INFLUENCE OF BIODYNAMIC NUTRITION ON IMMUNOLOGICAL PARAMETERS AND WELL-BEING OF POSTMENOPAUSAL WOMEN ("CONVENT-STUDY")

Fuchs, N. (1), Huber, K. (2), Hennig, J. (3) and Dlugosch, G. (4)
(1) Agriculture Section, Goetheanum School of Spiritual Science, Dornach, Switzerland, nikolai.fuchs@goetheanum.ch
(2) Research Circle for Biodynamic Agriculture, Darmstadt, Germany, kw_huber@hotmail.com
(3) Department of Psychology, University of Gießen, Germany
(4) Centre for Empirical Pedagogical Research, University of Koblenz-Landau, Germany

INTRODUCTION

The effect that organic and biodynamic foodstuffs have on the health and well-being of humans is an important consideration when evaluating organic and biodynamic farming. Numerous advantages have been shown for individual components, particularly antioxidants, vitamins, functional fatty acids and trace elements (Carbonaro et al., 2002; Kraft et al., 2003). Very few studies have been done on the overall effect of an organic diet on humans (Woese et al., 1997; Biao et al., 2003). One of the reasons for this is that it is difficult to carry out blind intervention studies on humans that investigate not one nutrient, but an entire diet. The findings of animal studies have been clear. Food selection studies have shown that rats prefer organic food when they are offered both organic and conventional food (Velimirov, 2001). Furthermore, doe rabbits fed biodynamic food (Staiger, 1991) and rats fed organic food (Velimirov et al., 1992) had markedly better fertility rates compared to control groups fed conventional food. The present study was conducted in a convent with volunteer subject nuns. This was done to achieve a small variance in lifestyle and environmental conditions, which otherwise, given a relatively small sample size, would have been nearly impossible, and to have the most control over what was eaten.

METHODS

Sample:
The participants in the study were 17 sisters belonging to a religious order, all post-menopausal and aged between 59 and 80 (M = 69.4). Participation was voluntary and no financial incentives were offered. When questioned, 53% responded that they were participating out of personal interest, while 47% were motivated by external factors.

Study design:
The study was conducted in a convent over a period of eight weeks. To the extent possible, the existing menu was retained, but the origin of the food changed. First there was a two-week adjustment period, during which the frozen, ready-made meals usually on the menu were replaced by freshly prepared dishes (using conventional products). Following this was a four-week period during which the menu consisted of foods produced and processed according to organic methods. All told, 85% of the foods used were products of biodynamic farming. For the final two weeks, there was another phase of freshly prepared conventional food. The sisters were asked to complete a daily food diary and a fortnightly questionnaire (five times) on their well-being. Over the course of the study period, the participants observed any changes in their weight. All the sisters, without exception, took part in the communal meals unless they were away from the convent, for example at a meeting. In such instances, they were given a packed meal prepared using the type of food corresponding to the given phase. In addition, a follow-up survey was conducted four weeks after completion of the study.

Recording the quantity of food consumed:
The foods consumed and quantities of food consumed were recorded in a food diary. As the participants' meals were provided on a communal basis, the menus could be used to list the served foods and dishes with the portion type and size in the diaries in advance, so the participants could just put a mark next to the amounts consumed. Any other meals consumed were recorded separately. The various recipes and portion sizes were recorded every day. The food diaries were analysed using EBIS software for Windows 95 and Windows NT.

Questionnaire on well-being:
The survey was conducted using a questionnaire ("Questionnaire on the effects of food on well-being") devised specifically for this study by the Centre for Empirical Pedagogical Research, ZepF (Zentrum für empirische pädagogische Forschung). Six slightly modified versions of the questionnaire were used for the different test times. The questionnaire consisted of standardized methods for recording psychological well-being (Steyer et al., 1995) and any physical complaints (Dlugosch and Krieger,

2000), along with scales devised specifically to suit the issues under investigation. The scales were tested for reliability wherever possible and reasonable, and proved sufficiently reliable.

