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Research Report

Serum triglycerides, but not cholesterol or leptin, are decreased in suicide attempters with mood disorders

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A B S T R A C T

Background: Many peripheral biomarkers, including low cholesterol and its fractions, have been examined to identify suicidal behavior. Herein, we assessed serum lipid profile and some proteins putatively associated with suicidal behavior in subjects with mood disorder (bipolar disorder or major depressive disorder) with a recent suicide attempt and with no lifetime history of suicide attempts.

Methods: Fifty subjects had presented an episode of attempted suicide during the last 15 days, and 36 subjects had no history of any suicide attempt. We measured total cholesterol, HDL, LDL and triglycerides as well as serum leptin, brain-derived neurotrophic factor (BDNF), S100B and C-reactive protein (CRP).

Results: Individuals that had attempted suicide presented decreased body mass index (BMI) and waist circumference. After adjusting for these confounders, we found that triglycerides were decreased in attempted suicide subjects. We found no differences among total cholesterol, LDL and HDL or leptin, S100B, CRP and BDNF.

Limitations: This is a cross-sectional study, and we cannot therefore assess whether a decrease in triglycerides caused a mood episode with suicidal ideation that led to a suicide attempt or if the presence of a mood episode originated a loss of appetite and consequent loss of weight, therefore decreasing triglyceride levels.

Conclusions: These results do not support the hypothesis that lower levels of cholesterol are associated with suicidal behavior in a mood disorder sample. However, our data support the idea that adiposity is differentiated in these patients (reduced BMI, waist circumference and serum triglycerides), which could lead to an altered communication between the adipose tissue and brain.

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1. Introduction

Suicide is a public health problem of high complexity, annually causing a premature loss of approximately one million lives worldwide (Bertolote and Fleischmann, 2002; Pompili et al., 2013), and generating a wave of psychic events in family, friends and society that are often irreparable. Many studies have searched for and proposed biological markers that might be linked to suicidal behavior and could be used as an additional tool for prevention and therapeutic actions (Arango et al., 2003; Asellus et al., 2010; De Luca et al., 2005; Lee and Kim, 2011; Marcinko et al., 2008; Pandey, 2013). Many peripheral markers have been investigated in persons vulnerable to suicide, including low serum cholesterol and its fractions (Atmaca et al., 2002; Chang et al., 2012; Coryell and Schlesser, 2007; Jee et al., 2011; Jokinen et al., 2010; Lee and Kim, 2003; Olie et al., 2011; Papadopoulou et al., 2013; Troisi, 2009). This is intriguing, considering that persons with mood disorders [particularly bipolar disorder (BD)] have an increased prevalence of metabolic syndrome, which includes obesity, increased waist circumference and hyperlipidemia (Fagioli et al., 2005; Nousen et al., 2014; Vancampfort et al., 2013). However, the biochemical connection reported between obesity and suicidal behavior (Dutton et al., 2013; Mukamal and Miller, 2009) demands further characterization, not only with regard to the serum lipid profile, but in relation to proteins associated with adipose tissue, such as leptin (Eikelis et al., 2006).

The link between low cholesterol and suicidal behavior is not clear, but the association between cholesterol and mental illness has
attracted the interest of researchers for over a century (Cruickshank and Tisdall, 1916; Poynder and Russell, 1926; Weston, 1915). Two meta-analyses summarize our current knowledge regarding cholesterol and suicidal behavior. Firstly, longitudinal studies show that individuals with lower cholesterol levels do have a slightly, but statistically significant, increased risk of completing suicide (Lester, 2002); secondly, cholesterol-lowering treatments, such as statins, have not been shown to increase non-illness mortality (including accidents, trauma and suicide) (Muldoon et al., 2001).

