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Trabajo Original

Otros

Changes in dietary habits of patients with chronic pain represent contributing factors to decreased pain intensity and improved quality of life. Pilot study from Croatia

Los cambios en los hábitos alimenticios de los pacientes con dolor crónico representan factores que contribuyen a la disminución de la intensidad del dolor y a una mejor calidad de vida. Estudio piloto de Croacia

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Abstract

Introduction: chronic pain is a complex entity with immense individual and societal burden.

Objectives: to assess the effectiveness of specifically designed nutrition education for the management of chronic pain and whether any change in dietary habits contribute to decrease in pain intensity.

Objectives and methods: 40 patients were enrolled in the 4-week intervention study. Patients filled-in questionaires regarding their basic characteristics, pain intensity, quality of life, and dietary habits at baseline and post-intervention. Intervention consisted of 1 individual and 2 group counselings based on the nutrition education specifically designed for the chronic pain management.

Results: post-intervention, pain intensity decreased in 67.5 % of patients while quality of life improved significantly (from 42.9 ± 31.3 to 70.1 ± 26.2 points, p = 0.015). All patients responded to nutrition education by increasing the number of meals per day (p < 0.001), improving regularity of breakfast (p = 0.005) and by less frequently skipping meals (p = 0.027). Fewer meal skipping (OR = 0.037, 95 % CI (0.003-0.482), p = 0.012) and lower consumption of foods with negative effect on chronic pain (OR = 0.008, 95 % CI (0.000-0.444), p = 0.019) were found to modestly, but independently contribute to decrease in pain intensity. Still, patients with higher BMI and several diagnoses had low response.

Conclusions: the developed nutrition education is fit for the management of chronic pain. The main benefits are improved meal consumption pattern along with reduced consumption of foods with pro-inflammatory effect and food cravings. The complexity of chronic pain is obvious in low responsiveness among patients with higher BMI and several conditions.

Keywords:

Chronic pain. Nutrition education. Education development. Pain intensity. Dietary recommendations. Quality of life.

Resumen

Introducción: el dolor crónico es una entidad compleja con una inmensa carga individual y social.

Objetivo: verificar si la educación nutricional diseñada específicamente para el tratamiento del dolor crónico y si algún cambio en los hábitos alimenticios contribuyen a disminuir la intensidad del dolor.

Material y métodos: se incluyeron 40 pacientes en el estudio observacional intervencionista de 4 semanas. Los pacientes completaron cuestionarios sobre las características básicas: la intensidad del dolor, la calidad de vida y los hábitos alimenticios al inicio y después de la intervención. La intervención consistió en 1 asesoramiento individual y 2 grupales basados en la educación nutricional diseñada específicamente para el tratamiento del dolor crónico.

Resultados: después de la intervención, la intensidad del dolor disminuyó en el 67,5 % de los pacientes al tiempo que mejoró significativamente la calidad de vida (de 42,9 ± 31,3 a 70,1 ± 26,2 puntos, p = 0,015). Todos los pacientes respondieron a la educación nutricional: aumentaron el número de comidas por día (p < 0,001), mejoraron la regularidad del desayuno (p = 0,005) y omitieron las comidas con menos frecuencia (p = 0,027). Menos saltos de comida (OR = 0,037, IC 95 % [0,003-0.482], p = 0,012) y menor consumo de alimentos con efecto negativo sobre el dolor crónico (OR = 0,008, IC 95 % [0,000-0,444], p = 0.019) se encontraron que modestamente, pero, de formma independiente, contribuyen a disminuir la intensidad del dolor. Sin embargo, los pacientes con mayor BMI y varios diagnósticos tuvieron baja resonancia.

Conclusión: la educación nutricional desarrollada es adecuada para el manejo del dolor crónico. Los mejores beneficios son un patrón mejorado de consumo de comida junto a un consumo reducido de alimentos con efecto proinflamatorio y antojos de alimentos. La complejidad del dolor crónico es visible en baja respuesta entre pacientes con mayor BMI y varios diagnósticos.

Palabras clave:

Dolor crónico. Educación nutricional. Desarrollo de la educación. Intensidad del dolor. Recomendaciones dietéticas. Calidad de vida.

