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The use of dietary supplements supporting functioning of musculoskeletal system in rehabilitation clinic patients

Stosowanie suplementów diety wspomagających funkcjonowanie układu ruchu u pacjentów poradni rehabilitacyjnej

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ABSTRACT

INTRODUCTION: Musculoskeletal conditions are often characterized by pain, as well as limited physical function. To alleviate pain accompanying musculoskeletal diseases, non-steroidal anti-inflammatory drugs (NSAIDs) and/or paracetamol are used. Dietary supplements, however, are increasingly being considered by patients with these types of conditions as additional treatment aids. The aim of the study was the quantitative and qualitative analysis of dietary supplements and the subjective assessment of patients regarding the effect of supplements on the reduction of musculoskeletal disorders.

MATERIAL AND METHODS: The study used the author's own questionnaire to conduct a survey in a group of 171 patients, including 110 (64%) women and 61 (36%) men, of a rehabilitation clinic in Katowice. The survey questionnaire consisted of questions concerning, among others, the types of past injuries, the use of dietary supplements, as well as subjective feelings related to their use.

RESULTS: Most respondents used preparations containing collagen (30.9%) and glucosamine (30%). Most of the respondents (43.6%) chose the supplement after consulting a doctor or physiotherapist. The large majority of respondents (65.4%) observed improvement after using the dietary supplement.

CONCLUSIONS: The study showed that the majority of patients using dietary supplements that affect musculoskeletal function experienced improvements, most often after a month of taking them. Among the most commonly chosen dietary supplements were those that contained collagen and glucosamine in their formulation.

KEY WORDS

dietary supplements, musculoskeletal system, chondroitin, glucosamine, collagen

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STRESZCZENIE

WSTĘP: Schorzenia narządu ruchu często charakteryzują się bólem, a także ograniczoną sprawnością fizyczną. Dla złagodzenia dolegliwości bólowych, towarzyszących chorobom układu ruchu, stosuje się niesteroidowe leki przeciwzapalne (*non-steroidal anti-inflammatory drugs* – NSAIDs) i/lub paracetamol. Suplementy diety są jednak coraz częściej brane pod uwagę przez pacjentów z tego typu schorzeniami jako dodatkowe środki wspomagające leczenie. Celem pracy była analiza ilościowa i jakościowa suplementów diety oraz subiektywna ocena pacjentów dotycząca wpływu przyjmowanych suplementów na zmniejszenie dolegliwości układu ruchu.
MATERIAŁ I METODY: Narzędzie badawcze stanowił autorski kwestionariusz ankiety, przeprowadzony w grupie 171 pacjentów, w tym 110 (64%) kobiet oraz 61 (36%) mężczyzn, poradni rehabilitacyjnej w Katowicach. Kwestionariusz ankiety zawierał pytania dotyczące m.in. rodzajów doznanych urazów, stosowania oraz rodzaju przyjmowanych suplementów diety, a także subiektywnych odczuć związanych z ich stosowaniem.
WYNIKI: Najwięcej respondentów stosowało preparaty zawierające kolagen (30,9%) oraz glukozaminę (30%). Większość ankietowanych (43,6%) dokonała wyboru suplementu po konsultacji z lekarzem lub rehabilitantem. Zdecydowana większość ankietowanych (65,4%) zauważyła poprawę po stosowaniu suplementu diety.
WNIOSKI: Przeprowadzone badania wykazały, iż większość pacjentów stosujących suplementy diety wpływające na funkcjonowanie układu ruchu odczuwała poprawę, najczęściej po miesiącu ich przyjmowania. Do najczęściej wybieranych suplementów diety należały te, które w składzie zawierały kolagen oraz glukozaminę.

