



RESEARCH ARTICLE

Improvement in Pensioners Quality of Life after Treatment with Mineral-Rich Medicinal Waters

M^a Teresa Ortega Maján^{1*}, Diego Júdez Legaristi² and Antonio Hernández Torres³

¹Department of Preventive Medicine, Hospital Reina Sofía, Spain

²Department of Anesthesiology, Hospital de Alcañiz, Spain

³Senior Titular Scientific, Medical Hidrology specialist, Health Technology Assessment Agency, Institute of Health Carlos III, Spain

*Corresponding author: M^a Teresa Ortega Maján, Department of Preventive Medicine, Hospital Reina Sofía, Tudela (Navarra), Spain, Tel: 0034617414492, E-mail: mayortega@yahoo.es

Abstract

Introduction: Because there are mineral-rich medicinal waters in natural thermal spas. Their mechanical, thermal and psychotropic properties should be harnessed and the transmineralisation resulting from absorption through the skin of the ions they contain is fundamental. The main objective of this study was to determine whether the possible improvement in quality of life following balneotherapy can be maintained for at least two months after undergoing various thermal treatments.

Methods: A quasi-experimental before-after study conducted in the months of April to June 2015 in a natural thermal spa in the province of Zaragoza (Aragon, Spain) with participants who benefited from the IMSERSO Social Balneotherapy programme and answered the quality of life SF12v2 questionnaire upon arrival and after two months.

Results: There were 221 people included in the study, 138 (62.4%) women, with a median (interquartile range - IR) of 73.6 (8) years, 11.0 (1) days stay at the spa and each patient had 4 (3) morbidities. The median number (IR) of thermal treatments was 4 (3); the most frequent was the hydroponic treatment, active pool and bubble-system spa, finding statistically significant improvements in the thermal treatment of the steam room and/or mud baths. The primary clinical outcome was obtained in an emotional role, where improvement was moderate being mild in the mental health, general health and the mental summary component dimensions.

Conclusions: It was concluded that balneotherapy has a multi-factorial impact on health as improvements were found in the eight dimensions and the two summary components.

Keywords

Mineral-rich medicinal waters, Spa, Elderly, Quality of life

Introduction

An aging population is a global phenomenon that primarily affects developing and technologically advanced countries. Forecasts show that the aging trend will continue, with the over 65-year-old group reaching approximately 16% of the population in 2050 [1]. In this sense, the “disability-free life expectancy” indicator, which refers to a healthy life expectancy, is an indicator that is becoming increasingly important as it measures more quality of life rather than quantity.

Balneotherapy and hydrotherapy techniques are usually mistakenly used interchangeably [2-5]. In addition to using techniques with mechanical and thermal effects during balneotherapy, patients are in contact with Medicinal Mineral Waters (MMW) and transmineralisation occurs when ions contained in these waters are absorbed through the skin.

MMW has multiple action mechanisms such as: mechanical, thermal, general unspecified, chemical and psychotropic, to which we can also add an antioxidant effect [6]. Oxygen free radicals in living organisms produce oxidative stress [7] in normal situations, however an imbalance between production and elimination can occur, determining whether diseases appear or not. Some authors [8,9] believe that the fundamental cause of aging is the production of free radicals in the mitochondria, with mitochondrial DNA damage, loss of

regenerative capacity and increased metabolic alterations. The effect of ion absorption and radon radioactivity of MMW that this chemical element has should also be considered.

In 1989 the IMSERSO Social Balneotherapy programme was created in Spain. It is a national social and health programme that facilitates many pensioners' access to the benefits of MMW.

The main objective of this study was to determine whether the possible improvement in quality of life following balneotherapy can be maintained for at least two months after the various thermal treatments.

Methods

Type of study

A quasi-experimental before-after study conducted in the months of April to June 2015 in a natural thermal spa in Jaraba, province of Zaragoza (Aragon, Spain) with participants who benefited from the IMSERSO Social Balneotherapy programme and complied with inclusion (both sexes, literate, owned a telephone) and exclusion (serious psychiatric illnesses, diseases in acute stage and difficulty understanding) criteria.