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INTRODUCTION

Chronic pain is defined as a long-term pain lasting 3-6 months after the damage healing period, and is described as continuous or recurrent. European Pain Federation (EFIC) in its Declaration on Pain (2001) (1) identifies chronic pain, unlike acute pain, as a distinct health issue, which has an immense financial impact on healthcare systems around the world. Every fifth person in Europe suffers from chronic pain syndromes. The annual healthcare cost for back pain only was estimated to £13.44 billion in Germany and £1 billion for the UK. Loss of productivity due to chronic pain is estimated at about US$7.1 billion and 1 million of sick leave per year (data for Denmark) (2).

Chronic pain alters all aspects of patient's life inducing severe physical, psychological and social impairments, increases consumption of opiates and analgesics, and finally significantly deteriorates individual's quality of life, which is even lower than of patients hospitalised after ischemic stroke (2). Some of the typical chronic pain conditions are osteoarthritis, neuropathic pain, rheumatoid arthritis, diabetic neuropathy, and cancer pain (1).

Modern medicine still has no efficient treatment to deal with chronic pain. Current recommendations are on self-management and emphasize the need for an individual approach in which, a patient is taking an active role. The role of nutrition education in the self-management of pain is ambiguous. Patients learn the importance of regular consumption of nutritionally valuable meals, the connection between hunger and pain perception, obesity and pain intensity, but also how to organize their daily life. Obesity is a well-known aggravating factor for various underlying conditions in chronic pain, and as such requires nutritional attention (3-6). Standard cognitive-behavioural treatment of chronic pain did not yield comparable outcomes for obese and non-obese patients, therefore, individual modifications are required for every Body Mass Index (BMI) category (7-9).

Pain is characterized with the presence of variety of inflammatory cytokines (10), so adding foods and nutrients with anti-inflammatory properties can be useful (11). Education strategies include optimization of the diet to ensure adequate intake of macronutrients, encourage introduction of foods with anti-inflammatory properties (like green leafy vegetables, fatty fish, olive oil, nuts, fruits) while simultaneously restricting the consumption of foods rich in saturated fats and easily digestible carbohydrates (e.g. fast food, sweetened beverages, etc.) (12-16).

The aim of this pilot study was to assess suitability and effectiveness of a specifically designed nutrition education for the management of chronic pain. Also, the aim was to analyse whether change in dietary habits correlates with pain intensity.

METHODS

SUBJECTS

This interventional pilot study was conducted on patients with chronic pain referred to the Department of Anesthesiology, Resuscitation and Intensive Care of the University Hospital Osijek, Croatia. This is the first programme of this kind in Croatia, active since 2003. Nutrition education has been integral part of the multidisciplinary programme since 2016. The team comprise anaesthesiologist, nurse, physiotherapist, endocrinologist, nutritionist, occupational therapist, psychologist, and psychiatrist. They are conducting a series of educations focused on self-management of the pain, both pharmacological and non-pharmacological. Despite being recognized as important, nutrition is rarely integrated into programs for the management of chronic pain, even on an international scale (17,18).

Patients were referred to the Department by primary care physicians, and then enrolled into groups by anaesthesiologists. In groups of 10, patients during 4 weeks go through a series of group and individual educations and therapies.This population is a heterogeneous group of chronic pain patients with different localisations of pain, such as low back pain, neck pain, shoulder pain, fibromyalgia, different forms of headache, and neuropathic pain syndrome. Only patients with a long history (at least 5 years) of chronic pain unresponsive to various treatments are eligible for the programme.

PAIN QUESTIONNAIRE

At the initial assessment, patients were given pain*DETECT* questionnaire (PD-Q) as an easy-to-use and reliable screening tool that can determine the prevalence of neuropathic pain components. PD-Q is used worldwide, to establish neuropathic pain component on patients with lower back pain, rheumatoid arthritis and osteoarthritis, thoracotomy, tumour diseases, fibromyalgia, diverse musculoskeletal conditions and other conditions (19,20).

QUESTIONNAIRE ON BASIC, SOCIOECONOMIC AND DIAGNOSIS-RELATED CHARACTERISTICS AND DIET

Basic information, nutrition and lifestyle habits, along with self-perception of the quality of life were assessed with a study-specific questionnaire. The first part of the questionnaire included questions about general and demographic characteristics, e.g. age, gender, body mass, body weight, education, monthly income per person, etc. On the basis of self-reported body mass and height patients' BMI was calculated and they were categorized according to their state of nourishment (21).