SŁOWA KLUCZOWE

suplementy diety, układ ruchu, chondroityna, glukozamina, kolagen

INTRODUCTION

Diseases of the musculoskeletal system include over 150 different diagnoses that may adversely affect the proper functioning of the locomotor system [1]. Musculoskeletal conditions are often characterized by pain as well as limited physical functioning. This results in a significant decline in mental health, as well as an increased risk of developing other chronic conditions [2].
The etiology of diseases of the musculoskeletal system, regardless of the musculoskeletal system affected by the dysfunction, is often associated with the same risk factors, including: obesity, improper eating habits (highly processed food) and a sedentary lifestyle, and on the other hand, some of the diseases may follow from an active lifestyle, often associated with intensively practiced physical activity. The treatment of musculoskeletal disorders consists primarily of symptomatic treatment including surgical, physiotherapeutic, and pharmacological methods. To alleviate the pain in the course of such conditions, non-steroidal anti-inflammatory drugs (NSAIDs) and/or paracetamol are used, which according to the results of studies has rather low effectiveness [3,4].
Dietary supplements are also often used as additional adjuncts to medical treatment. Dietary supplements are defined as foodstuffs whose purpose is to supplement the normal diet with concentrated vitamins, minerals or other substances having a nutritional or other physiological effect, taken orally in the form of a capsule, tablet or liquid [5]. The substances contained in the supplements stimulate osteoblasts to synthesize collagen types I and II and proteoglycans in the intercellular matrix of cartilage [6,7]. Dietary supplements with vitamin D, supporting the functioning of joints, affect the proliferation of osteoblasts, the synthesis and secretion of proteins regulating the bone mineralization process, improving the bone structure and increasing its mass [8]. Herbal extracts and substances such as turmeric inhibit inflammatory processes that accompany pathogenic processes of the musculoskeletal system [9]. A supplement containing curcumin and colloidal nanoparticles has one of the highest bioavailability and physiological activity available on the market, supported by clinical studies [3]. It is most commonly taken by people with osteoporosis or arthrosis to supplement tissue loss [10]. Depending on the composition, dietary supplements supporting the musculoskeletal system will differ in intensity and the area of action.
The most commonly used dietary supplements supporting the proper functioning of the musculoskeletal system include those containing chondroitin, glucosamine and methylsulfonylmethane (MSM) [11]. Chondroitin and glucosamine are also classified as SYSADOA (symptomatic slow acting drugs in osteoarthritis). Due to their multidirectional mechanism of action, they are a valuable supplement to the analgesic effect of classic analgesics [12]. Chondroitin sulfate has significant anti-inflammatory effects and effectively modifies the molecular pathology of cartilage in the course of osteoarthritis (OA) and the imbalance between the degradation and synthesis of cartilage tissue. By stimulating chondrocytes, it enhances the production of intercellular substance components and indirectly stimulates osteocytes to synthesize proteoglycans. As a dietary supplement administered orally, it inhibits the processes of degradation and degeneration of cartilage tissue. It reduces the synthesis of pro-inflammatory factors, acting synergistically with

drugs from the group of NSAIDs. A dose of 1500 mg of chondroitin sulfate corresponds to an anti-inflammatory and analgesic potency equal to 200 mg of celecoxib as an anti-inflammatory and analgesic [13]. Glucosamine sulfate, on the other hand, has a proven pharmacological effect as an analgesic booster, only in its crystalline form. It inhibits IL-1 activity and shows a moderate analgesic effect as a component of multimodal therapy for inflammatory pain [13]. Glucosamine also reduces the activity of certain enzymes that play a role in the degradation processes of articular cartilage [14]. Collagen is the main structural protein of the extracellular matrix in various connective tissues of the human body. It is found in the highest amount in bones, muscles, skin, and tendons [15]. Different types of collagens have the ability to form fibers and organize fibers into networks. Collagen fibers preserve the structure of the tissues by resisting deformation. This property allows joints to absorb shock [16].

The aim of the study was the quantitative and qualitative analysis of dietary supplements and the subjective assessment of patients regarding the effect of supplements on the reduction of musculoskeletal disorders.

MATERIAL AND METHODS

The survey was conducted among the patients of a selected rehabilitation clinic in Katowice (Poland). Participation in the survey was voluntary and anonymous, and the subjects consented to the survey. The study used a self-administered survey questionnaire consisting of demographics questions as well as 12 closed and open questions that included the types of injuries sustained, the fact of using and the type of dietary supplements taken, and subjective feelings about their use. Examples of questions in the survey concerned: why the patients were receiving treatment at the rehabilitation clinic, what the main ingredient was of the dietary supplement used and whether the patients noticed an improvement in the functioning of the musculoskeletal system after using the dietary supplement. The study group consisted of 171 patients, of which 64% (n = 110) were female, and 36% (n = 61) were male. The total mean age among the respondents was 48.7 years. Microsoft Excel 2019 was employed to compile the tables and figures. To test whether there were statistically significant relationships between the variables, analysis was performed using the Pearson correlation coefficient (r), and StatSoft STATISTICA 13 software. A value of $p < 0.05$ was assumed to indicate the presence of a significantly statistical relationship.