The selection of participants was done consecutively. The study was approved by the Aragon Clinical Research Ethics Committee (act No.CP14/2015). The natural thermal spa management and participants were informed of the study objectives and gave their signed informed consent.

The MMW of the natural thermal spa participating in the study are classified as containing a medium level of mineralisation, calcium, magnesium, mixed bicarbonates and being slightly radioactive. The composition of the MMW of this natural thermal spa is shown in (Table 1 and Table 2).

Table 1: Health condition depending on several variables.

Organoleptic analysis	
Color	Colorless
Odour	Odourless
Flavor	Inspid
Turbidity	0.1 U.N.F.
Physico-chemical determinations	
Emergency temperature	32 °C (hypothermal)
pH	7.42
Electrical conductivity	846 mS/cm (micro Siemens/cm) at 20 °C
Oxidation to KmnO ₄	0.8 mg/l
Derived properties	
Dry residue at 180 °C	599 mg/l (Medium mineralization)
Dry residue at 110 °C	750 mg/l
Total hardness	41.9 °F
Hardness (CO ₃ Ca)	419 mg/l (Very hard)
Alkalinity (CO ₃ Ca)	230 mg/l
Radiactivity	
Radon	4.07-13 Bq/l (0.11-0.35 nCi/l)

Information sources

The sources of information were: clinical history of the spa (socio-demographic data, comorbidity and crenotherapy treatments performed) and the 4-week quality of life questionnaire related to health SF12 version 2 (SF12v2 [10]), which was administered in two stages, upon arrival to the spa and two months after departure. The standard format of the SF12v2 questionnaire was used, which has 12 items (obtained through the multiple regression of SF36) constituting eight dimensions: General Health (GH), Physical Function (PF), Physical Role (PR), Body Pain (BP), Emotional Role (ER), Mental Health (MH), Vitality (VI) and Social Function (SF) These dimensions are subsequently grouped into two summary components: Physical (PSC) and Mental (MSC) Summary Component. The response options for the 12 items are on a Likert type scale, and the number of response options ranges from three to five, depending on the item; they evaluate intensity or frequency.

The following scores were obtained through using the SF12v2 questionnaire:

a) Direct or raw scores for the eight dimensions with a scale from zero (worst health condition) to 100 (healthiest condition). Patients' GH is established from one question: personal assessment of health; PF is established from two questions: the degree to which health limits the patient's physical activities of climbing stairs and walking for more than one hour; PR is established from two questions: the degree to which physical health interferes with work and other daily activities, including having a lower performance than desired, limitation on the type of activities performed or difficulty in performing activities; BP from one question: pain in-

Table 2: Mineral medicinal water composition: mineralization.

Mineralization		
Dissolved gases	Hydrogen sulfide (H ₂ S)	< 0.05 mg/l
	Carbonic anhydride (CO ₂)	25 mg/l
	Oxygen (O ₂)	8 mg/l
Non-ionized substances	Silica anhydride (SiO ₂)	9.8 mg/l
Anions	Bicarbonates (HCO ₃ ⁻)	301.3 mg/l
	Sulfates (SO ₄ ²⁻)	158.4 mg/l
	Chlorides (Cl ⁻)	65.7 mg/l
	Bromides (Br)	< 0.2 mg/l
	Iodides (I)	< 0.05 mg/l
	Fluorides (F)	< 0.2 mg/l
	Nitrates (NO ₃ ⁻)	12.4 mg/l
	Nitrites (NO ₂ ⁻)	< 0.02 mg/l
	Cations	Calcium (Ca ²⁺)
Sodium (Na ⁺)		42.5 mg/l
Potassium (K ⁺)		2.5 mg/l
Magnesium (Mg ²⁺)		40.9 mg/l
Strontium (Sr ²⁺)		1.08 mg/l
Lithium (Li ⁺)		0.03 mg/l
Manganese (Mn ²⁺)		< 0.005 mg/l
Iron (Fe ²⁺)		< 0.01 mg/l
Ammonium (NH ₄)		< 0.1 mg/l

tensity and its effect on the patient's usual work both outside and within the home; ER from two questions: the degree to which emotional problems interfere with work or daily activities; MH from two questions: a feeling of tranquility, despondency or sadness; VI from one question: feeling of vitality when tired and exhausted; SF from one question: the degree to which the problems of physical or emotional health interfere with the patient's normal life.