The second part of the questionnaire included questions about the diagnosis, course of the disease and the treatment (e.g. use of medications). Additional two questions in a form of a visual-analogue scale (VAS method) were used to assess patients' subjective opinion on how much does the pain they are experiencing influences their 1) psychophysical condition and 2) the quality of life. Patients were asked to place a vertical line on the scale (100 mm long). Marked place on the scale was measured with a

ruler, counted and transformed to a score. The score range was 0 to 100 for each item. Higher score reflects better condition. VAS is a widely used instrument for the assessment of complex measures, including pain (22).

The third part included questions about lifestyle and dietary habits, i.e. number of meals per day, breakfast consumption, physical activity, frequency of alcohol, coffee and tobacco consumption. The last part of the questionnaire assessed consumption frequency of 27 foods/food groups on a weekly basis. The list of foods was prepared based on the literature search, so that foods or food groups with documented positive or negative effect on chronic pain were included in the list (12-16,23,24). Each consumption corresponds to a certain number of points and higher number of points corresponds to higher consumption of particular food/food group. Offered categories and corresponding points were: 2 or more times per day (2 points), once per day (1 point), up to 5 times per week (0.71 point), 1 to 2 times per week (0.21) and rarely/never (0 points). The list of foods was divided into foods with positive (e.g. olive oil, cruciferous vegetables) and negative (e.g. foods with high content of added sugars, food sources of saturated fats) effect on chronic pain (12-16,23,24). Based on the change in scores pre- and post-intervention patient's diet was rated as improved (higher score for positive, lower score for negative characteristics) or unchanged/worse (all other score combinations).

NUTRITION EDUCATION INTERVENTION

We designed specific nutrition education for the management of chronic pain. Principles of the Medditeranean are the basis of the education, with special emphasis on regular consumption of meals to avoid hypoglycaemia. Besides explain the role of meal skipping, overeating, and obesity as pain amplifiers, patients are counselled on specific techniques on how to introduce foods with proven anti-inflammatory properties (olive oil, nuts, fish, green leafy vegetables, etc.) in their daily diet. Food cravings (for foods rich in saturated fats and simple carbohydrates) are explained from the aspect of pain management, and patients are introduced to potential substitutes.

During the 4-week programme every patient went through one individual and two group sessions with the nutritionist. Individual counselling was partially adapted to individual needs of the patient, based on their BMI, food preferences and lifestyle (e.g. impaired mobility).

At the end of the 4-week programme, at the final, wrap-up session, patients were given the same questionnaires to assess the effectiveness of the programme.

The study was approved by the Ethical Committee of the University Hospital Osijek and served as the pilot for the registered randomized clinical trial (NCT03837080). The analysis was performed on four groups of patients who received nutrition education (from February until June 2017), 40 patients altogether. Signed informed consent was obtained from all patients.

STATISTICAL ANALYSIS

Normality of data distribution was tested by the non-parametric Kolmogorov-Smirnov test for the comparison of medians and arithmetic mean, and histograms plotting. For the comparison of categorical data within and between groups Fishers exact test was used, and Pearson's test of correlations was used to calculate correlations between numerical data. T-test for independent samples was used to test differences between groups according to change in pain scores.

By an inferential statistics the association of a number of independent variables with change in pain scores as a binary dependent variable was tested with a univariate logistic regression. Independent variables tested were: age, BMI, number of diagnosis, number of meals per day, consumption of breakfast, meal skipping, and the change in consumption of foods with positive and negative effect on chronic pain. Independent factors that were found significant in a univariate logistic regression were included in the multiple logistic regression model. If the probability of alpha error was less than 0.05 we considered the relationship significant. Software tool Statistica 13.3 (StatSoft Tulsa, Oklahoma, USA) was used for the statistical analysis.

RESULTS

Total of 40 patients completed the questionnaire. The average age of patients was 60.4 ± 9.1 years (36 to 88 years), 15.0 % males (n = 6) and 85.0 % females (n = 34). After the 4-week programme, according to the change in painDETECT scores pre- and post-intervention, the pain decreased in 27 patients (67.5 %), in 3 patients (7.5 %) there was no change in pain and for the remaining 10 patients (25.0 %) the pain worsened (Table I). No significant difference was found for age, BMI or the number of diagnosis between these two groups of patients (Table I).

Patients self-assessed the number of meals per day, frequency of breakfast and dinner consumption, and tendency to skip meals and overeat before and after the education (Table II). Consumption of dinner is the only dietary characteristic that did not change after the intervention. Patients increased the number of meals per day, introduced breakfast, and significantly reduced meal skipping and overeating (Table II). After the intervention, total of 11 patients improved their diet (10 patients with reduced pain, 1 with worse pain score).

