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The Relationship Between Vegetarian Eating, Gender and Fatigue in Students

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Summary

This study examines the relationship between vegetarian eating, gender and fatigue. It is known that women and vegetarians are a risk group for iron deficiency and that a deficiency in blood iron levels can lead to fatigue. Based on the literature, vegetarians and women are expected to be more fatigued in daily life than non-vegetarians and men. Using online questionnaires, fatigue and eating habits of 95 students are measured. The hypothesis that women are more fatigued than men is confirmed. However, nonvegetarians were more fatigued than vegetarians. A possible explanation for the inverse relationship found could be the healthier lifestyle of vegetarians. Nevertheless, there was a disparity within vegetarians. Vegetarian women were more tired than non-vegetarian men. This may be explained by the dual risk for iron deficiency, namely gender (female) and vegetarian eating. Follow-up research is needed to further investigate this relationship.

Keywords Gender. Eating. Vegetarian. Students. mental health. Fatigue.

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Introduction

From an evolutionary perspective, one of sleep's core functions is its role as an adaptive state of inactivity, sleep likely evolved to help organisms conserve energy and reduce exposure to predators during vulnerable periods (Borbély et al., 2016). According to the National Sleep Foundation, healthy adults aged 18 to 64 should aim for seven to nine hours of sleep per night, while older adults (65+) typically require seven to eight hours (Hirshkowitz et al., 2015; National Sleep Foundation, 2020). Sleep needs also vary across the lifespan and are influenced by factors such as genetics, health status, and lifestyle (Hirshkowitz et al., 2015).

Sleep deprivation frequently leads to fatigue, manifesting in declines in cognitive performance, attention, reaction time, and mood stability—even after partial or total deprivation (Ren et al., 2025).

Fatigue can manifest as both mental and physical exhaustion (Van Cutsem et al., 2022). Mental fatigue refers to cognitive weariness, while physical fatigue involves bodily tiredness. Generally, fatigue is understood as the difficulty in initiating or sustaining voluntary activities (Van Cutsem et al., 2022). Consequently, sleep plays a crucial role in reducing fatigue, though other factors, such as stress, lifestyle, and health conditions, also significantly influence fatigue levels.

One factor that can have a positive effect on fatigue is a varied diet. Within the scientific literature, it is known that vegetarian eating can have a strong positive effect on health (Xu et al., 2023). In the study of Wang et al. (2023), a vegetarian diet was found to be associated with a lower incidence of all cancer-related diseases.

Although vegetarian eating can have a wide range of positive health effects, there can also be negative aspects associated with it. As a specific example, the importance of the trace element iron can be mentioned. Iron is an essential trace element for humans that is responsible for transporting and

storing oxygen. A lack of iron can cause the transport of oxygen in the cells to be impaired. If the cells do not receive enough oxygen, fatigue can be a consequence. Meat and fish products is the most effective way to absorb iron ((Fletcher & French, 2024). One reason for this is that iron from vegetables and fruits cannot be properly broken down and processed by the body. In short, a deficiency of meat and fish products can lead to fatigue (Fletcher & French, 2024).

A risk group regarding iron deficiency is especially vegetarians. This group of people refuses to eat meat and fish products or need to supplement it. Therefore, they lack the essential trace element from meat and fish products that the body processes best, namely iron (Neufingerl & Eilander, 2022). In addition to vegetarians, a second risk group is known. These are women, especially during menstruation and childbirth. On average, they have lower blood iron levels than men, by virtue of higher blood loss (Ekroos et al, 2024).

On the one hand, it is scientifically relevant to gather knowledge about the relationship between vegetarian eating and fatigue, because both eating and preventing fatigue have an essential value for survival. Moreover, this research contributes to people's awareness to monitor their own eating habits regularly. A recent systematic review and meta-analysis by Knoop et al. (2021) demonstrated that fatigue is a significant predictor of negative health outcomes, including functional decline, falls, hospitalizations, and even mortality, particularly among older adults. These findings highlight the importance of identifying and reducing fatigue as a preventative health measure. The relevance to current

research lies in the clear association between decreased fatigue and improved safety, cognitive function, and overall well-being, supporting the need for effective fatigue management strategies in both clinical and occupational contexts.

On the other hand, it is of social importance to gather knowledge about the relationship between vegetarian eating, gender and fatigue because the vegetarian lifestyle is becoming increasingly popular among young people. Women decide to adopt a healthy lifestyle more often than men, in part because of the current beauty ideal of looking slim. One component of a self-chosen healthy lifestyle is vegetarian eating (World Economic Forum, 2022). From the literature reviewed earlier, it appears that women are particularly at risk for iron deficiency. Iron deficiency is again a risk factor for fatigue. From this it can be inferred that women are more fatigued than men in everyday life due to their self-selected diet. Especially in students, studying learning materials requires a high level of concentration. This proves difficult if the self-chosen eating pattern (vegetarian food) has a negative effect on fatigue.