We analyzed the lipid profiles of subjects with mood disorders (BD and major depressive disorder (MDD)) and with a recent suicide attempt and in subjects with no lifetime history of suicide attempt. We aimed to determine whether total cholesterol, its fractions and triglycerides were decreased in subjects that had attempted suicide, as well as to investigate serum levels of other proteins putatively associated with suicidal behavior: leptin (Atmaca et al., 2008), S100B protein (Falcone et al., 2010), brain-derived neurotrophic factor (BDNF) (Pandey et al., 2010) and C-reactive protein (CRP) (De Berardis et al., 2008).

2. Methods and materials

2.1. Subjects and measurement

Eighty-six subjects with mood disorders (BD and MDD), according to DSM-IV criteria, were enrolled in the study upon admission to the São José Clinic, an inpatient psychiatric unit in Porto Alegre, Brazil, from April 2010 to December 2012. Of those, 50 had presented a suicide attempt during the last 15 days, and 36 had no lifetime history of suicide attempt. Suicide attempts were considered as “situations in which a person performs a life-threatening behavior with the intent of jeopardizing his or her life, or to give the appearance of such intent” (Beck et al., 1973; Brundin et al., 2007). All study participants underwent a general physical examination that showed no evidence of ongoing infection. Individuals on antibiotics and anti-inflammatory medications were excluded from the study. Demographic data and somatic diagnoses for the study participants are shown in Table 1. All subjects were on psychiatric medication for their current mood episode at the moment of sample collection. According to the criteria of Traskman et al. (1981), suicide attempters were further divided into two subgroups: 20 subjects with a violent attempt (5 subjects with a knife wound, 1 subject jumping from a high place, 1 with a firearm, 7 that had tried to hang themselves, and 6 that had thrown themselves in front of a vehicle in movement), and 30 with a non-violent attempt (medication ingestion and/or a superficial wrist cut). This study was approved by our local Ethical Review Board for human studies (UFRGS, 18153) in accordance with the 1964 Declaration of Helsinki. All subjects provided their written informed consent before being enrolled in this study.

2.2. Biochemical measurements

All subjects were fasted overnight. Venous blood samples were drawn from the antecubital vein at 08:00 a.m. After whole blood was obtained, the serum was separated by centrifugation at 3000 rpm for 15 min and was then aliquoted at −80 °C until analyses to determine the serum levels of cholesterol and triglycerides, as well as leptin, S100B protein, brain-derived neurotrophic factor (BDNF) and C-reactive protein (CRP).

Total cholesterol, HDL, LDL and triglyceride levels were determined by colorimetric assays using LaTest Diagnostica Kits, as indicated by the manufacturer, and employing the Labmax 240 equipment from LabTest Diagnostica (Minas Gerais, Brazil). Serum S100B was measured by sandwich ELISA, as described previously (Leite et al., 2008). BDNF and leptin were measured by sandwich ELISA kits from Millipore (MA, USA). CRP was measured by a high sensitivity turbidimetric immunoassay kit from Biotécnica (Minas Gerais, Brazil), using the Labmax 240 for absorbance reading (Labtest Diagnostica, Minas Gerais, Brazil).

2.3. Statistical analysis

Statistical analyses were performed using SPSS 17.0 for Windows. All continuous variables are presented as means ± standard deviation (SD) or medians and interquartile range, as appropriate. Categorical variables are presented as the raw number and percentage (%). χ² and Fisher’s test were used to evaluate associations between categorical variables, as appropriate. For the comparisons of continuous variables among groups, we employed the independent t test for parametric variables, and the Mann–Whitney test for non-parametric variables. For analyses of total cholesterol, LDL, HDL, triglycerides, BDNF, and leptin we used the analysis of covariance (ANCOVA). Length of illness and of current episode, sex, use of anticonvulsants or selective serotonin reuptake inhibitor (SSRI), body mass index (BMI), and waist circumference were used as covariates. As leptin was a highly skewed variable, we applied a logarithmic transformation in order to use parametric methods. S100 and CRP were highly skewed and not suitable for mathematical transformations, and therefore we used non-parametrical methods. Pearson’s and Spearman’s correlations coefficients were used to analyze the correlations between parametric and non-parametric continuous variables, respectively. We also analyzed the effect of the presence of suicide attempt as a moderator in the correlations. Two-tailed p values < 0.05 were considered to be statistically significant.