b) Eight standardized scores and two summary components (physical and mental) using an algorithm containing the means, standard deviations and weighting factors of the general American population in 2009. Thus, for each dimension, 50 (Standard Deviation (SD) of 10) is the general population mean. Values that are higher or lower than 50 should be interpreted as better or worse, respectively, than the reference population.

c) PSC is composed of the dimensions GH, PF, PR and BP, while MSC is obtained from the ER, MH, VI and SF dimensions.

d) The Impact was also calculated as the effect size is a reflection of the magnitude of change observed before and after treatment and expressed relative to the initial variability in scoring. The effect size for each dimension or component was calculated as: mean score from two months after departure minus the mean upon arrival, divided by SD at arrival. Clinically relevant differences were considered as follows: a value between 0.2 and < 0.5 is a slight improvement, from 0.5 to < 0.8 is moderate and ≥ 0.8 is high [11].

Development of the study

People who come to the natural thermal spa to participate in the IMSERSO Social Balneotherapy programme do so in groups and stay at the spa for 10-12 days. The water participants used the first day to learn about the thermal spa and its facilities and visited the hydrologist doctor where, depending on the patient's personal conditions, age, needs, etc., they are prescribed a personalized crenotherapy treatment. To facilitate participation, the research study form was given immediately after the medical consultation. Because the medical consultation was conducted relatively quickly and there were one, two or three consultations according the number of water participants, a total of 45.7% of the people who visited the thermal spa during the study period was recruited to take part in the study. The objectives and phases of the study were individually explained in the research study form (containing medical information previously provided by the hydrologist doctor). Once participants accepted and signed the informed consent, the first questionnaire was given, in addition to a folder containing the research study information and the second questionnaire, which was conducted by telephone two months after departure. It was emphasized to the participants that it was essential to respond to the sec-

ond questionnaire; in order to ensure their participation, they provided the time of day that was best for them to participate and several telephone numbers.

Study variables

The patients' social demographic variables (sex, age, education level, pathologies), and crenotherapy treatments received (hydroponic treatment, bubble-system spa, thermal jet-streams, steam room, circular shower, pool exercises, active pool, toning, thermal aromas, phlebotonic channels, salt chamber, mud baths, massages, aerosols, nebulisation) were collected in addition to the variables from the quality of life SF12v2 questionnaire (information sources section).

Statistical analysis

The results were described by central tendency (median) and dispersion (interquartile range - IR) statistics for the quantitative variables of non-compliance of normality and percentages for qualitative variables. Chi-square tests (Fisher test plus 20% of expected frequencies under 5) were used for the bivariate analysis and for the association between qualitative variables and the Mann-Whitney test was used for quantitative variables, for non-compliance of normality. Normality was assessed using the Kolmogorov-Smirnov test with Lilliefors significance correction.

The analysis of time-related variables (repeated variables of measurements) was performed for qualitative variables using the McNemar test for paired data and for the quantitative variables using the Wilcoxon test for non-compliance of normality.

The application of tests used the bilateral hypothesis and the statistical significance of the difference was considered from p values less than α , being $\alpha = 0.05$.

To obtain raw, standardised scores (according to age, sex and American population) and standardised physical and mental summary components from the SF12v2, the Quality Metric Health Outcomes™ Scoring Software 4.5® from OPTUM was used, with prior authorisation from the corresponding Research Centre. The exploitation of the data was made using the Statistical Package for the Social Sciences, version 15.

Results

During the three-month study, 221 people were included, 138 (62.4%) of the total were women, with a median (IR) age of 73.6 (8) years and a stay of 11.0 (1) days. Categorizing them by level of studies, 17.7% had a university degree, 18.5% had secondary education or vocational training, 62.9% primary education and 0.9% did not have any kind of study. The response rate to the second questionnaire was 98.6%, only 3 people did not answer.