From these data, the question of this study follows: Is there a relationship between vegetarian eating, gender and fatigue in college students? The question is investigated based on questionnaires that measure fatigue in both vegetarians and non-vegetarians. Based on the literature consulted, the following hypotheses are formulated. First, vegetarians are more fatigued in daily life than non-vegetarians. Second, women are more fatigued in daily life than men. These hypotheses are independent of use of dietary supplements.

METHODS

Participants

The study involved 95 students (27 males and 68 females). Within the participants, there were

30 vegetarians. The research women took the participants from the

Radboud University recruited through the Sona System (half a credit point for 30 minutes). Participants not studying at Radboud University were asked to voluntarily participate in the study without compensation. An exclusion criterion for study participants was an incompletely completed questionnaire. Sleep quantity, age, nationality and intake of iron supplements were controlled for.

Materials

The material consisted of three questionnaires. The first questionnaire was designed to collect demographic data.

The second questionnaire focused on collecting information on sleep quality. To measure sleep function, the abbreviated version of the Pittsburgh Sleep Quality Index (PSQI) was used (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989).

To measure subjective fatigue, the researchers used the Checklist Individual Strain Strength (CIS).

The Individual Tension Checklist consists of twenty statements that assess how the participants have felt over the past two weeks (Vercoulen et al., 1994).

Design

The non-experimental study had a between-subject design and the sample was collected cross-sectionally. The study had as dependent variable the degree of fatigue (the total score of the CIS, quantitative) and as independent variables eating pattern with the two levels: vegetarians and non-vegetarians (qualitative) and gender with the two levels: male and female (qualitative).

Before analysis could begin, the researchers first prepared the data. Eleven items of the CIS had to be mirrored and then all items were added up to a total score. Only then could the analysis begin. First, descriptive statistics were used to describe the sample. Participants were divided into vegetarians and non-vegetarians and men and women. Categorical variables (level of education, use of dietary supplements, nationality) were described using frequencies.

Continuous variables (sleep quality, age) were described using means and standard deviations.

Second, a histogram of CIS scores was requested to look at the normal distribution of these scores to look at. Third, the differences on demographics between the groups were tested and, if necessary, adjusted for variables that were significantly different. To test differences between groups for the variables dietary supplement, nationality and educational level, a chisquare test was performed. For the variables sleep and age, a t test was performed. When a variable was significantly different between the groups, it was included in the analysis. To answer the research question, the study uses an ANOVA analysis to compare the difference of the mean score on the CIS questionnaire between the groups. If only the variable sleep is significantly different between the two groups, an ANCOVA will be performed with sleep as a covariate to correct for it. If all variables differ significantly, gender and dietary supplements will be included as factors in the analysis. The strength of each significant effect was assessed by eta^2. An association can be called strong if eta^2

>.20, weak if eta^2 <.10 and moderate in between (Ellis, 2006). The Statistical Package for the Social Sciences (SPSS), Windows version 18.0 was used for all analyses.

RESULTS

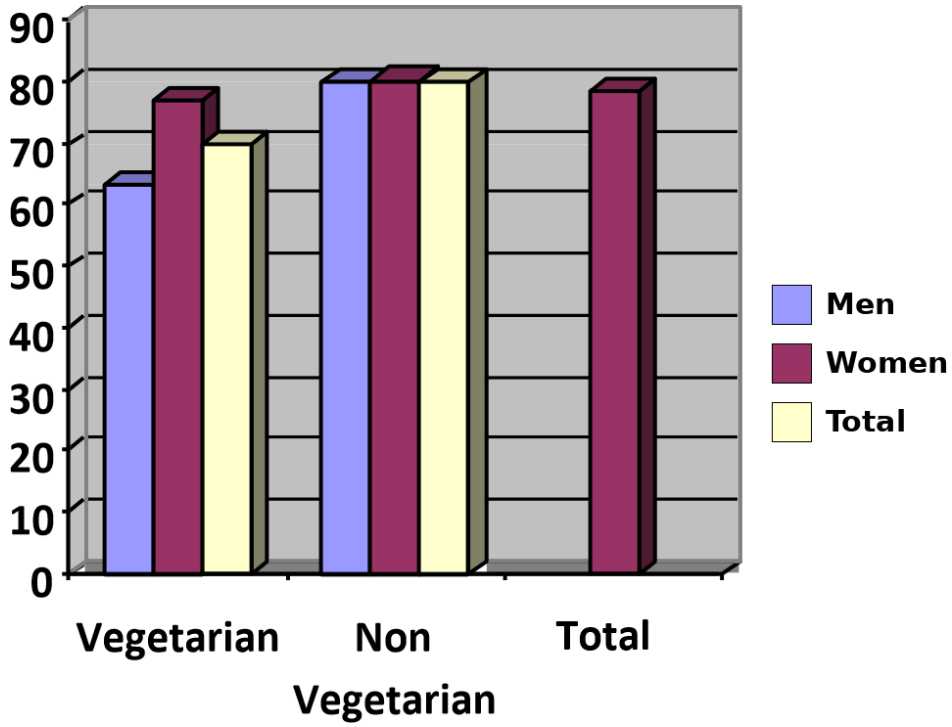
Within the 30 vegetarians, there were 9 participants who took dietary supplements. The mean age of all participants was 22 (SD = 3.27). Predominantly German students participated in the study (n = 70) and 44 Dutch students. The histogram showed that the scores on the CIS resembled a normal distribution (M = 76.72, SD= 10.01) with a maximum score of 109, a minimum score of 62.