3. Results

A total of 86 subjects with mood disorders were included in this study. Fifty subjects had presented an episode of suicide attempt during the last 15 days, and 36 subjects had no lifetime history of suicide attempt. The characteristics of the sample are summarized in Table 1. All subjects were on current psychiatric medication at the time of the suicide attempt and at the time of blood withdrawal. The frequencies of the types of psychiatric medication were similar between both groups, except for the use of anticonvulsants and SSRI antidepressants, which were higher in the subjects without any suicide attempt. Subjects with a recent suicide attempt had decreased BMI and waist circumference, when compared to subjects that had not attempted suicide. We identified the presence of T2DM (Type 2 diabetes mellitus) and hypothyroidism in subjects without any history of suicide attempt. After adjusting for length of illness and of current episode, sex, use of anticonvulsants and SSRI, BMI, and waist circumference, we found that triglycerides were decreased in attempted suicide subjects when compared to subjects without any suicide attempt (103.45 ± 31.72 vs. 144.15 ± 74.48, p = 0.001) (Fig. 1). We found no differences among total cholesterol, LDL, and HDL between subjects with and without any suicide attempt.

Moreover, there were no differences among BDNF, S100B, CRP, and leptin between those attempted suicide and non-suicide subjects (Table 2). In addition, we found no difference in total cholesterol, LDL, HDL, triglycerides, BDNF, S100B, CRP, and leptin when analyzing the suicide attempters, according to the violence of the act (data not shown).

We found a positive correlation between leptin and length of illness (r = 0.24, p = 0.03), leptin and waist circumference (r = 0.32, p = 0.003), and between leptin and BMI (r = 0.48, p = 0.001). The correlation between leptin and BMI is clearly observed in subjects with and without suicide attempt (Fig. 2A). There were positive
particularly with BD and MDD, have elevated BMI and other metabolic abnormalities, which contribute to metabolic syndrome (Carpiniello et al., 2012; Fiedorowicz et al., 2008; Lopresti and Drummond, 2013). Herein, we found some differences between suicide attempters and non-attempters in the sample of mood disorders studied, particularly with regard to BMI and waist circumference, which were both reduced in suicide attempters. In agreement with these body parameters, the suicide attempters exhibited lower serum triglycerides. It is important to emphasize that the difference found in serum triglycerides (and not in cholesterol) in suicide attempters was adjusted for gender and BMI, which is generally underestimated in other cross-sectional studies of suicidality [see Zhang (2011)].

Three demographic data parameters deserve consideration in our sample; gender, length of illness and current episode and current medication. The gender difference regarding risk of suicide attempt is well known. Worldwide the risk of attempted suicide is higher in females (Borges et al., 2010; Rihmer et al., 2013). Accordingly, our study included more females than males with a history of attempted suicide. Furthermore, the average time between the onset of disease and the current suicide attempt was 10 years. This period has been considered to present a higher risk of suicide in patients with both BD and MDD. Triglyceride levels were decreased in subjects without a history of suicide attempt even after adjusting for the use of anticonvulsants and antipsychotics (particularly valproate) contributing to insulin resistance and obesity (Pylvanen et al., 2006; Verrotti et al., 2012). Notably, we did not find any differences in the use of antipsychotic drugs between suicide attempters and non-attempters. Triglyceride levels were decreased in subjects without suicide attempt even after adjusting for the use of anticonvulsants and SSRI. However, since ours is a cross-sectional study, we cannot consider these differences in the use of antipsychotics as definitive evidence of a causal relationship.