Of the total population, 220 (99.5%) had an illness of some sort, the mean (IR) of morbidity variable per

Table 3: Health condition depending on several variables.

Health condition		Bad			Regular			Good-Very good-Excellent			Total	P value
		n	%	%	n	%	%	n	%	%		
Sex	Male	4	26.7	4.8	18	23.4	21.7	61	47.3	73.5	83	0.002
	Female	11	73.3	8.0	59	76.6	42.8	68	52.7	49.3	138	
Age	< 75	11	73.3	8.2	49	63.6	36.6	74	57.4	55.2	134	0.390
	> = 75	4	26.7	4.6	28	36.4	32.2	55	42.6	63.2	87	
Education	None-primary	9	60.0	6.4	51	66.2	36.2	81	62.8	57.4	141	0.840
	VT-B-U	6	40.0	7.5	26	33.8	32.5	48	37.2	60.0	80	
No. of diseases	< 5	1	6.7	0.9	32	41.6	28.1	81	62.8	71.1	114	< 0.001
	> = 5	14	93.3	13.1	45	58.4	42.1	48	37.2	44.9	107	
Total		15	100.0	6.8	77	100.0	34.8	129	100.0	58.4	221	

None-primary: No Education or Primary Schooling; VT-B-U: Vocational Training, Baccalaureate or University.

Table 4: Thermal treatments performed.

	n	Cases: 221	Responses: 985	Median	IR
Hydroponic treatment	221	100.0%	22.4%	36	6
Bubble-system	113	51.1%	11.5%	10	2
Thermal jet-streams	40	18.1%	4.1%	10	2
Steam room	16	7.2%	1.6%	10	2
Circular shower	37	16.7%	3.8%	9	2
Pool exercises	94	42.5%	9.5%	10	2
Active pool (open)	172	77.8%	17.5%	9	2
Toning	70	31.7%	7.1%	8	5
Thermal aromas	38	17.2%	3.9%	8.5	6
Phlebotonic channels	33	14.9%	3.4%	9	4
Salt chamber	49	22.2%	5.0%	8	5
Mud baths	41	18.6%	4.2%	6	0
Massage	21	9.5%	2.1%	2	2
Aerosols	25	11.3%	2.5%	8	2
Nebulisation	17	7.7%	1.7%	9	2

IR: Interquartile Range.

Table 5: Thermal treatments received and health improvement.

Thermal treatment	Overall improvement		P value
	WS	SSA	
Hydroponic treatment	100.00%	100.00%	P = 1.000
Bubble-system	49.00%	53.30%	P = 0.540
Thermal jet-streams	19.60%	14.70%	P = 0.370
Steam room	3.50%	13.30%	P = 0.007
Circular shower	16.80%	17.30%	P = 0.918
Pool exercises	42.00%	45.30%	P = 0.633
Active pool	77.60%	78.70%	P = 0.860
Toning	32.20%	32.00%	P = 0.980
Thermal aromas	16.80%	18.70%	P = 0.728
Phlebotonic channels	16.10%	10.70%	P = 0.278
Salt chamber	22.40%	20.00%	P = 0.686
Mud baths	14.00%	28.00%	P = 0.012
Massage	10.50%	8.00%	P = 0.555
Aerosols	14.00%	6.70%	P = 0.108
Nebulisation	7.00%	9.30%	P = 0.541
Total	143%	75%	

WS: Worse or the Same; SSA: Somewhat, Sufficient or A lot.

person was 4 (3). 48.4% had five or more conditions; the relative distribution of the five main groups of the most common diseases was as follows: 248 (25.1%) musculoskeletal system and connective tissue diseases and disorders, 238 (24.1%) endocrine, nutritional and metabolic disorders, 224 (22.7%) circulatory system diseases,

64 (6.5%) respiratory system diseases and disorders and 64 (6.5%) kidney and urinary tract diseases. Differences in patients health condition at the time of arrival to the spa was observed in several variables (Table 3), with Statistically Significant Differences (SSD) according to sex and number of pathologies (better health in men and those who had fewer diseases).

