIAamp DNA Mini Kit, Qiagen, USA) from whole peripheral blood collected in EDTA tube and all samples were bisulfite converted (MethylEdge™ Bisulfite Conversion System, Promega, USA) before methylation-specific polymerase chain reaction (MS-PCR). Converted Methylated Human Control DNA (Promega, USA) was used as positive control and Human non-Methylated DNA (Zymo, USA) was used as negative control. Primers for BDNF exon I promoter were designed according to D'Addario et al 2012; M_BDNF: Forward: 5'-GTAGTTTTCGTAGGATGAGGAAGC-3'; Reverse: 5'-AATATAAATTAACAACCCCGATACG-3'; Product size 163 bp; U_BDNF: Forward 5'-GTAGTTTTTGTAGGATGAGGAAGT G-3'; Reverse: 5'-TATAAATTAACAACCCCAATACACA-3'; Product size 161 bp (D'Addario, Dell'Osso et al. 2012). Qualitative analysis of methylation was performed by confirming the expected product size on a 1.5%

agarose gel. The item number 2 from Beck depression inventory (BDI-II), which is not a depressive disorder diagnosis tool but rather an instrument of self-reporting that assesses the presence and severity of depressive symptoms in normal and psychiatric populations, was used in this study. This item is especially about the presence of pessimism and subjects were grouped into "no pessimism related" and "pessimism related." For statistical analysis, stacked bars represented categorical variables, and Chi-square was used to compare the prevalence of DNA methylation between the group that related pessimism and the group that did not relate pessimism. A p-value of 0.05 or less was considered to indicate statistical significance. GraphPad Prism 7.0 (GraphPad Software Inc, USA) and licensed Stata® statistical software package version 14 was employed for statistical analysis and graphic presentations.

RESULTS

DNA was extracted from 116 subjects. From those, 89 (77%) related no pessimism while 27 (23%) related pessimism; 80 (69%) were non-methylated and 36 (31%) were methylated. From those subjects which related no pessimism (n=89), 26% presented DNA methylation, and from those who related pessimism (n=27), 45% presented DNA methylation. This difference of epigenetic change between groups is significantly different (Chi2 = 4.8; $P = 0.028$) evidencing higher quantity of this finding in the group with more pessimists (Fig.1).

DISCUSSION

The results showed that pessimism is related with BDNF methylation. This brief result is the first to show this correlation with this gene and calls our attention to epigenetic changes that can be caused by feelings, especially the pessimism.

Pessimism is described as reflecting a generalized negative expectation about the future. Studies about the effect of pessimism on people's health have been performed for a long time and it was already observed that people who related pessimism about their-selves, when they were evaluated 30 years later, they actually self-related poorer on their health according to the 36-Item Short-Form Health Survey (Maruta, Colligan et al. 2002). Another extended period study aimed to determine whether pessimism could be used as early warning signs for adverse changes in caregiver depressive symptoms and physical health. This study was conducted over a 10-year period and used several methods to evaluate subject's health, including the Life Orientation Test, the Center for Epidemiological Studies-Depression Scale, and the SF-36 Health Survey physical functioning scale. They found that high baseline pessimism signaled high levels of baseline depressive symptoms and poor physical health, as well as a faster decline in health over the 10-year study (Lyons, Stewart, et al. 2004).

People are pointing to factors related to the pessimism that can be eliminated by changing some habits. For instance, pessimism was found to be positively and significantly related to sedentary behaviors (Taylor, Baranowski, et al. 2004). Besides, the way we face situations and lead with awkward moments in life also demonstrates that we can avoid health failures depending on how optimist we are. Health was assessed by sickness absence days during a period covering 36 months prior to some event and 18 months after the event. It was demonstrated that the increase in sick days after the event was smaller and returned to the prevent level more quickly among highly optimistic individuals than among their counterparts with low optimism suggesting that pessimism may increase the risk of health problems and also may be related to a slower recovery after a significant life event (Kivimaki, Vahtera, et al. 2005). When the quality of life was measured in breast cancer survivors, patients with a pessimistic explanatory style were significantly lower on all of the health-related quality of life (QOL) scores, compared to those with a nonpessimistic style. Surprisingly, breast cancer survivors who exhibit a pessimistic explanatory style report lower health-related QOL for years after receiving a cancer diagnosis, compared to nonpessimistic women(Petersen, Clark, et al. 2008).

Although all these works about the influence of optimism/pessimism on health have been published, underlying biologic pathways are incompletely understood. Very recently, Tindle et al. measured biomarkers of metabolic function (fasting insulin and glucose) at baseline, and they found that in postmenopausal women, higher levels of pessimism were related to worse metabolic function. This kind of research is important to direct future investigations that can answer whether interventions to modify

pessimistic attitudes could potentially reduce a woman's risk of diabetes and cardiovascular disease (Tindle, Duncan, et al. 2017) and many other health issues.

This present data contribute in the comprehension of changes occurring inside our body linked to pessimism. This is an unprecedentedly finding describing the correlation between this mental status and an epigenetic alteration in this important gene for brain maintenance. Besides, this data strengthen the need of psychosocial actions that aim to interfere with the mental health of people, believing that the gains can be greater that can be determined today.

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FIGURE 1.

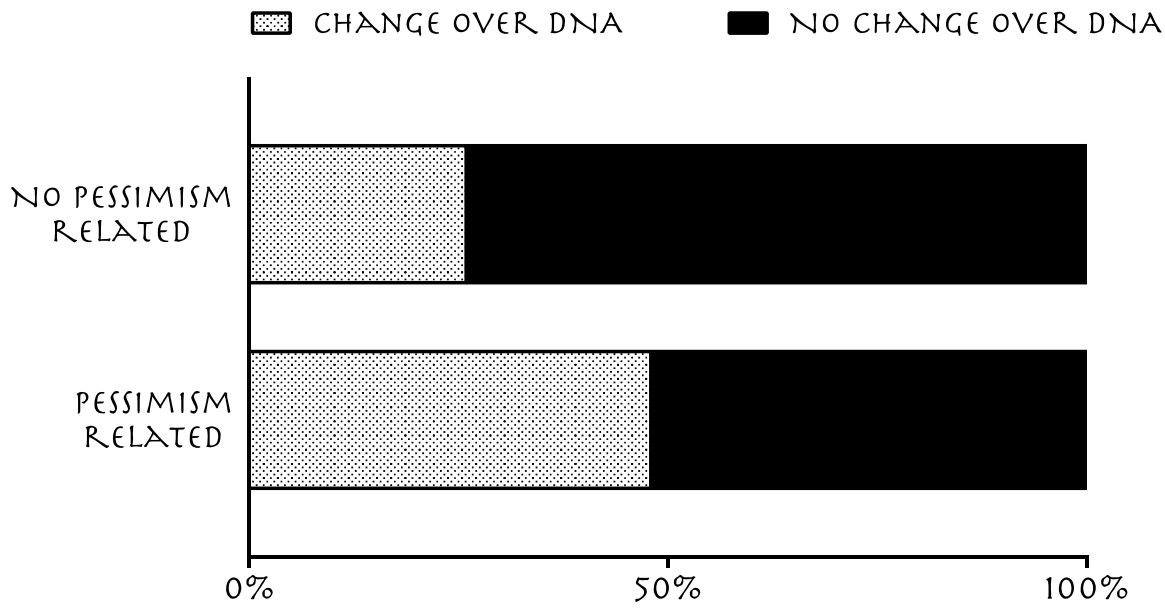

Figure 1. This graphic shows a higher percentage of change over DNA in the group with pessimism related.