RESULTS

The structure of the respondents who took part in the survey took into account their level of education, place of residence and type of work. The highest percentage of respondents declared that they had secondary education (54.4%; n = 93), resided in a city with a population of more than 100 000 (66.1%; n = 113), and had white-collar jobs (35.7%; n = 61). When asked about the type of disease for which the patient uses the services of the rehabilitation clinic, the respondents most often indicated injuries (52.6%; n = 90), followed by pain, e.g. of the spine or knees (20.5%; n = 35), or arthrosis (8.7%; n = 14). The remaining number of people reported other diseases (for example, low bone mineral mass, osteoporosis), making up a total of 32 people (18.7%). 110 patients (64.3%) gave an affirmative answer to the question regarding the use of dietary supplements in connection with musculoskeletal disorders. The remaining patients used only other forms of treatment, such as physiotherapy, without taking supplementation.

When asked about the main ingredient contained in the dietary supplement used, the respondents most often indicated preparations containing collagen (30.9%; n = 34) and glucosamine (30%; n = 33). Vitamin D was taken by 16.4% (n = 18) of the respondents and calcium by 11.8% (n = 13). When enquiring about the source of motivation for choosing the given type of supplementation used, 48 respondents (43.6%) indicated that they made their choice after consultation with a doctor or physiotherapist, while 28 respondents (25.5%) made their choice on their own. It is surprising that only 3 respondents were guided by advertising when purchasing a given supplement (2.7%). The respondents also asked how long they had been using the supplements and whether they felt any improvement afterwards. The highest percentage of respondents (44.5%; n = 49) declared that they had been using the supplement for less than 3 months. Despite this, the vast majority of respondents (65.4%) noticed improvement. More women (42.7%) than men (22.7%) expressed their satisfaction with the achieved effect.

Only 72 of the surveyed patients were able to specify after what time they felt improvement in the functioning of the musculoskeletal system in connection with the intake of dietary supplements, regardless of the component of the supplement. The analysis of the given answers showed that the positive effect of the supplements was more often noticed by the respondents the longer the given product was used (Fig. 1). Moreover, the statistical analysis showed

a statistically significant relationship between the duration of use of dietary supplements and the time of improvement ($p < 0.001$; Table I).

The main dietary supplement that the respondents believed gave significant improvement in musculoskeletal function was collagen, used for one month (18.1%; n = 13). Glucosamine supplementation was also significant, with 5 subjects (6.9%) reporting a therapeutic effect in the first month of use, 9 subjects (12.5%) in the second month, and 5 subjects (6.9%) in the third month. The effectiveness of calcium-containing preparations was observed most often after 1 month (5.6%). Most of the respondents noticed positive effects of using dietary supplements improving the functioning of the musculoskeletal system, already after one month of use (Table II).