Statistical analysis:
In order to test the issues forming the focus of the study, a variance analysis was carried out for each of the independent variables (perception of well-being, eating behaviour, and immunological parameters) with repeated measurements, using the statistics software SPSS11®. The potential effects of subjects' expectations were also included as covariants to check for non-specific expectation effects. Statistical significance was accepted at an error probability of <.05. In addition, T-tests for dependent samples were performed to obtain values for total caloric intake and for the principal components (protein, fat and carbohydrates) averaged across the phases of conventional and biodynamic foods.

RESULTS

Eating behaviour
Although the meals prepared during both of the periods under comparison followed exactly the same menu, the mean daily caloric intake during the period when biodynamic food was provided was lower than during the period of "adapted" conventional food. This was due to a significantly lower intake of protein ($T = -5.18$; $df = 1$, $p < .001$) and carbohydrates ($T = -4.74$; $df = 1$, $p < .01$). The decrease in protein intake was largely due to reduced consumption of animal protein, i.e., less meat and dairy produce. As regards the intake of plant-derived proteins, in contrast, no difference could be discerned between the biodynamic and conventional phases. Fat consumption remained unchanged ($T = .94$; $df = 1$, p = n.s.), while intake of fibre increased.

Physiological parameters
During the biodynamic phase and the subsequent conventional phase CD4+ cells were noticeably reduced ($P<0.01$) and the natural killer cells increased, the latter only in those people who had expressed a positive expectation in relation to the improvement of their immune status at the beginning of the study. Blood pressure values fell to an equally significant degree in the biodynamic phase and the subsequent conventional phase (Fig. 1; $P<0.01$).

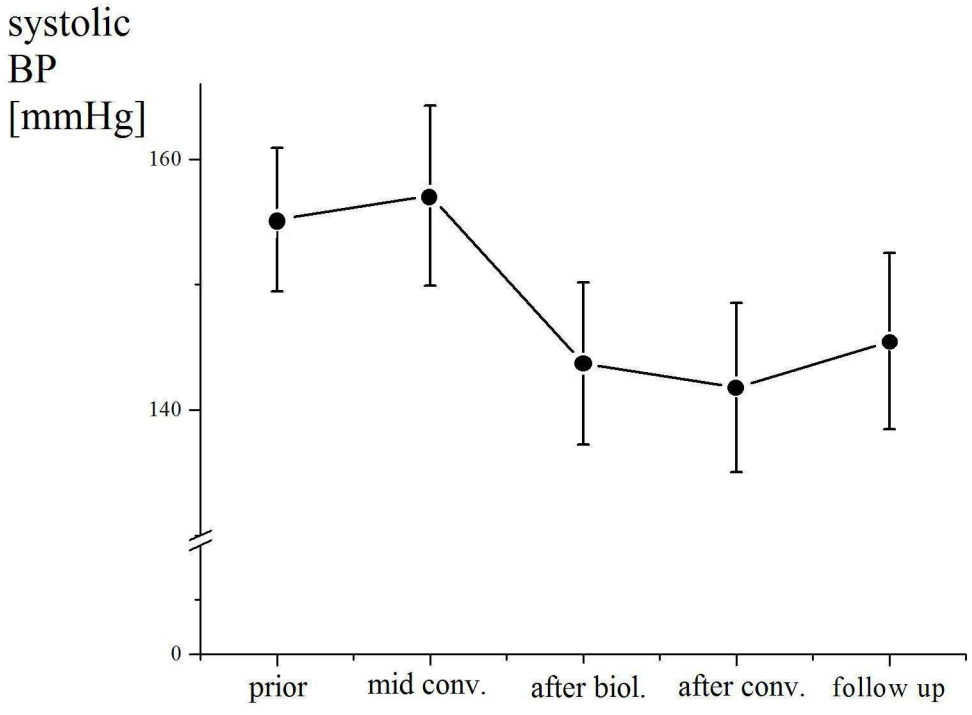

Figure 1. Systolic blood pressure of probands in dependence on the different experimental periods

Changes in well-being
During the change in diet, the participants' physical fitness and their general ability to cope with exertion was statistically highly significant. The highest value was shown in the biodynamic phase and the lowest was in the follow-up phase. The curves representing the sisters' perception of their

psychological well-being (Fig. 2) followed the same curve, so we can assume that a general psychotropic effect was produced by the change in diet.

