Personality Traits, Motivation and Bone Health in Vegetarians

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ABSTRACT

Vegetarian diets attract more and more attention due to growing concerns about health, ecology and/or animal welfare in general population. The main purpose of this paper was to examine whether vegetarianism could be associated with some specific personality characteristics, with the emphasis on the main motivational factors which determined acquiring the diet. Since the nutrition is also an important determinant of bone health we additionally analyzed the association between personal characteristics and bone density. On a sample of 109 adult vegetarians of both sexes we applied Eysenck Personality Questionnaire (including Psychoticism, Extraversion, Neuroticism and Lie scale), bone densitometry and questionnaire on dominant motives for dietary choices. The results on overall personality characteristics, bone density and basic anthropometric measures were within expected values for age. Vegetarian men had significantly more fractures during lifetime and lower neuroticism scores than women. Dominant motivational factors for acquiring vegetarianism were moral values. In addition »moral vegetarians« showed more pronounced introversion compared to »health vegetarians«, lending further support to the argument that personality plays an important role in the structure of motivation.

Key words: personality, neuroticism, extraversion, bone density, motivation, vegetarians, osteoporosis

Introduction

It seems that vegetarianism is getting more and more popular and publicly accepted, while estimated number of followers reaches 2.5 to 7% in US¹-⁴, 3 to 7% in UK⁵-⁶, 4% in Canada⁷, and 3.3% in Finland⁸. Estimated numbers of vegetarians for Croatian population reaches 4–5%⁹. But, Vinnari and coauthors found on a large sample of more than 24 000 participants that self-identification is not good method for observation the prevalence of vegetarianism because self-identification indicated more than double the incidence of vegetarianism than the operationalized definition³,⁸. Self-identification meaning that respondents denoted themselves as vegetarians, while operationalized definition groups were formed by obeying strict inclusion criteria, those who reported less than once per month or rarely consumption were considered non-consumers. Thus pesco-lacto-ovo-vegetarians are defined as those eating vegetarian food, dairy products, eggs and fish but not meat or poultry less than once per month.

Based on the available literature vegetarians adopted their diet for a variety of reasons including moral, environmental, health, or religious. Marjaana Lindeman and Minna Sirelius⁴ suggested that food choice has become much more than what one is allowed to eat and became a part of one’s philosophy of life. Since vegetarians and non-vegetarians differ in their attitude toward meat, it is possible that they differ in some personality characteristics too. In accordance with this presumption Lindeman found on a large sample of female subjects that vegetarians express less happiness than other individuals¹¹.

It appears that food related lifestyle can be associated with some socioeconomic variables as higher educational level, higher socioeconomic status or living in more urban areas¹².

Jabs and coworkers⁴ examined the process of adopting vegetarian diets and found clear distinction between those whose dominant motive was ethical as contrasted
to health. Ethical motives included moral considerations, aligning dietary behaviors with beliefs and values about animal welfare. Health motives comprised perceived threat of disease as well as potential health benefits associated with vegetarian diets.

Vegetarians differ among themselves at the extent to which they avoid animal products from the avoidance of red meat only to the avoidance of all food derived from animals.

It is known that nutrition, especially a calcium intake is important for building and preserving an adequate bone mass \(13,14\). It is therefore of great importance to recognize specific patterns in nutrition, like vegetarianism, which might potentially increase the risk for osteoporosis. The lack of estrogen or calcium are principal risk factors for osteoporosis and vegetarians usually have lower circulating estrogens and body mass index, while vegans usually have lower calcium intake or they take calcium of lower bioavailability. On the other hand, a good acido-basic balance, which is present in vegetarian nutrition, could be useful for bone health \(18\). However, majority of studies \(16-20\), but not all \(21-23\), did not show a difference in bone density between vegetarians and omnivores. A few studies found a low bone density in vegans, compared to non-vegans \(24\).

Our study is an attempt to examine whether vegetarianism could be associated with some specific personality characteristics measured by Eysenck Personality Questionnaire (EPQ), and to assess bone density in our group of healthy adult vegetarians. Further we shall analyze the association between some personality characteristics with bone density and the number of fractures.