The medium number (IR) of thermal treatments administered was 4 (1). Of the participants, 173 (78.3%) complied with initially set thermal treatments (both the type of treatment and number of sessions), the distribution being shown in Table 4. Changes were observed in health condition according to thermal treatments received (Table 5), finding SSD in those that had improved somewhat, sufficiently and a lot and those that had undergone the steam room and/or mud bath treatment.

Table 6 shows the results of direct scores obtained for the eight dimensions of the questionnaire given upon arrival to the spa. No significant differences were observed for age (except in MH and SF, which was higher for 75 year-olds), or for educational level; there were, however, differences observed for gender (better health in the physical component dimensions for men) and number of diseases (better health for all components in the group that had fewer than five, except in the ER dimension).

Table 6: Median (IR) of direct scores in the eight SF12v2 dimensions upon arrival at the spa.

		Physical summary component				Mental summary component			
		GH	PF	PR	BP	ER	MH	VI	SF
Overall		60 (35)	75 (50)	87.5 (37.5)	75 (50)	75 (25)	75 (37.5)	75 (50)	100 (0)
Gender	Male	60 (35)	100 (50)	100 (25)	100 (25)	75 (25)	75 (25)	100 (50)	100 (0)
	Female	25 (35)	75 (50)	75 (37.5)	75 (50)	75 (25)	62.5 (37.5)	75 (50)	100 (25)
	Sig.	P < 0.001	P = 0.009	P = 0.011	P < 0.001	P = 0.542	P = 0.001	P = 0.010	P = 0.083
Age	< 75-years-old	60 (35)	75 (50)	87.5 (37.5)	75 (50)	75 (25)	62.5 (37.5)	75 (50)	100 (25)
	≥ 75 years	60 (35)	75 (50)	87.5 (25)	75 (50)	75 (25)	75 (25)	75 (50)	100 (0)
	Sig.	P = 0.357	P = 0.788	P = 0.707	P = 0.294	P = 0.465	P = 0.032	P = 0.683	P = 0.024
Education	None-primary	60 (35)	75 (50)	87.5 (25)	75 (50)	75 (25)	75 (37.5)	75 (50)	100 (0)
	VT-B-U	60 (35)	87.5 (50)	93.75 (37.5)	87.5 (50)	75 (25)	75 (25)	75 (50)	100 (0)
	Sig.	P = 0.276	P = 0.721	P = 0.428	P = 0.822	P = 0.836	P = 0.326	P = 0.756	P = 0.590
No. of diseases	< 5 diseases	60 (35)	100 (25)	100 (25)	100 (50)	75 (25)	75 (25)	87.5 (50)	100 (0)
	≥ 5 diseases	25 (35)	75 (75)	75 (37.5)	75 (50)	75 (25)	62.5 (37.5)	75 (50)	100 (0)
	Sig.	P < 0.001	P < 0.001	P < 0.001	P = 0.010	P = 0.307	P = 0.001	P = 0.014	P = 0.655

IR: Interquartile Range; GH: General Health; PF: Physical Function; PR: Physical Role; BP: Body Pain; ER: Emotional Role; MH: Mental Health; VI: Vitality; SF: Social Function.

Table 7: SF12v2 standardised scores and impact on arrival at the thermal spa and two months after departure.