The subjects' weight remained constant throughout the investigation period, regardless of whether they had hoped to lose weight during the change in diet. During the biodynamic phase, the participants noted frequently in the questionnaires that they had particularly enjoyed their meal.

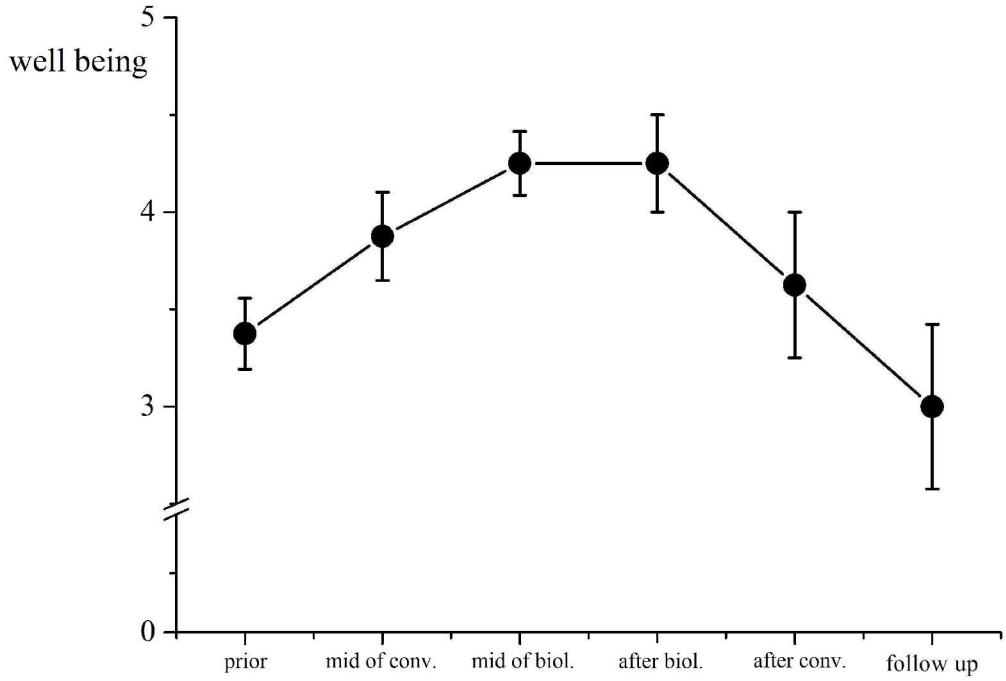

Figure 2. Subjectively evaluated well-being of probands in dependence on the different experimental periods

DISCUSSION

The change in diet from conventional to biodynamic foods resulted in a change in the eating preferences of the survey subjects. They consumed smaller quantities of animal protein and carbohydrates, and as a result their overall energy intake was lower. At the same time, as a result of higher consumption of wholemeal products their dietary fibre intake increased, which has a satiating effect. This is congruent with the observation that households converting to organic products as a rule tend to choose different products compared to conventional households. Most notably, they consume less meat, and fewer sweets and alcoholic beverages (Brombacher, 1992). The increase in the subject nuns' dietary fibre intake may be regarded as positive. Dietary fibre derived from cereals has great potential for reducing existing constipation, and in the case of older people a higher dietary fibre intake reduces the risk of coronary artery disease (Watzl and Leitzmann, 1986). Moreover, a diet that is higher in dietary fibre strengthens the intestinal walls, including the immune structures located there (Penn et al., 1991).

Some of the observed physiological effects of the biodynamic diet were linked to the subjects' psychological expectations. The fact that this context could be recorded and depicted is more of a validation of the study's unblinded design than it is a repudiation of it. For those who follow an organic diet, which is predicated on a certain type of awareness, one needs to assume such a psychosomatic predisposition, which, considered objectively, contributes to the overall effect of an organic diet (Köpke, 2005).

The changes in physical and psychological well-being over the course of the study are worth noting. The relevant parameters improve during the biodynamic phase, and then fall below the pre-survey values after the study. Alongside the effects of the food, the latter phenomenon may also be partly due to a non-specific effect arising from a reduction in the care and attention focused on the subjects. On

the other hand, the withdrawal of an established diet of biodynamic food may bring about a more pronounced deterioration in mood than the enhancement of mood associated with the introduction of such a diet. The fact that the taste enjoyment experienced during the study ceased may have been one reason for this. The cultural and ethical associations of organically grown foods can account for a large degree of the subjective well-being caused by eating these foods (Köpke, 2005) and could have therefore contributed to the effects described here, in the form of an experience of heightened consciousness.