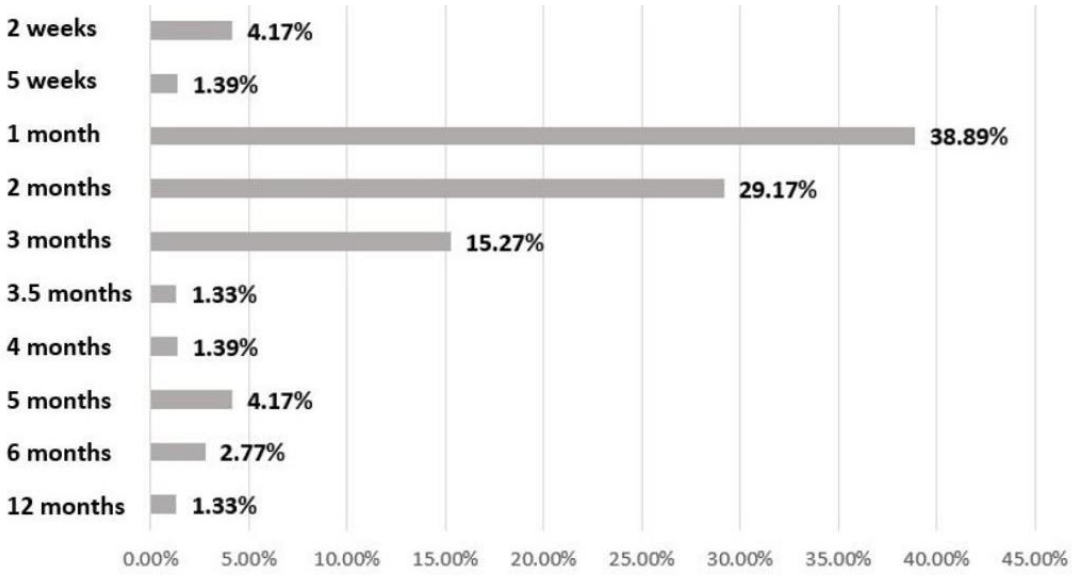

Fig. 1. The period after which patients experienced improved musculoskeletal function in connection with use of dietary supplement.
Ryc. 1. Okres, po jakim pacjenci odczuwali poprawę funkcjonowania układu ruchu w związku ze stosowaniem suplementu diety.

Table I. Relationship between time of improvement and duration of dietary supplement use expressed in months (Pearson's r)
Tabela I. Zależność między czasem poprawy a czasem stosowania suplementu diety wyrażonego w miesiącach (korelacja r Pearsona)

Variable X & variable Y	Mean	SD	r (X, Y)	r2	t	p	N
Time of improvement in months	1.966250	1.242633	–	–	–	–	–
Duration of use in months	1.847222	0.914049	0.403736	0.163003	3.692191	0.000437	72

SD – standard deviation; r (X, Y) – the Pearson correlation coefficient; r2 – the coefficient of determination; t – the value of the t-statistic examining the significance of the correlation coefficient; p – p values indicate a significant relationship between the duration of use of dietary supplements and the time of improvement; N – group size.

Table II. Dietary supplement use with specific ingredient and time to experience improvement
Tabela II. Stosowanie suplementu diety z określonym składnikiem a czas odczuwania poprawy

Ingredient of dietary supplement	Time after which patient felt improvement when taking dietary supplement										Number of patients taking dietary supplement
	2 wks.	5 wks.	1 mo.	2 mos.	3 mos.	3.5 mos.	4 mos.	5 mos.	6 mos.	12 mos.	
Chondroitin	0	0	2	2	0	0	0	0	0	0	4
Glucosamine	1	1	5	9	5	0	1	0	0	1	23
Collagen	2	0	13	3	2	1	0	2	1	0	24
Hyaluronic acid	0	0	0	2	0	0	0	0	0	0	2
Calcium	0	0	4	1	3	0	0	0	1	0	9
Vitamin D	0	0	3	3	1	0	0	1	0	0	8
Vitamin K	0	0	1	1	0	0	0	0	0	0	2
Total number	3	1	28	21	11	1	1	3	2	1	72

DISCUSSION

The dietary supplements market in Poland is constantly developing. It is estimated that the profits in this sector in 2008 amounted to 1.7 billion PLN, while in 2018 they were as much as 4.4 billion PLN. A further increase in the production and use of dietary supplements is forecasted. In the study by Kostecka [17], more than half of the respondents declared that the taken dietary supplements were prescribed by a doctor as a means of supporting traditional treatment. In this study, the majority of respondents (75%) also replied that the main place to buy dietary supplements was the pharmacy. This choice was based on easy accessibility, trust and consultation. The knowledge about dietary supplements was obtained by the respondents from various sources. As many as 1/3 of the respondents were guided by advertising, the opinion of friends and family. Similar results were obtained in this study with regard to dietary supplements improving the functioning of the locomotor system. A large number of respondents were aware of the need to consult a doctor before purchasing a dietary supplement (43.5%). However, a large group consisted of patients who made their own choice (25.9%).