**Materials and Methods**

Subjects were 109 vegetarians with an age range of 19 to 67 years of both sexes (89 women and 20 men). They were recruited from the Institute for Education of Adults, from the Animal Friends Society and by personal contact. Potential participants have received an informed letter, with the explanation of the study protocol. Total of 169 subjects responded to the invitation letter, giving the basic information about age, sex, duration and type of the vegetarian nutrition. The study had two phases: 1) taking the blood samples; 123 participants responded, while 46 participants signed off due to diseases and other personal reasons; 2) obtaining nutritional questionnaires and bone density measurement. One hundred and nine subjects completed both phases. Sixteen of our subjects claimed that they were vegans at the time of research. All of them were first committed to vegetarianism and then gradually became vegans. The whole sample is characterized by the equable educational level of approximately 15 years of schooling with the range from secondary school to university degree. At the average they followed their vegetarian diet for 11 years (range 1 to 35 years), and started at the age of 25 years (all of them starting as adolescents or adults). Height and weight were measured using a portable stadiometer and electronic scale. Body mass index (BMI) was calculated as the weight (kg) divided by the square of the height (m\(^2\)). Content of fat and lean tissue (kg) were automatically calculated in total body densitometry.

Study was approved by Ethical Committee of the Institute for Medical Research and Occupational Health. Each participant has signed an informed consent.

**Bone density measurement**

Bone mineral density (BMD; g/cm\(^2\)) was measured using dual energy X-ray absorptiometry (Lunar – Prodigy, Madison, WI). Measurements were made in the lumbar spine (L1-L4), and total body. The in vivo coefficient of variation was 1.5% for the lumbar spine and 1.1% for the total body. BMD was also expressed as T score, which represents the number of standard deviations with respect to the mean BMD of a control population between 20 and 40 years of age, using the manufacturer’s reference values. T score between –1 and –2.5 is defined as osteopenia and T score lower than –2.5 is defined as osteoporosis \(25\). BMD between –1 and –2.5 standard deviations was defined as osteopenia and BMD lower than –2.5 standard deviations was defined as osteoporosis.

**Diet assessment**

Nutrient intakes were calculated from weighed 7-days food records using food composition tables. Data from a multiply-day records is more representative of usual intake than a single-day data from either a 24-h recall or a 1-day food record, and don’t depend on memory. To ensure an adequate level of detail the records were reviewed by trained nutritionists and subjects were additionally contacted for further information. All were recruited through local vegetarian societies and an inclusion criterion was duration of vegetarian diet longer than one year. Confirmation of vegetarianism i.e. veganism was based on food records what is preferred method over self-reporting that can be inaccurate.

**Eysenck Personality Questionnaire (EPQ)**

Personality traits were assessed by Eysenck Personality Questionnaire, one of the most used questionnaires developed by Hans and Sybil Eysenck in 1975 \(26\). EPQ has for scales: Psychoticism, Extraversion, Neuroticism and Lie scale, covered by 90 questions:

EPQ-P : Psychoticism represents aggressiveness, assertiveness, egocentrism and tough – mindedness and inclination toward manipulation (25 items).

EPQ-E : Extraversion represents sociability, liveliness, dominance, impulsiveness, irresponsibility, risk-taking, and outgoing and talkative persons (21 item).

EPQ-N : Neuroticism represents emotional instability and anxiety, feelings of guilt and depressed mood (high levels of negative affect such as depression and anxiety)(23 items).

EPQ-L : Lie scale represents dissimulation, social naivété, social conformity (21 item).
Mc Crae and Costa confirmed the assumption that dimension measured by Lie scale is in fact a stable personality characteristic, rather than a response set, or a tendency to fake, which was indicated before.

**Motivation**

To determine basic food preference motives 105 respondents were presented with the choice list of 9 major reasons for adopting a vegetarian diet:


**Statistics**

Data were analyzed using the software Statistica, version 9.0 (StatSoft Inc., Tulsa, USA). The results are shown as mean ± standard deviation. Differences between groups (means) were tested using the t-test. The relation between two variables was tested with the linear correlation. The multiple regression model was created with bone mineral density as dependent variable and with psychological characteristics and all potential confounding factors as independent variables. Those included age, sex, body mass index and duration of vegetarian nutrition. The distribution of variables was tested using the Kolmogorov-Smirnov test. Variables not distributed normally were recalculated to the new variables, using logarithmic function. In all tests, p value lower than 0.05 was considered significant.

**Results**

There were more women than men in this study, which is expected as there are generally more women than men who practice vegetarian diet. Men had significantly higher weight, height, content of lean tissue (p=0.0001) and total body BMD (p=0.005). All anthropometric measures and bone density variables showed expected values for age and gender (Table 1). Eight women (9%) and four men (22%) had an osteopenia, while two men (11%) had an osteoporosis. Total number of fractures was 38, but the vast majority of fractures (88%) occurred before the beginning of the vegetarian diet, which supports significant association between the frequency of fractures and personality characteristic – extraversion (Table 2).

