

Connectedness to nature and its association with food choice motives among primary health care professionals

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Abstract *Connectedness to nature can boost well-being and lead to healthier and more sustainable food choices. Health professionals have the potential to be key agents in promoting environmental health. A cross-sectional study was conducted with 146 primary healthcare professionals to determine the association between nature connectedness and food choice motives considered important for human and environmental health. We used the 14-item Connectedness to Nature Scale (CNS) and the Food Choice Questionnaire (FCQ), consisting of 36 items distributed between nine factors, including “health”, “natural content”, and “ethical concern”. The average CNS score was 53.8 (± 9). The highest scoring factors of the FCQ were sensory appeal and price. Ethical concern was ranked last. There was a significant positive association between degree of nature connectedness and scoring for the factors health ($p = 0.031$), natural content ($p = 0.001$), and ethical concern ($p < 0.001$). The results of this unprecedented study show that increased connectedness to nature may lead to healthier and more sustainable food choices.*

Key words *Healthy diet, Health personnel, Environmental health, The environment, Primary healthcare*

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Introduction

Understanding how people's connection to nature forms and how this relation influences personal values and the planet's health is a relevant topic, particularly given the current environmental crisis¹, marked by complex problems such as global warming, excessive waste generation, natural disasters, an increase in water vector-borne disease outbreaks, poor housing conditions and sanitation, and suffering, experienced mainly by the most vulnerable segments of society².

Climate change is the greatest threat to global health in the 21st century³. Attention should be paid to the fact that levels of greenhouse gases (GHG), which directly influence climate change, have far exceeded the natural variation in recent years as a result of human activities, including agriculture⁴.

Large-scale farming, marked by the use of genetically modified crops and dominated by the fertilizer, pesticide, and agricultural chemical industry—which grew 93% globally and 190% in Brazil between 2005 and 2015—has been accompanied by an increase in the consumption of ultra-processed foods, contributing not only to an increased prevalence of chronic diseases, but also climate change due to the emission of GHGs during the production and consumption processes⁵⁻⁷. In addition, excessive packaging resulting from high levels of consumption of these foods is particularly worrying because it makes up a significant part of urban waste, with plastic alone accounting for 20% of the volume of waste in tons^{8,9}.

Despite this problem, a recent study by Cunha *et al.*¹⁰ shows that packaging was not a major factor influencing consumer purchasing decisions. The review explored the main factors influencing food choices among different populations based on studies using the Food Choice Questionnaire (FCQ) developed by Steptoe *et al.*¹¹. The FCQ assesses nine food choice factors, one of which is *ethical concern*, which includes a specific question about food packaging. According to the review, ethical concern was ranked among the lowest scoring factors among the general population. A validation study conducted by Heitor *et al.*¹² that adapted the FCQ for use in Brazil using a sample of 86 students reported that more than half of the sample responded *not at all important* for two of the three items of the ethical concern factor.

There is little data on the views of health professionals on this topic. The only relevant study found, conducted by Sushma *et al.*¹³ with 159

dental students in India, showed that ethical concerns scored higher than *familiarity*, *convenience*, and *mood*. The differences between the findings of this study and Cunha *et al.*'s literature review¹⁰ suggest that food choices may also be influenced by profession and cultural factors.

The Ministry of Health's report "Inputs for Building a National Environmental Health Policy"¹⁴ clearly states that environmental health is a key aspect of health promotion and protection, given that an ecologically balanced environment is in consonance with the guiding principles of Brazil's national health system, such as comprehensiveness, universality, equity, and public participation.

Health professionals have the responsibility to understand the inextricable links between health and the environment and take a critical and reflexive stance towards modes of production, consumer capitalism, and the environmental and health problems facing humanity today¹⁵. Health professionals should act as scientific knowledge brokers, contributing to the adoption of healthy habits and behavior¹⁶.

Evidence has shown that nature connectedness, understood to be how people identify with the natural environment and the relationships they form with nature, is associated with pro-environmental behavior, reflecting more sustainable food choices^{17,18}. This connection is also linked to psychosocial aspects such as subjective well-being and human values¹⁹.