CONCLUSION

Irrespective of whether the results obtained were brought about by the biodynamic food itself or by the modification in eating preferences induced by this food, or both, we can conclude that for older people, switching to organic food leads to improvements in physical and psychological well-being, lower blood pressure and an immune status indicative of lower stress levels.

REFERENCES

Biao, X., Xiaorong, W., Zhuhong, D. & Yaping, Y. (2003) 'Critical Impact Assessment of Organic Agriculture', Journal of Agricultural and Environmental Ethics 16: 297–311.

Brombacher,J. (1992) Ökonomische Analyse des Einkaufsverhaltens bei einer Ernährung mit Produkten des ökologischen Landbaus. Schriftenreihe des Bundesministeriums für Ernährung, Landwirtschaft und Forsten, Reihe A, Angewandte Wissenschaft 406, Landwirtschaftsverlag, Münster .

Carbonaro, M., Mattera, M., Nicoli, S., Bergamo, P. & Cappelloni, M. (2002) 'Modulation of Antioxidant Compounds in Organic vs Conventional Fruit (Peach, Prunus persica L., and Pear, Pyrus communis L.)', Journal of Agricultural and Food Chemistry 50: 5458-5462

Dlugosch, G.E.; Krieger, W. (1995) 'Der Fragebogen zur Erfassung des Gesundheitsverhaltens (FEG)', Frankfurt, Swets Test Gesellschaft (1995).

Köpke, U. (2005) 'Organic Foods: Do they have a Role?', In: Elmadfa, I. (Ed.) (2005) Diet Diversification and Health Promotion. Forum for Nutrition, Basel vol. 57: 62-72.

Kraft, J., Collomb, M., Möckel, P., Sieber, R. & Jahreis, G., (2003) 'Differences in CLA isomer distribution of cow's milk lipids', Lipids 38: 657-664.

Penn, M.D., Purkins, L.; Kelleher, J.; Heatley, R.V.; Mascie-Taylor, B.H.; Belfield, P.W. (1991) 'The effect of dietary supplementation with vitamins A, C, and E on cell-mediated immunity function in elderly long-stay patients: A randomized controlled trial', Age and Aging 20: 169-174.

Pöert , W. und Löhlein, I. (1995) Praktische Umsetzung von Ernährungsempfehlungen,. In: Biesalski, H.-K.; Fürst, P.; Kaspar, H; Kluthe, R.; Pölert, W.; Puchstein, C.; Staehelin, H.B. (Eds.) (1995) Ernährungsmedizin. Georg Thieme Verlag: 464-473 .

Staiger D. (1991) 'Möglichkeiten und grenzen zur Erfassung der ernährungsphysiologischen Qualität'. In: Meier-Ploeger und Vogtmann (eds.) (1991) Lebensmittelqualität, Ganzheitliche Methoden und Konzepte 66, 251 ff.

Steyer, R.; Schwenkmetzger, P.; Notz, P. Eid, M. (1995) 'Testtheoretische des Mehrdimensionalen Befindlichkeitsfragebogens (MDBF)', Diagnostica: 40: 320-328

Velimirov, A. (2001): Ratten bevorzugen Biofutter, Ökologie und Landbau 117, 1, 19-21.

Velimirov, A., Plochberger, K., Huspeka, U. & Schott, W. (1992) 'The Influence of Biologically and Conventionally cultivated Food on the Fertility of Rats', Biological Agriculture and Horticulture 8: 325-337.

Watzl, B.; Leitzmann, C.: 'Einfluß der Vollwert-Ernährung auf Immunantwort und Infektabwehr', Der Vegetarier 4/87, 146-152.

Woese, K., Lange, D., Boess, C. & Werner, K. (1997) 'A Comparison of Organically and Conventionally Grown Foods. Results of a Review of the Relevant Literature', Journal of the Science of Food and Agriculture 74: 281-293.