### Table 1
Characteristics of subjects with and without a history of suicide attempt.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>With suicide attempt (n = 50)</th>
<th>Without suicide attempt (n = 36)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Socio-demographics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male/female</td>
<td>11/39</td>
<td>12/24</td>
<td>0.048*</td>
</tr>
<tr>
<td>Age, years</td>
<td>27.83 ± 12.21</td>
<td>32.28 ± 13.91</td>
<td>0.120</td>
</tr>
<tr>
<td>Education level, years</td>
<td>10.27 ± 3.35</td>
<td>12.17 ± 3.09</td>
<td>0.064</td>
</tr>
<tr>
<td><strong>Psychiatric disorder</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bipolar disorder</td>
<td>37</td>
<td>29</td>
<td>0.323</td>
</tr>
<tr>
<td>Current mania</td>
<td>23</td>
<td>16</td>
<td>0.658</td>
</tr>
<tr>
<td>Current depression</td>
<td>14</td>
<td>13</td>
<td>0.658</td>
</tr>
<tr>
<td>Major depressive disorder</td>
<td>13</td>
<td>7</td>
<td>0.323</td>
</tr>
<tr>
<td>Presence of psychosis</td>
<td>21</td>
<td>8</td>
<td>0.133</td>
</tr>
<tr>
<td>Length of illness, years</td>
<td>10.0 (3.0–20.0)</td>
<td>18.0 (11.0–30.0)</td>
<td>0.032*</td>
</tr>
<tr>
<td>Length of current episode, days</td>
<td>25.0 (15.0–60.0)</td>
<td>60.0 (30.0–180.0)</td>
<td>0.046*</td>
</tr>
<tr>
<td>Family history of psychiatric disorder</td>
<td>31</td>
<td>33</td>
<td>0.780</td>
</tr>
<tr>
<td>Current psychiatric medication</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SSRI</td>
<td>7</td>
<td>14</td>
<td>0.020*</td>
</tr>
<tr>
<td>Others</td>
<td>14</td>
<td>13</td>
<td>0.680</td>
</tr>
<tr>
<td>Lithium</td>
<td>15</td>
<td>11</td>
<td>0.570</td>
</tr>
<tr>
<td>Anticonvulsants</td>
<td>21</td>
<td>29</td>
<td>0.021*</td>
</tr>
<tr>
<td>Antipsychotics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typical</td>
<td>28</td>
<td>17</td>
<td>0.280</td>
</tr>
<tr>
<td>Atypical</td>
<td>27</td>
<td>21</td>
<td>0.475</td>
</tr>
<tr>
<td><strong>Metabolic characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td>24.61 ± 4.77</td>
<td>28.13 ± 6.41</td>
<td>0.001*</td>
</tr>
<tr>
<td>Waist circumference (cm)</td>
<td>81.14 ± 9.48</td>
<td>96.68 ± 17.17</td>
<td>0.049*</td>
</tr>
<tr>
<td>T2DM</td>
<td>0</td>
<td>2</td>
<td>0.310</td>
</tr>
<tr>
<td>Hypothyroidism</td>
<td>0</td>
<td>2</td>
<td>0.310</td>
</tr>
</tbody>
</table>

Abbreviations: SSRI, selective serotonin reuptake inhibitor; BMI, body-mass index; T2DM, Type 2 diabetes mellitus.

* Columns show means ± standard deviation (SD) for all categories except male sex, presence of psychosis, pathology, current psychiatric medication, family history of psychiatric disorder, and presence of T2DM or hypothyroidism, which are presented as raw data. Length of illness and current episode are shown as median and interquartile range.

a Chi-square test.
b Independent t test.
c Mann-Whitney test.
d Fisher’s exact test.

correlations between CRP and waist circumference (r = 0.32, p = 0.003), and CRP and BMI (r = 0.38, p = 0.001). However, the presence of a suicide attempt did not act as a moderator in these correlations (Table 3). Moreover, we found no correlation between S100B and BDNF with any clinical characteristic, including BMI and length of illness.