We were unable to find any studies on nature connectedness and/or motives for food choice involving health professionals²⁰. This article therefore presents the results of an unprecedented study that assessed these constructs and the association between them among a sample of primary healthcare professionals in Brazil.

Methods

Study design and sample

A cross-sectional study was conducted with health professionals working in primary healthcare (PHC) services in a municipality in the State of São Paulo. The municipality has an estimated population of 145,000 inhabitants, a Human Development Index of 0.8, 95.8% of households have adequate sewage disposal, and 25.8% of urban households are on public thoroughfares with adequate urban infrastructure (manholes, sidewalk/pavement, and curbs)²¹.

Sample size ($n = 135$) was calculated based on an estimate taken from a meta analysis performed by Capaldi et al.²², adopting a power of 0.8, type I error of 0.05, and significance level of 0.05 ($p < 0.05$). It is important to note that, given the lack of studies on the association between nature connectedness and food choices, the correlation between connectedness to nature and well-being – the object of interest of the wider project that gave rise to this study – was used as the basis for calculating sample size.

According to the data provided by the local health department, during the collection period, 362 health professionals were working in PHC services, distributed across 22 different facilities and belonging to 13 different professions: 46 community health agents, 99 nursing assistants, 31 nursing technicians, 35 nurses, 22 dental assistants, 25 dentists, 18 pharmacy technicians, 6 pharmacists, 3 psychologists, 2 physical therapists, 3 speech therapists, 4 nutritionists, and 68 doctors.

After calculating the minimum sample size (minimum $n = 135$), professionals working in primary care centers and the Family Health Strategy were randomly selected in numbers proportional to the overall number of professionals in each profession. Subsequently, we decided to include professionals working in the Family Health Support Center (*Núcleo de Apoio à Saúde da Família*- NASF), since they also belong to and perform activities in PHC services and were not initially encompassed. Since only a small number of staff were working in the NASF, all professionals were invited to participate in the study and those who accepted were included in the sample, resulting in a further two professions: social workers and physical educators. As a result, for some professions the number of professionals in the sample was proportionately higher than the overall number of members of that profession working in the municipality, particularly the nutritionists.

The final sample consisted of 146 professionals.

The only inclusion criterion was that the professional belonged to a PHC team working in the municipality.

Ethics

The study was approved by the relevant research ethics committee (June 07, 2017). All participants signed an informed consent form.

Data collection

Data was collected in July 2017.

The questionnaires and instructions for filling them in were handed to the professionals during a visit to the health facilities. Due to time restraints, the questionnaires were completed during the visit in only four facilities. In the rest of the facilities the questionnaires were collected back a week later.

Variables and data collection instruments

Exposure

Nature connectedness refers to how integrated and connected a person feels with nature from an affective and individual perspective. It was assessed using the Connectedness to Nature Scale (CNS), validated for use in Brazil by Pessoa et al.¹⁹. The scale contains 14 items responded on a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree), with a possible overall score of between 14 and 70, where the higher the score the greater the degree of connectedness.

The value for Cronbach's alpha coefficient obtained by the version validated for use in Brazil by Pessoa et al.¹⁹ was 0.82, while the value for the present study was 0.77.

Outcomes

We used the version of the FCQ¹¹ validated for use in Brazil by Heitor et al.¹². This self-administered instrument assesses nine factors influencing food choice: 1) health, 2) mood, 3) convenience, 4) sensory appeal, 5) natural content, 6) price, 7) weight control, 8) familiarity, and 9) ethical concern. Respondents are asked to endorse the statement "It is important to me that the food I eat on a typical day..." for each item within the nine factors by selecting one of the following responses: not at all important, a little important, moderately important, and very important, scored from 1 to 4.

Three outcome variables were selected from these nine factors to determine the association between nature connectedness and motives for food choice: factor 1 (health), with scores ranging from 6 to 25; factor 5 (natural content), with scores ranging from 3 to 12; and factor 9 (ethical concern), with scores ranging from 3 to 12. We selected these three factors over the others based on the literature, which shows that people with a stronger sense of connection to nature are more likely to make healthy (aspects considered

by factors 1 and 5 of the FCQ) and sustainable (assessed in some measure by factor 9) choices^{6,23}.