		Direct scores			Standardised scores				
		Median	IR	Sig t1-t3	Median	IR	> 50	Impact	Sig t1-t3
General health	Arrival	60	35	P < 0.001	44.74	15.09	11.8%	0.425	P < 0.001
	Two months	60	33.75		44.74	14.55	25.2%		
Physical function	Arrival	75	50	P = 0.031	47.88	17.18	43.9%	0.066	P = 0.031
	Two months	75	50		47.88	17.18	46.3%		
Physical role	Arrival	87.5	37.5	P < 0.001	52.57	13.82	53.4%	0.175	P < 0.001
	Two months	87.5	25		52.57	9.22	62.4%		
Body pain	Arrival	75	50	P = 0.031	47.25	20.38	48.0%	0.091	P = 0.031
	Two months	100	50		57.44	20.38	50.5%		
Emotional role	Arrival	75	25	P < 0.001	44.90	11.19	28.1%	0.513	P < 0.001
	Two months	87.5	25		50.49	11.18	57.8%		
Mental health	Arrival	75	37.5	P < 0.001	52.35	18.29	54.8%	0.225	P < 0.001
	Two months	75	25		52.35	12.20	62.4%		
Vitality	Arrival	75	50	P = 0.013	57.81	20.13	63.8%	0.079	P = 0.027
	Two months	75	50		57.81	20.13	67.4%		
Social function	Arrival	100	0	P < 0.001	56.57	0.00	77.4%	0.122	P < 0.001
	Two months	100	0		56.57	0.00	79.8%		
PSC	Arrival	-	-	-	49.02	16.72	48.4%	0.092	P = 0.002
	Two months	-	-	-	50.49	14.73	53.2%		
MSC	Arrival	-	-	-	50.95	12.73	53.4%	0.209	P < 0.001
	Two months	-	-	-	54.68	12.40	70.6%		

Impact: Materials and Methods: Calculated as the difference between the means divided by the initial SD [11]. PSC: Physical Summary Component; MSC: Mental Summary Component; IR: Interquartile Range.

The before (upon arrival) and after (two months after departure) were compared both in direct and standardised scores (by age and sex of the American population), improvements in all dimensions were observed and there were statistically significant differences. See (Table 7).

Table 8 shows the changes between the scores upon arrival to the spa and two months after departure in the dimensions and the summary components based on the value of 50 where improvements in all dimensions can be observed - being statistically significant in the dimensions of general health, physical role, emotional role, mental health and mental summary component.

Discussion

Strengthening a healthy life is one of the World Health

Organization's (WHO) main objectives. The real challenge for society and science is not to increase life expectancy, but a healthy life expectancy [12]. The concept of aging has evolved, from the definition of healthy aging provided by WHO in 1990 [13] (focused on health), towards the much more inclusive model that is active aging [14] (WHO, 2002).

Because self-perceived or subjective health is a reflection of multiple variables, it is considered to be a good predictor of mortality.

The SF12v2 questionnaire is one of the best generic instruments to measure quality of life and summarises results of its 12 items into two subscales: physical and mental health.

The mechanisms through which improvements oc-

Table 8: Before and after comparison according to the value of 50 in the dimensions (standardised) and summary components.

		Two months after departure from thermal spa					P value McNemar	
		n	% row	n	% row	n		
Upon Arrival at Spa	General health	GH < 50	162	84.4%	30	15.6%	192	< 0.001
		GH > = 50	1	3.8%	25	96.2%	26	
			GH < 50		GH > = 50		Total	
	Physical function	PF < 50	114	93.4%	8	6.6%	122	0.227
		PF > = 50	3	3.1%	93	96.9%	96	
			PF < 50		PF > = 50		Total	
	Physical role	PR < 50	75	73.5%	27	26.5%	102	0.001
		PR > = 50	7	6.0%	109	94.0%	116	
			PR < 50		PR > = 50		Total	
	Body pain	BP < 50	100	88.5%	13	11.5%	113	0.383
		BP < 50	8	7.6%	97	92.4%	105	
			BP < 50		BP < 50		Total	
	Emotional role	ER < 50	89	57.1%	67	42.9%	156	< 0.001
		RE > = 50	3	4.8%	59	95.2%	62	
			ER < 50		RE > = 50		Total	
	Mental health	MH < 50	76	76.8%	23	23.2%	99	0.002
		MH > = 50	6	5.0%	113	95.0%	119	
			MH < 50		MH > = 50		Total	
	Vitality	VI < 50	67	84.8%	12	15.2%	79	0.077
		VI > = 50	4	2.9%	135	97.1%	139	
		VI < 50		VI > = 50		Total		
Social function	SF < 50	39	78.0%	11	22.0%	50	0.210	
	SF > = 50	5	3.0%	163	97.0%	168		
		SF < 50		SF > = 50		Total		
Physical component	PSC < 50	96	85.7%	16	14.3%	112	0.052	
	PSC > = 50	6	5.7%	100	94.3%	106		
		PSC < 50		PSC > = 50		Total		
Mental component	MSC < 50	61	60.4%	40	39.6%	101	< 0.001	
	MSC > = 50	3	2.6%	114	97.4%	117		
		MSC < 50		MSC > = 50		Total		