There was only a significant difference between the groups on the following demographic variable: The use of dietary supplements and vegetarian eating (X^2(4)

= 100.42, p < .05). This means that vegetarians used more dietary supplements than nonvegetarians. However, whether or not they used dietary supplements was not included in the analysis because the n was too small for adequate analysis.

ANOVA analysis with the independent variables gender (male/female) and diet (vegetarian/non-vegetarian) and total score on CIS as the dependent variable revealed a moderately significant two-way interaction effect (F (1,91) = 11.49, p < .05, eta^2 = . 11). On average, women scored significantly higher (M = 78.43, SD = 1.55) than men (M = 71.30, SD = 1.19) on the CIS. Vegetarians scored significantly lower on average (M = 69.89, SD = 1.45) than non-vegetarians (M = 79.94, SD = 1.31). The two-way interaction showed that vegetarian women scored higher on the CIS (M = 76.71, SD = 10.03) than vegetarian men (M = 63.06, SD = 11.44). However, there was no significant difference between non-vegetarian men and nonvegetarian women on the CIS questionnaire. Figure 1 shows a graphical representation of the CIS scores of vegetarian and non-vegetarian participants and men and women.

Figure 1 Mean score on CIS among vegetarians/non-vegetarians and men/women.



DISCUSSION

The question of this study was: Is there a relationship between vegetarian eating, gender and fatigue in college students? The first hypothesis of this study was that vegetarians are more fatigued in daily life than non-vegetarians. The second hypothesis was that women are more fatigued in daily life than men. The results showed that there was a significant relationship between gender, diet and fatigue.

Contrary to the first research hypothesis, an inverse relationship was found between vegetarian eating and fatigue. Not vegetarians are more tired, but rather non-vegetarians. From this it can be concluded that the first research hypothesis is not confirmed. Linked back to the literature discussed, an inconsistent picture becomes clear. Saller et al. found in 2007 that a deficiency of the trace element iron can lead to fatigue and a risk group for deficiency of this trace element are mainly vegetarians. A possible explanation for the inverse relationship found is that vegetarians generally have a healthier lifestyle than nonvegetarians. They not only eat healthily but also live healthier lives than non-vegetarians. It has already been shown in the introduction that vegetarians have a lower risk of diseases (Wang et al., 2023). This could not just come from eating vegetarian, but also from other relevant factors that can positively influence health and therefore fatigue. Concrete examples that could have negative effects on fatigue are smoking and alcohol consumption. It is well known that vegetarians do not pay

attention to their health only when eating.

Vegetarians are more concerned with their own health than non-vegetarians. Therefore, the relationship found in this study that nonvegetarians are more tired than vegetarians can be explained by a healthier lifestyle of the vegetarians.

However, the two-way interaction reveals differences within vegetarians in terms of gender. Indeed, vegetarian women are significantly more fatigued than vegetarian men. But no difference can be seen among non-vegetarians. Non-vegetarian women and nonvegetarian men hardly differ from each other in terms of the degree of fatigue. This is confirmed by the discussed literature. In vegetarian women, two risk factors come together that can lead to fatigue lead, namely vegetarian eating and

gender (female). Women are already a potential risk group for fatigue. If they then go vegetarian, women may increase the risk of fatigue due to iron deficiency (Tang, & Sholzberg, 2024).

In contrast, the second research hypothesis is confirmed. Women are more tired than men in daily life. This is consistent with the literature discussed in the context of the introduction.

The results found can only be generalized to another population of German students, because predominantly German students participated in this study. This study makes an important contribution to science because it also aims to measure the negatives effects on fatigue that can result from a self-selected diet, namely vegetarian eating. Vegetarian women are especially at high risk for fatigue, as they have a double risk of being more fatigued in daily life than men.

Nevertheless, the study is not without shortcomings. On the methodological side, a further measurement can be included in the study, which is to measure blood iron levels. This could correct for iron levels, as iron deficiency can predict fatigue. However, measuring iron levels was not possible in this study because of the time limitation of this study. In addition, recruiting a more international sample may provide more scope for generalizing the results found. It may be interesting whether there are differences between fatigue, vegetarian eating and ethnicity. In this study, however, the majority of participants were German. Furthermore, after an overall healthy lifestyle can be looked at to correct for lifestyle. It follows that there is much room for follow-up research such as: (a) an additional measurement regarding blood iron levels; (b) an additional measurement regarding healthy lifestyle; and (c) recruiting a more international sample.

Despite its shortcomings, it can be concluded that the study prompt people to reflect on their diet, and vegetarian women in particular can thereby prevent fatigue in daily life. In particular, vegetarian female students can compensate for their fatigue with iron tablets, for example, with the goal of achieving increased concentration.

Fatigue remains an interesting and relevant topic for further research, because preventing fatigue can lead to a better quality of life.

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