The value for Cronbach's alpha coefficient for the FCQ administered by in this study was 0.92, compared to values ranging between 0.70 and 0.87 for the original version developed by Steptoe *et al.*¹¹ and 0.75 and 0.89 for the version adapted by Heitor *et al.*¹².

Potential confounders

The following potential confounders were chosen: sex, age (< 35, 35-50, >50; ref= <35 years); degree (yes or no); length of service in the area of health (< 5, 5-10, > 10; ref = < 5 years); self-reported health (good, very good, fair, bad, very bad), and physical activity (yes or no).

Studies show that women are generally more concerned with health than men and that diet quality, which is associated with food choices, varies according to age and socioeconomic status^{24,25}. There is also evidence that physical activity influences healthy food choices²⁶. This information was obtained using a sociodemographic questionnaire, which was self-administered together with the CNS and FCQ.

Analysis

The data was tabulated and stored using Epi Info™ for Windows. Consistency analysis was performed followed by descriptive statistical analysis.

The association between nature connectedness and scoring for the three motives for food choice (factors 1, 5 and 9 from the FCQ) was determined using multiple linear regression with normal response, including the potential confounders and the covariables that showed an association with the outcomes in the univariate analysis ($p < 0.20$). The analyses were performed using SPSS® Statistics 21 and adopting a significance level of 0.05.

Results

Table 1 shows the number of professionals who participated in the study by profession.

The study sample was composed mainly of women (82.3%), whites (83.6%), people aged between 20 and 50 years (84.9%), people with a degree or post-graduate qualification (58.2%), people living in urban areas (96.6%), and peo-

ple who had been working in health for over five years (72.60%).

The overall average score for the CNS was 53.8 (SD 0.9), compared to 52 and 59 for the 1st and 2nd terciles, respectively. The average score per item was 3.84. The minimum and maximum scores obtained were 26 and 70, respectively (data not shown).

The average scores for each factor of the FCQ are shown in Table 2. The highest scoring factor was factor 4 (sensory appeal), with a weighted average score per item of 3.67, whereas the lowest scoring factor was factor 9 (ethical concern), with an average score per item of 2.60. Health and natural content were ranked third and fifth, respectively.

The following scores were found for the different factors: factor 1 (health) - minimum and maximum score of 6 and 24, respectively, median of 21 (1st quartile 18 and 3rd quartile 23), and interquartile range of 5; factor 5 (natural content) - minimum and maximum score of 3 and 12, respectively, median of 10 (1st quartile 8 and 3rd quartile 12), and interquartile range of 4; factor 9 (ethical concern) - minimum and maximum score of 3 and 12, respectively, median of 8 (1st quartile 6 and 3rd quartile 10), and interquartile range of 4 (data not shown).

A positive significant crude association was found between CNS score and the factors health ($p = 0.023$), natural content ($p = 0.002$), and ethical concern ($p < 0.001$) (data not shown).

Table 3 shows that CNS score was positively and significantly associated with factor 1 of the FCQ (health) ($p = 0.031$) in the analysis adjusted for the confounders sex, age, degree, length of service in the area of health, and self-reported health. The FCQ1 score increased an average of 0.07 points for each one point increase in the nature connectedness score. There was also a significant association between CNS score and factor 5 (natural content) of the FCQ. The FCQ5 score increased an average of 0.06 points for each one point increase in the nature connectedness score ($p = 0.001$) after adjusting for the confounders age and length of service in the area of health. CNS score was also significantly associated with factor 9 (ethical concern) after adjusting for age, education, and length of service in the area of health, showing an increase of 0.09 points for each one point increase in the nature connectedness score ($p < 0.001$).

Table 1. Number of professionals who participated in the study by profession.