While the overall self-assessed psychosocial condition improved ($p = 0.044$), separate analysis did not show improvement post-intervention in either group (Table III). Similarly, the overall self-assessed quality of life improved ($p = 0.015$) but the patients whose pain reduced post-intervention reported striking improvement; from 42.9 points to 70.1 points ($p = 0.002$) (Table III).

Patients whose pain worsened or did not change after the intervention had higher BMI at baseline and had more diagnosis (Table I). Still, they seem to responded well on the nutrition education.

Table I. Baseline characteristics of the patients, total and depending on the change in the pain score after the intervention

	Total n = 40 n (%)	Reduced pain n = 27 n (%)	No change/worse n = 13 n (%)
Age (years)*	60.4 ± 9.1	59.6 ± 9.5	62.2 ± 8.4
Male	6 (15.0)	4 (14.8)	2 (15.4)
Female	34 (85.0)	23 (85.2)	11 (84.6)
BMI (kgm^{-2})*	26.6 ± 4.5	28.0 ± 4.4	29.9 ± 4.8
Normal	11 (27.5)	7 (25.9)	4 (30.8)
Overweight	14 (35.0)	12 (44.4)	2 (15.4)
Obese	15 (37.5)	8 (29.7)	7 (53.8)
Number of diagnosis)*	2.80 ± 1.36	2.78 ± 1.45	2.85 ± 1.21
One	6 (15.0)	4 (14.8)	2 (15.3)
Two	13 (32.5)	10 (37.0)	3 (23.1)
Three	11 (27.5)	7 (25.9)	4 (30.8)
Four or more	10 (25.0)	6 (22.3)	4 (30.8)

**Results are given as average ± standard deviation (SD).*

Table II. Patients' dietary habits related to meal consumption before and after the 4-week intervention (n = 40)

Dietary habits		Before intervention		Post intervention		p*
		n	%	n	%	
Meals per day	≥ 5	3	7.5	3	7.5	< 0.001
	3 to 5	6	15	18	45	
	2 to 3	26	65	10	25	
	1 to 2	5	12.5	1	2.5	
Breakfast	Every day	20	50	25	62.5	0.005
	Up to 5 times/week	3	7.5	3	7.5	
	1 to 2 times/week	11	27	2	5	
	Never	6	15	2	5	
Meal skipping	Always	14	35	2	5	*0.027*
	Sometimes	13	32.5	12	30	
	Never	12	30	18	45	
Overeating	Always	2	5	1	2.5	*0.006*
	Sometimes	31	77.5	13	32.5	
	Never	6	15	17	42.5	

**Fisher's exact test.*

Table III. Patients' self-assessed psychosocial condition and quality of life, total and depending on the change of the pain score after the intervention

	Total n = 40		p*	Reduced pain n = 27		p*	No change/worse n = 13		p*
	Before	Post		Before	Post		Before	Post	
Psychophysical condition	50.2 ± 34.1	51.5 ± 33.0	*0.044*	52.6 ± 34.5	54.0 ± 34.4	0.886	45.6 ± 34.4	45.4 ± 30.3	0.993
Quality of life	48.4 ± 30.3	65.4 ± 26.5	*0.015*	42.9 ± 31.3	70.1 ± 26.2	*0.002*	59.0 ± 26.2	53.4 ± 24.6	0.622

t-test for independent variables, statistically significant change post-intervention are given in italic.

Table IV. Odds ratio for pain score change in relation to meal skipping and the abundance of negative dietary characteristics after the intervention in patients with chronic pan (n= 40) (univariate logistic regression)

Factor	Odds ratio (OR)	95 % Confidence interval for OR		p
		Lower	Upper	
Age (years)	0.968	0.896	1.045	0.404
BMI (kgm^{-2})	0.908	0.780	1.057	0.213
Number of diagnosis	0.963	0.591	1.570	0.880
Meals/day	1.735	0.732	4.114	0.211
Breakfast (days/week)	1.159	0.827	1.625	0.392
Meal skipping (never = 1; frequently = 2; always = 3)	0.101	0.019	0.554	*0.008*
Positive dietary characteristics (worse = 0; improved = 1)	2.437	0.522	11.387	0.257
Negative dietary characteristics (worse = 0; improved = 1)	0.035	0.003	0.345	*0.004*