With regard to the serum triglycerides (the parameter that differed between subjects with and without a history of suicide attempt) we found no correlations between triglycerides and BMI (r = 0.12, p = 0.261), triglycerides and waist circumference (r = 0.17, p = 0.098), or triglycerides and length of illness (r = 0.08, p = 0.454). The lack of correlation between triglycerides and BMI, observed in mood disorder subjects with and without a history of suicide, is shown in Fig. 2B.

### 4. Discussion

In contrast to current hypotheses reported in the literature, we did not find any relationship between low total cholesterol and its fractions and suicidal behavior in patients with mood disorders. However, this lack of relationship is in agreement with some other studies in the literature (Almeida-Montes et al., 2000; Asellus et al., 2010; Paplos et al., 2012; Park et al., 2013; Persons et al., 2012) and our data are in accordance with two other independent and contemporary studies in individuals with BD and MDD, where no differences were found in serum cholesterol content (Baek et al., 2014; D’Ambrosio et al., 2012). We did not find any difference in total cholesterol, HDL or LDL. Commonly, psychiatric patients, particularly with BD and MDD, have elevated BMI and other...
rule out that the use of anticonvulsant drugs, which were more prevalent in the non-attempter group, contributed to the discrepancy observed in BMI and serum triglyceride levels. In another study regarding BD, decreased cholesterol and triglycerides were observed in suicide attempters (Vuksan-Cusa et al., 2009). Interestingly, in Vuksan-Cusa’s study the sample was free of psychotropic medication, reinforcing the idea that medication is not the sole contributor to changes in lipid profile.

It has been proposed that a decreased serotonergic activity could result in a poorer inhibition of impulsivity and, consequently, suicidal behavior (Arango et al., 2002; Mann, 2013). In our study, we observed that the prescription of SSRI in persons without suicide attempts was higher than in those with suicide attempts. This difference in prescribing may be secondary to a possible association between the class of SSRI, particularly fluoxetine, with violence and suicide (Gunnell and Ashby, 2004; Hammad et al., 2006; Marcinko, 2007; Walsh and Dinan, 2001), although no consensus regarding the direct relationship between antidepressant use and development of suicidal ideation or behavior exists (Fazel et al., 2007; Hammad et al., 2006; Miller et al., 2014; Walsh and Dinan, 2001). More recently, the serotonergic system, widely established as being linked to suicidality (Arango et al., 1995; Jokinen et al., 2009; Traskman et al., 1981), has been studied in the area of genetics and presented interesting results. For example, the presence of sequence variants in HTR5A (serotonin type 5A receptor gene) was strongly associated with high plasma levels of triglycerides (Zhang et al., 2010) and associations between lower HDL cholesterol levels with depression were also modified by a 5-HTTLPR (serotonin transporter gene linked promoter region) polymorphism; however this association was only significant in the presence of one or more copies of the s (short) allele (Kim et al., 2011).

Some studies have suggested that lower cholesterol can be more linked to violent suicide attempts than suicidality itself [e.g. (Atmaca et al., 2008)]. We did not find a significant difference in

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**Table 2**

<table>
<thead>
<tr>
<th></th>
<th>With suicide attempt</th>
<th>Without suicide attempt</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BDNF, pg/ml</td>
<td>1070.94 ± 371.29</td>
<td>1045.38 ± 672.07</td>
<td>0.60</td>
</tr>
<tr>
<td>S100B, ng/ml</td>
<td>3.00 (1.00–7.00)</td>
<td>3.50 (1.00–7.75)</td>
<td>0.85</td>
</tr>
<tr>
<td>CRP, mg/l</td>
<td>4.00 (1.00–9.00)</td>
<td>3.50 (2.00–6.00)</td>
<td>0.89</td>
</tr>
<tr>
<td>Leptin, ng/ml</td>
<td>2.74 ± 1.12</td>
<td>3.05 ± 1.19</td>
<td>0.65</td>
</tr>
</tbody>
</table>

Abbreviations: BDNF, brain-derived neurotrophic factor; CRP, C-reactive protein.

a Independent t test, mean and standard deviation.

b Mann–Whitney test, median and interquartile range.

c Log-transformed variable.
serum cholesterol between violent and non-violent attempters, in agreement with a previous study in BD (D’Ambrosio et al., 2012). We also did not find any difference in triglyceride levels between violent and non-violent suicide attempters.