Profession	Number	%
Community health agent	18	12.3
Dentist	2	6.2
Dental assistant	6	4.1
Doctor	33	15.1
Nurse	6	11.0
Nursing assistant	9	22.6
Nursing technician	2	8.2
Nutritionist	16	4.8
Pharmacist	3	2.1
Pharmacy assistant	1	4.1
Physical educator	5	1.4
Physical therapist	22	3.4
Psychologist	7	2.7
Social worker	4	1.4
Speech therapist	12	0.7
Total	146	100

Discussion

This study investigated the association between degree of nature connectedness, measured using the CNS, and the level of importance placed on three food choice factors that are important from a health and environmental point of view: health, natural content, and ethical concern. The study population was chosen because of the potential that health professionals have to assume a health education role^{15,16,27}. To the best of our knowledge, this is the first study at both national and international level to investigate this association among this population group²⁰.

The results show that the respondents showed weak low nature connectedness and ethical concern as a motive for food choice. However, we detected a positive association between nature connectedness and scoring for the factors health, natural content, and ethical concern of the FCQ. This suggests that increasing connectedness to

Table 2. Scores of the Food Choice Questionnaire.

Measure	Factors								
	F1 Health	F2 Mood	F3 Convenience	F4 Sensory appeal	F5 Natural content	F6 Price	F7 Weight control	F8 Familiarity	F9 Ethical concern
Average	20.08	18.75	16.59	14.70	9.75	10.07	9.25	8.39	7.82
per factor ±SD	±3.57	±5.01	±3.57	±2.06	±2.34	±1.92	±2.64	±2.63	±2.84
WA	3.35	3.12	3.32	3.67	3.25	3.36	3.08	2.80	2.61
±SD	±0.59	±0.83	±0.71	±0.51	±0.78	±0.64	±0.88	±0.88	±0.95

SD: standard deviation; WA: weighted average.

Table 3. Association between the connectedness to nature score and the factors health, natural content, and ethical concern of the Food Choice Questionnaire weighted for potential confounders.

CNS score	Health*	Natural content**	Ethical concern***
	β (95% CI); p	β (95% CI); p	β (95% CI); p
	0.07 (0.01 to 0.13); 0.031	0.06 (0.03 to 0.10); 0.001	0.09 (0.04 to 0.14); < 0.001

*Adjusted for sex, age, education, length of service in the area of health, and self-reported health. **Adjusted for age and length of service in the area of health. ***Adjusted for age, education, and length of service in the area of health.

nature may be one way of increasing the possibility that health professionals assume a leading role in environmental and food and nutrition education directed at service users, as proposed by the report “Inputs for Building a National Environmental Health Policy” prepared by Ministry of Health, Pan American Health Organization, Brazilian Public Health Association, and National Health Council¹⁴.

To assess these complex constructs, we used scales developed by renowned researchers^{11,28} translated for use in Brazil^{12,19} to ensure the validity of the results summarized above and provide the basis for further research in this area at national and international level²⁰. One of the limitations of this study is that some of the professionals completed the questionnaires in the presence of a researcher, immediately after signing the informed consent form, while others, due to time restraints, filled in the questionnaire at home, returning them later. In addition, part of the sample was selected using convenience sampling. Furthermore, the size of the sample may be considered small to test the association of interest, meaning that type II error may be > 0.20 . It is therefore recommended that future studies use larger samples and standardize data collection.

The average score per item (3.84) for the CNS was similar to that reported by Rosa *et al.*²⁹ in a study with 224 Brazilian students doing different courses at a university in the Northeast Region (3.83), and slightly higher than studies with 322 French students (3.33)³⁰ and 324 Canadian students (3.28)³¹. However, it is considerably lower than that of a study undertaken in Sweden with 1,320 supermarket customers using a shortened version of the CNS (4.92)²³. Despite reduced comparability due to the use of a shortened version of the scale, the studies mentioned above suggest that cultural factors may influence degree of nature connectedness.

It is important to highlight that the least important motive to health professionals was ethical concern, with low scores for the items “*Comes from countries where I approve of the way food is produced*”; “*Has the country of origin clearly marked*”; “*Is packaged in an environmentally friendly way*”. The scores did not differ from those of the general population, who do not place much importance on these factors as motives for food choice¹⁰.