The dietary supplements available on the market are intended to support the musculoskeletal system by stimulating osteoblasts to synthesize collagen, proteoglycans and glycoproteins in the intercellular matrix of cartilage tissue, and relieve pain. They also affect the synovium, stimulating the production of synovial fluid and thus improving the mobility of joints [6,7]. Nevertheless, we are still not able to state exactly what support in the form of dietary supplements should be implemented in the treatment. Nonetheless, when reviewing the measures available on the market, it is considered right to use dietary supplements that contain ingredients such as collagen, glucosamine, chondroitin and hyaluronic acid, included in proteoglycans in connective tissue and being the main, natural, component of the synovial fluid. In addition, dietary supplements containing glucosamine, chondroitin sulfate and hyaluronic acid began to be treated as additional symptomatic medications. Important evidence also suggests that glucosamine, when combined with alternative medicine such as acupuncture, has anti-inflammatory and analgesic effects [18]. On the other hand, other studies indicate that the therapeutic use of chondroitin sulphate and glucosamine in clinical conditions is still debatable [19]. Some studies question the notion that the therapeutic effect of glucosamine in OA is due to improvement in the production of glycosaminoglycans in articular cartilage. In these studies, the synthesis of glycosaminoglycans took place only after the administration of a very high dose of glucosamine (> 100 μmol). Biggee et al. [20] demonstrated that no more than 2% of galactosamine incorporated into chondroitin sulfate comes from glucosamine incubated with human chondrocyte cells. On the other hand, in vivo studies suggest the potential application of glucosamine and chondroitin in the treatment of cartilage defects [21,22]. The studies conducted in this area are characterized by inconsistencies. The duration of the study, the time of dietary supplement use and the selection of the study group have the greatest influence on the final result. A meta-analysis by Simental-Mendía et al. [19] on supplementation with glucosamine or chondroitin sulfate revealed a reduction in pain in patients with knee OA. Few studies have been conducted on the dosage of glucosamine and chondroitin supplements, making the dosages used rather empirical. Different dosing regimens are reported in the literature [23]. The duration of glucosamine or chondroitin supplement use is a very important factor [24]. Most patients of the rehabilitation clinic in Katowice, experienced improvement after only one month of taking the supplements. Some studies have shown clinical efficacy of supplements between 4 and 12 weeks of supplementation [25,26]. However, the results of more recent studies do not indicate visible effects even when these supplements are taken for a period ranging from 3–6 months [9]. In the present study, the patients of the rehabilitation clinic in Katowice were most likely to choose those supplements that contained collagen (30.9%) and glucosamine (30%). Nevertheless, in the literature, the efficacy of glucosamine and chondroitin is most commonly analyzed. Bruyère et al. [27] on the other hand, demonstrated that over a 6-month period of collagen hydrolysate supplements, a higher percentage of positive treatment responses was obtained (51.6%), compared to the placebo group (36.5%). This further suggests that collagen hydrolysate at a dose of 1200 mg/day may increase the number of responsive patients by 20% [28]. There is evidence of the efficacy of symptomatic and chondroprotective treatment with collagen derivatives (gelatin and hydrolysate) in patients with OA. A distinction is made between the effects of non-denatured collagen II on articular cartilage degeneration in rheumatoid arthritis, which induce the body's humoral antibody response, showing the potential to reduce swelling and pain. Hydrolyzed collagen is more effective for OA [28]. Long-term clinical trials are required to provide solid therapeutic evidence for the use of dietary supplements to support musculoskeletal function [19]. The duration of taking dietary supplements that can provide optimal symptom relief or cartilage restoration, for example, is still unknown. It is also essential to note which patient groups may benefit from the use of such dietary supplements. Efforts are also needed to accurately define the properties of supplements and formulations

with specific compositions to reduce their heterogeneity [9].

CONCLUSIONS

The study showed that most patients using dietary supplements affecting the functioning of the musculoskeletal system felt their effectiveness, most often after a month of taking them. The most popular dietary supplements were those containing collagen and glucosamine. The positive effects of using dietary supplements supporting the functioning of the locomotor system noticed by the respondents may be the basis for considering the possibility of including this type of preparations in the treatment of patients.

Author's contribution

Study design – P. Pluta, A. Piekut
Data collection – P. Pluta
Data interpretation – P. Pluta
Statistical analysis – P. Pluta, W. Osmala-Kurpiewska
Manuscript preparation – P. Pluta, W. Osmala-Kurpiewska
Literature research – P. Pluta, W. Osmala-Kurpiewska, A. Piekut

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