This study also evaluated other markers related to adiposity, namely leptin, CRP and S100B (Eikelis et al., 2006; Steiner et al., 2010a). BDNF was also investigated because it is widely involved in body energetic homeostasis and commonly associated with psychiatric disorders with an elevated rate of suicide (Fernandes et al., 2010a). Some studies have shown elevated levels of serum S100B in episodes of mood disorders, and these elevations were more evident in major depressive disorder than in bipolar disorder (Schroeter and Steiner, 2009).

Serum leptin, an adipocyte-derived protein regulator of food intake, has a positive correlation with BMI [e.g. (McConway et al., 2003)]. Leptin (together with cholesterol) was found to be reduced in suicidal patients, compared to healthy controls (Atmaca et al., 2008, 2000). In addition, low levels of cerebrospinal leptin were found in female suicide attempters with major depression (Westling et al., 2004), in agreement with reduced levels of brain leptin observed in suicide victims (Eikelis et al., 2006). However, serum leptin was not altered in pregnant women with a higher suicide risk (Farias et al., 2013). Herein, we found a positive correlation of leptin with BMI in our sample, but no difference was found in serum leptin between patients with and without a history of suicide. This finding contends the idea that serum leptin may act as a suicidality marker in patients with mood disorders. Moreover, we did not find an association between CRP and a history of suicide in patients with mood disorders.

Leptin (together with cholesterol) was found to be reduced in the anthropomorphic signals of adiposity observed in these patients reinforces the idea that a systemic inflammatory process (including adipose tissue) may contribute to the pathophysiology of mood disorders (Kling et al., 2007).

No differences were observed in serum BDNF and S100B between mood disorder subjects with and without a history of suicide. Moreover, no correlation was found between these proteins and the anthropomorphic signals of adiposity observed in these patients (BMI or waist circumference) or these proteins and the length of illness. Serum BDNF was reduced in suicidal individuals soon after an attempted suicide (Dawood et al., 2007), in agreement with the changes in brain BDNF and its receptors observed in postmortem studies of depressive patients (Lee and Kim, 2011). Our sample included patients with suicide attempts during the last 15 days, time enough to “recover” possible decreases in the peripheral levels of BDNF associated with a suicidal attempt. However, further studies are necessary to clarify this question. S100B increments have been reported in many conditions of brain injury and neurodegenerative diseases (Kleindienst et al., 2007; Rothermundt et al., 2003). Serum S100B protein comes from the brain and from other non-neural sources, particularly adipose tissue (Goncalves et al., 2010, 2008). In fact, serum S100B levels in humans appear to closely reflect adipose tissue mass (Gross et al., 2010; Steiner et al., 2010a). Some studies have shown elevated levels of serum S100B in episodes of mood disorders, and these elevations were more evident in major depressive disorder than in bipolar disorder (Schroeter and Steiner, 2009).

We found elevated levels of S100B (compared to those of healthy individuals) [e.g. (Andreazza et al., 2007; Schroeter et al., 2011)], but no difference was found between patients with and without a

![Fig. 2](image) Correlations between leptin or triglycerides with body-mass index (BMI). A positive correlation between leptin and BMI is observed (in a, r=0.48), but no correlation between triglycerides and BMI (in b, r=0.12). History of suicide attempt is not a moderator of the correlations (p > 0.05).

Table 3
Analysis of a “history of suicide attempt” as a moderator of the correlations between body-mass index and length of illness in years with C-reactive protein, leptin, brain-derived neurotrophic factor (BDNF), protein S100B, and lipidic profile.