Furthermore, the respondents did not place much value on whether or not the foods contained chemical additives or artificial ingredients, with the factor natural content— with the items

“*Contains no additives*”, “*Contains natural ingredients*”, and “*Contains no artificial ingredients*”—ranked fifth.

Comparisons of our findings with those of other studies suggest that both motives for food choice and nature connectedness are influenced by cultural factors. In this regard, a study with 165 women in Japan³² reported that ethical concern was ranked fourth, while studies in Italy ($n = 163$)³³, Poland ($n = 1,045$)³³, and Taiwan ($n = 263$)³² showed that the most important factor was natural content.

These findings draw us to the Ministry of Health guide Dietary Guidelines for the Brazilian Population³⁴, which exhaustively warns of the risks of the excessive consumption of food additives, which are particularly common in ultra-processed foods. A growing number of studies have investigated the potential harmful effects of additives on our health, with evidence pointing to an association between abusive consumption of these substance and rhinitis and allergies (mainly color additives), child behavior problems (hyperactivity), intestinal inflammation and dysbiosis (emulsifiers and sweeteners), and metabolic syndrome^{35,36}.

We did not find any studies in the literature that investigated nature connectedness in relation to motives for food choice. However, a study with 31,842 adults from the NutriNet-Santé cohort investigating the relationship between motives for food choice and diet quality showed that individuals who had a healthy diet were more likely to be concerned with ethics and the environment, local production of food, health, and absence of contaminants³⁷.

Based on the findings of our study and the recommendations of the Ministry of Health¹⁴ and Dietary Guidelines for the Brazilian Population³⁴, we might question whether these professionals are prepared and motivated to act as health promoters and raise awareness among service users of the importance of healthy and sustainable eating. It is possible that their education and training did not have an adequate focus on healthy eating and environmental education capable of encouraging the adoption of new habits and attitudes. It is also possible that they have little contact with natural environments such as parks, forests, and waterfalls, which can help promote greater nature connectedness and pro-environmental behavior¹ and provide physical and mental health benefits³⁸.

It therefore seems important to think/rethink environmental education on healthcare courses

at undergraduate level in Brazil and in continuing education and training programs. More attention needs to be paid to environmental education for health professionals, both in everyday practice and during undergraduate training, particularly for those who work in primary health-care and have the responsibility to transmit this knowledge to service users^{15,27}.

Discussing the importance of the role of the health sector in tackling climate change, McMichael et al.³⁹ propose that professionals should encourage people to rethink their food choices, favoring production practices that do not pose health risks. Walpole et al.⁴⁰ highlight the need to include content on environmental issues in medical curriculums to prepare future health professionals and equip them with the appropriate tools to take the lead in developing positive attitudes towards environmental sustainability.

In short, our results show that the health professionals who participated in this study are not equipped to act as promoters of environmental health. It is necessary to develop health professionals' knowledge of the environment as a key

determinant of health and disease to help guide them, and consequently their patients, towards healthy and sustainable choices.

We believe that activities and projects aimed at facilitating contact with nature, such as walks in the park and other green spaces and nature trails, along the lines of forest therapy model developed in Japan, could help increase nature connectedness among health professionals and, consequently, promote pro-environmental behavior^{1,38}.

Conclusion

Respondents showed little nature connectedness and ethical concern was ranked last out of the nine motives for food choice. The factors that most influenced food choice were sensory appeal and price. Nevertheless, a positive association was found between degree of nature connectedness and scoring for the factors health, natural content, and ethical concern.

Collaborations

VHT Bruno - Responsible for research (Master's Project). Participated in all phases of the research (submission of the project to the Ethics Committee, data collection, tabulation, analysis of results) and writing of the manuscript. IS Beteto - Participated in the study design, data collection and manuscript review. PHL Habimorad and FM Catarucci - Participated in the study design, analysis of the results and review of the manuscript. HRC Nunes - Participated in the study design, responsible for the statistical analysis and revision of the manuscript. KP Patrício - Participated in the study design, analysis of results, revision of the manuscript and was the project advisor. MABL Carvalhães - Participated in the statistical analysis and the analysis of the results, participated in the original writing and revision of the manuscript.

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