Multiple regression analysis did not reveal any of the four psychological characteristics as significant predictors of bone density in our vegetarians. Dominant factors affecting food choice decision were recorded into one of the following nine categories as follows: 1. Negative attitude toward meat (11); 2. Ethic (36); 3. Health (19); 4. Animal welfare (26); 5. Ecology (1); 6. Spiritual believes (4); 7. Vegetarian food is sufficient (3); 8. Taste (1); 9. Other (4). The majority of our respondents cited moral reasons for vegetarianism (36) followed by animal welfare/strong opposition to cruelty toward animals (26), both of which are in fact ethical categories. We may assume that persons who were brought up as vegetarians or whose vegetarianism is strictly regulated by strong religious rules may have different rank of motives. Kim

### TABLE 1

<table>
<thead>
<tr>
<th></th>
<th>Women (n=89) Mean ± Std.Dev.</th>
<th>Men (n=20) Mean ± Std.Dev.</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>35.9 ± 10.2</td>
<td>35.2 ± 8.7</td>
<td>0.767</td>
</tr>
<tr>
<td>Education (years)</td>
<td>15.0 ± 1.4</td>
<td>14.5 ± 1.6</td>
<td>0.139</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>167.5 ± 6.4</td>
<td>180.6 ± 6.4</td>
<td>0.000</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>61.1 ± 9.4</td>
<td>76.3 ± 14.1</td>
<td>0.000</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>21.7 ± 3.2</td>
<td>23.3 ± 3.9</td>
<td>0.065</td>
</tr>
<tr>
<td>Fat tissue (g)</td>
<td>19.0 ± 7.7</td>
<td>14.1 ± 10.5</td>
<td>0.020</td>
</tr>
<tr>
<td>Lean tissue (g)</td>
<td>38.3 ± 5.9</td>
<td>60 ± 5.8</td>
<td>0.000</td>
</tr>
<tr>
<td>Spine BMD (g/cm²)</td>
<td>1.217 ± 0.14</td>
<td>0.30 ± 0.20</td>
<td>0.663</td>
</tr>
<tr>
<td>Spine T score</td>
<td>-0.17 ± 0.60</td>
<td>0.67 ± 0.80</td>
<td>0.143</td>
</tr>
<tr>
<td>Total body BMD (g/cm²)</td>
<td>1.166 ± 0.115</td>
<td>1.249 ± 0.119</td>
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</tr>
<tr>
<td>Total body T score</td>
<td>1.33 ± 0.62</td>
<td>0.67 ± 0.80</td>
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</tr>
<tr>
<td>Number of fractures</td>
<td>0.27 ± 0.5</td>
<td>0.65 ± 0.8</td>
<td>0.006</td>
</tr>
<tr>
<td>Duration of vegetarian nutrition (years)</td>
<td>11.1 ± 7.2</td>
<td>11.0 ± 6.7</td>
<td>0.964</td>
</tr>
<tr>
<td>Onset of vegetarianism</td>
<td>24.85 ± 8.4</td>
<td>24.2 ± 7.1</td>
<td>0.752</td>
</tr>
<tr>
<td>EPQ – Psychoticism</td>
<td>4.45 ± 2</td>
<td>5.15 ± 1.9</td>
<td>0.149</td>
</tr>
<tr>
<td>EPQ – Extraversion</td>
<td>12.98 ± 3.8</td>
<td>13.45 ± 3.5</td>
<td>0.614</td>
</tr>
<tr>
<td>EPQ – Neuroticism</td>
<td>8.27 ± 4.8</td>
<td>5.30 ± 3.9</td>
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</tr>
<tr>
<td>EPQ – Lie scale</td>
<td>9.45 ± 4</td>
<td>7.70 ± 3.7</td>
<td>0.076</td>
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</table>
and coworkers noted increase in importance of ethical and animal welfare motivational factors over time, investigating dietary choice in two groups of vegetarians 25 years apart28.

For statistical analysis we grouped answers about the dominant motives of adherence to a vegetarian diet into two categories: 1. ethical motives (answers 2. Ethic, 4. Animal welfare, 5. Ecology, and 6. Spiritual believes) and health motives (1. Negative attitude toward meat, 3. Health, 7. Vegetarian food is sufficient, and 8. Taste), excluding four answers in category »other«. The only statistically significant difference between these two groups was found for the continuous variable »extraversion – introversion« on EPQ, suggesting that health motivated vegetarians are more extraverted compared to those whose motives were predominantly ethical in nature (M_healthy=14.2; M_ethic=12.5; p=0.035). EPQ results revealed that our whole group is characterized by somewhat lower scores on psychoticism (M=4.58±2), neuroticism (M=7.72±4.7) and lie scale (M=9.13±4), while extraversion results show expected values (M=13.06±3.8) compared to published norms for general population25.