<table>
<thead>
<tr>
<th>R values with suicide attempt (n = 50)</th>
<th>R values without suicide attempt (n = 36)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI vs. BDNF</td>
<td>0.17</td>
<td>0.15</td>
</tr>
<tr>
<td>BMI vs. CRP</td>
<td>0.38</td>
<td>0.45</td>
</tr>
<tr>
<td>BMI vs. Leptin</td>
<td>0.45</td>
<td>0.39</td>
</tr>
<tr>
<td>BMI vs. S100B</td>
<td>0.08</td>
<td>0.05</td>
</tr>
<tr>
<td>Length of illness vs. BDNF</td>
<td>-0.26</td>
<td>-0.06</td>
</tr>
<tr>
<td>Length of illness vs. CRP</td>
<td>0.01</td>
<td>0.15</td>
</tr>
<tr>
<td>Length of illness vs. Leptin</td>
<td>0.19</td>
<td>0.25</td>
</tr>
<tr>
<td>Length of illness vs. S100B</td>
<td>0.16</td>
<td>-0.06</td>
</tr>
</tbody>
</table>

* Columns show Pearson’s correlation (r). The P values refers to the effect of the presence of suicide attempt as a moderator to the correlations.

Fig. 2. Correlations between leptin or triglycerides with body-mass index (BMI). A positive correlation between leptin and BMI is observed (in a, r=0.48), but no correlation between triglycerides and BMI (in b, r=0.12). History of suicide attempt is not a moderator of the correlations (p > 0.05).
history of suicide attempt. Moreover, no correlation was found with BMI. Interestingly, this lack of correlation was also observed in schizophrenic patients and attributed to insulin resistance in these patients (Steiner et al., 2010b). However, augmented S100B was correlated with the severity of suicidal ideation in adolescents with psychosis or mood disorders (Falcone et al., 2010). As such, this matter demands further studies.

Our study presents some limitations; firstly, our sample is probably underpowered to detect a difference in total cholesterol between subjects with and without a history of suicide attempt. However, in support of our analysis, another cross-sectional study of a sample of schizophrenic patients, also adjusted for gender and BMI, found no association between cholesterol and suicidal behavior (Huang and Wu, 2000). Secondly, all subjects were on medication and a higher number of non-suicidal persons were on anticonvulsants, drugs known to increase insulin resistance; however, we adjusted for this type of medication in our analysis. Thirdly, ours was a cross-sectional study, and we cannot therefore assess whether a decrease in triglycerides caused a mood episode with suicidal ideation that led to a suicide attempt or if the presence of a mood episode originated a loss of appetite and consequent loss of weight, therefore decreasing triglyceride levels. Taken together our data suggest that suicide attempters with mood disorders exhibit less adiposity, expressed as a reduced BMI, waist circumference and serum triglycerides, when compared to non-attempters. Our data opposed the idea that serum leptin, CRP and S100B could represent the markers of suicidality in patient with mood disorders. However, further studies are investigating these and other markers related to adiposity, such as ghrelin (Atmaca et al., 2006), are necessary not only to diagnose such behavior, but for the follow-up of treatment of psychiatric diseases with elevated rates of suicide.

5. Conclusions

We did not find any decrease in serum cholesterol when comparing suicide attempters with non-attempters in a sample of subjects with mood disorders. However, we found a reduced adiposity in suicide attempters, as indicated by reduced BMI, waist circumference and peripheral triglycerides. These data do not support the hypothesis that lower levels of cholesterol are associated with suicidal behavior. Moreover, although peripheral levels of leptin, BDNF, S100B and CRP may be associated with mood disorders, we did not find any difference in the levels of these proteins in subjects that had a history of suicide, or not. However, our data contribute to the idea that adiposity is differentiated in these patients, which could lead to an altered adipose tissue–brain communication.

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Conflict of interest

The authors declare no conflict of interest.

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