Table V. Odds ratios for pain score change in relation to meal skipping and the abundance of negative dietary characteristics after the intervention in patients with chronic pan (n = 40) (multiple logistic regression)

Factor	Odds ratio (OR)	95 % Confidence interval for OR		p
		Lower	Upper	
Meal skipping (never = 1; frequently = 2; always = 3)	0.037	0.003	0.482	*0.012*
Negative dietary characteristics (worse = 0; improved = 1)	0.008	0.000	0.444	*0.019*
Constant	9.126			0.007

Strong positive correlation was found between the number of diagnosis and the consumption of foods with positive effect on chronic pain (r = 0.713; the results are not shown) in patients whose pain did not change post-intervention. These results clearly indicate the need for a more intensive, specifically targeted (modified) nutrition education for people with higher BMI and other health issues.

Logistic regression analysis revealed that fewer meal skipping (Odds Ratio; OR=0.037, 95 % Confidence Interval; 95 % CI (0.003-0.482), p = 0.012) and reduced consumption of foods with negative effect on chronic pain (OR = 0.008, 95 % CI (0.000-0.444), p = 0.019) post-intervention represent independent dietary factors that contribute to decrease in pain intensity (Tables IV and V).

DISCUSSION

THE CONNECTION BETWEEN BMI AND CHRONIC PAIN

Substantial amount of evidence points to a coexistence between obesity and chronic pain, and therefore requires utmost attention. Patients with higher BMIs often report increased pain, decreased quality of life and difficulties performing every-day activities (23,25). The prevalence of obesity is higher in those with chronic pain and the prevalence of chronic pain is higher in those who are obese (16,23,25-27). Compared to normal weight people, overweight people reported 20 % higher rates of recurring pain, class I obesity people 68 %, people with class II obesity reported 136 % higher rates, while morbidly obese reported 254 % higher rates of recurring pain (27). The inter-relationship between obesity and chronic pain is not yet completely elucidated, but potential mechanisms have been hypothesised to include structural, mechanical, metabolic and behavioural changes (23). The pressure on joints and spine increases due to weight (27). Obese patients commonly have altered body mechanics, postures and gait patterns, which may be involved in the link between obesity and pain (16). Alternately, chronic pain may result in weight gain and obesity through reduced physical activity (16,26).

Furthermore, adipose tissue is not a passive storage space, but metabolically active tissue, which conducts endocrine function, producing and releasing cytokines, such as interleukins (IL), tumor necrosis factor alpha (TNF-α), and adipokines such as adiponectin, leptin, and adipsin (28). Leptin and adipsin have been proposed as a possible causative link between obesity and osteoarthritis while TNF-α and ILs-6 and –8 have been associated with structural joint abnormalities, nociceptive pathways, and in the development and progression of chronic pain. Higher adipsin levels were further related to back pain in overweight or obese,

otherwise healthy adults, independently of adiposity, as well as in knee osteoarthritis (29). Elevated levels in inflammatory markers in the serum (such as [IL-6], and C-reactive protein [CRP]) have been observed in obese patients; therefore obesity may be characterized as chronic inflammatory state (27,29).

A randomized 18-month clinical trial (30) showed that intensive diet and exercise reduce plasma levels of IL-6 in patients with osteoarthritis. Participants in the group with combined diet-exercise and diet group had higher weight loss and greater reductions in IL-6 levels than those in the exercise group only (30).

High prevalence of depression and chronic pain has been documented both in patients with chronic pain and obesity. Chronic pain is related to high levels of anxiety, depression, social and occupational dysfunction, where pain related fear and catastrophizing play a prominent role. The combination of decreased life reinforcement in depression and chronic pain seems to promote emotional eating and craving for comfort, high-caloric foods (23,26). These patients often report so-called binge episodes, which are connected with short reduction in pain and instant mood elevation (23). Many patients describe eating as the only activity that continues to bring them regular and reliable pleasure, especially if they feel physically limited due to constant pain. Those episodes include eating more frequently, in large amounts, and choosing foods high in sugar, sodium, fat and calories in response to pain or a combination of pain and mood (23,26,31,32). Foods mentioned above turn on the inflammatory response in the body, which makes pain worse (24). One must also remember that chronic inflammatory states have also been linked to major depression (7). Geha *et al.* (26) gave neuroscientific explanation for disrupted food hedonics describing them as hedonic blunting (a reduced ability to experience pleasure) which is plausible mechanistic link between pain and obesity.