At the average our participants became vegetarians at the age of 25 years, and only 12 began between 11 and 18 years. Negative correlation between onset of vegetarianism and extraversion (r = –0.24) would indicate that those with more pronounced extroversion would start earlier (Table 2). Expected positive correlation (r = 0.37 with pairwise deletion of missing data) was found between chronological age and lie scale results, i.e. older give more socially desirable responses, while younger show some kind of social naıveté. This is in accordance with data published in the Manual25, and with recent results gained on the large sample in Croatia29. Extroversion has statistically significant positive association with number of fractures during lifetime (Table 2. and Figure 1.), which is also expected since males have more fractures and higher scores on extraversion scale.

Discussion

Although the osteoporosis and osteopenia are more frequent in women, we found a higher prevalence of both

<table>
<thead>
<tr>
<th>Age</th>
<th>Edu</th>
<th>Veg</th>
<th>Ons</th>
<th>P</th>
<th>E</th>
<th>N</th>
<th>L</th>
<th>Fr</th>
<th>Fat</th>
<th>Lean</th>
<th>Spine BMD</th>
<th>TB BMD</th>
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<tr>
<td></td>
<td>0.17</td>
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<tr>
<td>Edu</td>
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<tr>
<td>Veg</td>
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<td>–0.15</td>
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<tr>
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<td>–0.11</td>
<td>0.04</td>
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<tr>
<td>P</td>
<td>–0.16</td>
<td>–0.08</td>
<td>0.05</td>
<td>–0.24</td>
<td>0.05</td>
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<tr>
<td>E</td>
<td>0.07</td>
<td>0.05</td>
<td>–0.05</td>
<td>0.13</td>
<td>0.09</td>
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<td>L</td>
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<td>Fr</td>
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<tr>
<td>Fat</td>
<td>0.06</td>
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<td>0.09</td>
<td>0.00</td>
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<td>0.07</td>
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<td>Lean</td>
<td>–0.31</td>
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<td>–0.08</td>
<td>–0.31</td>
<td>0.03</td>
<td>0.18</td>
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<td>0.10</td>
<td>–0.05</td>
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<tr>
<td>Spine BMD</td>
<td>–0.12</td>
<td>–0.17</td>
<td>0.07</td>
<td>–0.19</td>
<td>0.05</td>
<td>0.24</td>
<td>–0.27</td>
<td>0.08</td>
<td>0.05</td>
<td>0.22</td>
<td>0.39</td>
<td>0.60</td>
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<tr>
<td>TB BMD</td>
<td>–0.13</td>
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<td>–0.09</td>
<td>–0.08</td>
<td>0.13</td>
<td>0.02</td>
<td>–0.14</td>
<td>–0.22</td>
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<td>–0.05</td>
<td>0.57</td>
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<tr>
<td>H</td>
<td>0.12</td>
<td>–0.14</td>
<td>0.11</td>
<td>0.05</td>
<td>0.15</td>
<td>0.08</td>
<td>–0.16</td>
<td>–0.05</td>
<td>0.31</td>
<td>0.58</td>
<td>0.58</td>
<td>0.17</td>
<td>0.45</td>
</tr>
</tbody>
</table>

r<0.21 are significant at p<0.05; Pairwise deletion of missing data was used

Legend: Edu-education in years; Veg-duration of vegetarian diet in years; Ons-age of the onset of vegetarianism in years; P-psychopticism; E-extroversion; N-neuroticism; L-lie scale; Fr-number of fractures; Fat-fat tissue; Lean-lean tissue; Spine BMD; TB BMD- Total body BMD; H-height; W-weight.

Fig. 1. Extraversion in vegetarians with and without fractures; t=2.49; p=0.014.
conditions in our male subjects. One man with osteopo-
rosis had the lymphoma in his early twenties, while other
men with osteoporosis and those with osteopenia had no
condition which could have influenced a bone metabo-
lism. Therefore, it seems that lower bone density in men
compared to women was not a consequence of the selec-
tion bias. The ratio between women and men in our
study sample was approximately 3:1 which is in accor-
dance with the fact that there are more vegetarian wo-
men than men6.

Vegans had lower bone density than vegetarians, al-
though that difference was not statistically significant.
This is similar to the results of several other studies
which showed that vegetarianism, especially vegan diet
was associated with lower bone density, but on un-signif-
ant level30. Fractures related to or caused by trauma (se-
rious strokes or falls) were found in 23 women and 10
men. We could not assess whether this fracture preva-
ience was high or low since we did not have a control
group. However, some other studies showed that fracture
rate did not differ between omnivores and vegetarians81.
The symptoms in osteoporosis are usually caused by frac-
ture and they include back pain, loss of height and
stooped posture, which can result in loss of confidence or
even depression. In 2001, The National Institute of Health
launched a study including women ages 21 through 45
who were suffering from depression32. Their findings
showed a very strong correlation between depression and
osteoporosis. It is believed that depression is associated
with hormonal abnormalities that can lead to changes in
bone tissue33.

Concerning main motives of adherence to a vegetar-
ian diet we may assume that stable personality dimen-
sion «extraversion – introversion» shapes motivational
factors as such, turning introverts dominantly towards
motivators of moral nature, and extraverts towards ones
own health welfare/benefit. This would mean that the fo-
cus within health vegetarianism would more often be in-
ternal (desire to sustain good health or lose weight),
while ethical vegetarians would more frequently focus
outward showing interest for welfare of other living crea-
tures. Very similar results were found recently by Fox
and Ward27. We may speculate that the strong media pro-
motion of «Cult of healthiness» nowadays may increase the
number of health motivated vegetarians in future, es-
specially among extraverts.

Our results show expected significant gender differ-
ences in height, weight, fat and lean tissue as well as in
total body BMD. The number of fractures during life
time also shows predictable male supremacy, while vari-
able neuroticism on EPQ shows higher values in female
subjects. Among psychological variables there were no
other statistically significant differences, although women
scored higher on lie scale, and lower on psychoticism and
extraversion. These results are again expected and in ac-
cordance with recent study in Croatian population26. No
association was found between the four EPQ subscales
and fat (in kg), BMD spine, or weight (in kg). According
to our results those with bigger Total Body BMD have
higher results on extraversion scale and lower on neuro-
ticism scale which is characteristic for male participants.
Negative correlations often appear between the traits of
neuroticism and extraversion (in our case r −0.38), re-
gardless of the instrument used, indicating that those
who are more prone to emotional instability tend to be
more introverted.

Due to the small number of participants in our study,
we could not analyze vegans separately (only 16 sub-
bjcts), but rather they were studied as a vegetarian sam-
ple. Therefore no final conclusion could be made consid-
ering differences between these two groups. Further
research on the topics of motivational factors, personal-
ality and bone health would be needed. Larger study, using
the same methods could highlight possible differences
between those two subgroups and comparable control
group in terms of stable personality traits that influence
our dietary choices and attitude towards vegetarianism
in brother sense. Also, larger sample may answer the
question weather vegan diet induces negative influence
on bone health, since our results point to this direction,
although at statistically non significant level. Another
limitation of our sample is non-homogeneity in respect to
age, which should be considered in future study too.

Conclusions

On a sample of 109 adult vegetarians of both sexes we
found that overall psychological profile on EPQ was
within the expected boundaries for all four scales. An-
thropometric and bone density parameters in vegetari-
ans were within expected values without certain benefi-
cial or harmful effect of vegetarianism on bone health.
The only exception was somewhat higher presence of
osteopenia and osteoporosis in men than it is generally
found in population.

Overall, our participants expressed strong ethical,
rather than health component as a dominant motiva-
tional factor for acquiring vegetarianism. We found sta-
tistically significant difference between health and moral
vegetarians in psychological dimension «extraversion-in-
troversion», and thus we may conclude that «moral vege-
tarians», motivated by moral considerations towards ani-
mals and environment have outward focus, and are more
often introverts. They would start vegetarian diet later
in life. On the other hand, «health vegetarians» who
would start earlier, are more often extraverts motivated
by potential health benefits, and thus focused inward.
These findings expend understanding of a wide variety of
food-related behaviors, especially specific psychological
processes and personality characteristics that affect our
dietary choices beside cultural factors, and may help nu-
trition professionals in developing strategies to work
with those who want or need to change diet habits.

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SAŽETAK


OSOBINE LIČNOSTI, MOTIVACIJA I ZDRAVLJE KOSTIJU U VEGETARIJANACA

REFERENCES


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Color profile: Generic CMYK printer profile
Composite Default screen