Behavioural factors associated with chronic pain and obesity are physical deactivation and deconditioning, also known risk factors for developing both conditions, and represent major barrier for successful rehabilitation (23,27). Since obese patients find it more difficult to participate in active therapy, this comorbidity often leads to a vicious cycle of pain-inactivity-obesity-depression-food cravings (23,31). Sedentary lifestyle further intensifys isolation which may worsen both depression and trigger emotional eating (8).

Regardless of the causal underpinnings, chronic pain and obesity have additive effects, resulting in decreased quality of life and increased disability. Encouragingly, weight loss seems to reduces and even prevents pain (8,30,33). *Larsson* (34) showed musculoskeletal pain in obese women significantly improved after losing 14 % of weight. Another observational study of approximately 800 women estimated that by losing only 5 kg, risk of developing knee osteoarthritis can be reduced by 50 % (35).

THE CONNECTION BETWEEN FOOD AND PAIN

Diet based on the Mediterranean principles (rich in unrefined carbohydrates, nuts, fish and olive oil) has been shown to pose strong anti-inflammatory properties (decrease in IL-6 and subsequently CRP) and has an overall positive impact on health (11,15,24,36-38).

Food cravings, especially for simple carbohydrates are compensatory mechanisms. Sugars stimulate endorphine secretion which, as endogenous opioid, modulate physical and emotional pain. Endogenous opioids potentiate reward processes and motivate appetite, concurrently diminishing emotional responsiveness to noxious stimuli and thus giving the analgesic effect (38). Hunger has the opposite effect. Pain threshold and tolerance are reduced in hypoglycaemia, therefore it is very important for patients not to skip meals (39,40). Fasting periods, through activity of hormone ghrelin, can influence brain mechanisms, which make high caloric foods subjectively attractive, and increases the overeating occurrence (27,40,41).

The very same aspects were achieved with the nutrition education we developed, proving the education to be suitable and effective. Even modest, positive effect of fewer meal skipping and lower consumption of foods with negative effect on chronic pain were found to independently contribute to decreased pain.

The most desired benefits in patients' diet achieved after the education were higher consumption of high-fiber and nutrient dense foods such as fruits (e.g. raisins, prunes, peaches, and apples), vegetables (e.g. squash, broccoli, carrots, and celery), and whole grains. These changes have well documented contributing effect not only to prolonged satiety but also weight loss and contain precursors of endogenous opioids (39-41). Fish should be consumed at least two times per week due to anti-inflammatory properties of eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) (12,42), but the consumption remained low post-intervention. Intake of EPA and DHA is related to decrease concentration of CRP, proinflammatory eicosanoids, cytokines, chemokines and other inflammation biomarkers (14,24,42). Polyunsaturated fatty acids (PUFA) and phenolic fractions in extra-virgin olive oil also have strong anti-inflammatory properties (11) highlighting why it is the preferred source of dietary fats (24,31,37). However, consumption of olive oil also remained unchanged post-intervention. These aspects (fish and olive oil consumption) need to be addressed more thoroughly through adaptation of the education. Sinergistic effects of all previously mentioned foods pose the strongest anti-inflammatory effect and more attention is needed on the ways how patients can introduce these foods into their daily diet to achieve the strongest analgesic effect.

CONCLUSIONS

Our results show that the specifically designed nutrition education for chronic pain is suitable and effective, but the effect of dietary changes on the pain intensity is modest. Possible explanation for the modest impact lies in the fact that patients with higher BMI and those with several diagnoses need more specifically tailored education. Also, patients included in the study had various chronic pain conditions, and future interventions should focus on a specific diagnosis like the low back pain.

The strongest points of the education are 1) regularity of meal consumption, especially emphasized in the introduction of break-

fast which surpasses the hypoglycaemia-induced pain stimuli, and 2) reduced consumption of foods rich in saturated fats and simple carbohidrates, which reflect reduction in food cravings among patients. Ammendments of the education protocol are necessary for fish and olive oil consumption, foods with the strongest anti-inflammatory properties. Although borderline significant, patients increased the consumption of high-fiber and nutrient-dense foods, which have strong anti-inflammatory potential.

The complexity of chronic pain is repeatedly emphasized, and our results support the same conclusion. There is no simple solution for chronic pain but nutrition education can help. Pain relief is a fundamental human right, yet the immense burden of pain requires us to look for other ways to cope with it. Nutrition education seems promising.

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