GH: General Health; PF: Physical Function; PR: Physical Role; BP: Body Pain; ER: Emotional Role; MH: Mental Health; VI: Vitality; SF: Social Function.

cur in balneotherapy are not exactly known. The results are not due exclusively to a strict form of balneotherapy treatment, but the so-called “thermal spa effect” occurring within a thermal spa context that includes both the effects of treatment with MMW and the effects of the radioactivity in the water caused by the (albeit minimal) presence of radon in the thermal spa’s MMW which is constantly absorbed through the skin and through the respiratory system leading to a state of peace and tranquillity. All this produces the entire “thermal spa effect”.

With regard to the treatment received and the overall improvement of health conditions, SSD were found in those who had improved somewhat, sufficiently and a lot and had undergone the steam room and/or mud bath treatment. A review by Fioravanti A in 2011 [15] on balneotherapy mechanisms of action, found that mud increased β -endorphin levels in plasma and corticotropin, cortisol, growth hormone and prolactin secretion. In addition, they induce a reduction in circulating levels of prostaglandin E2, leukotriene B4, interleukin-1 β and tumour- α factor necrosis, which are important mediators of inflammation and pain. With regard to the steam room, no relevant scientific studies were found.

When analyzing the health condition based on different variables, it was found that there were differences according to sex and number of diseases. 73.5% of men believed their health condition was good, very good or excellent compared with 49.3% of women. These differences are the “paradox of morbidity”, according to which men die earlier, but women live longer with a poorer health condition [16]. Differences in sex have also been observed in the general Spanish population [17] older than 65, where 51% of men assess their health as good compared to 38.99% of women.

A report published using data from the 2011 Spanish National Health Survey [18] on the assessment of health conditions by sex and age group, showed how a negative perception increases with age and that sex is a differentiating factor of subjective health.

In our work no SSD were found for level of education, although the perception of health condition was assessed more positively among those with a higher level of education.

Upon leaving the spa, patients’ perceived health condition significantly improved, to the extent that only 3.2% considered they had a poor health condition and

75.2% believed theirs was good, very good or excellent.

Various other scientific studies, mainly in people with fibromyalgia [19,20], osteoarthritis [21-30], chronic low back pain [31,32] and chronic venous insufficiency [33,34], have found that balneotherapy and undergoing such treatments resulted in an improved quality of life in regard to health.

The answer to the second questionnaire showed excellent levels of quality. When the results of the two SF12v2 questionnaires given - upon arrival to the thermal spa and two months after departure - were compared, SSD were observed in the standardized scores for the eight dimensions of health and the component summary of physical and mental health. In all cases the change was an improvement. Although there were positive changes that were statistically significant, when calculating the clinical impact of these changes slight improvements were obtained in the mental health and general health dimensions and mental summary component; the best clinical outcome occurred in the emotional role where the improvement was moderate.

The improvement of mental health is intrinsically linked to improvement of physical health and both with increasing or raising the individual's level of self-esteem.

The results obtained have to consider the time of year when the study was done, as some studies have shown a relationship between seasonality and the effects of thermal treatments. A study by Hernández A [6] found that the greater the number of hours of sunshine and/or proximity to summer times and/or higher temperatures, the greater the therapeutic effect, this is related to the seasonal variations found in urinary excretion of lipid peroxidation products. In addition, in summer there is a process of oxidation in the body, so that the margin of therapeutic manoeuvring and therefore antioxidant effects that could be obtained with MMW, are much higher.

Despite the therapeutic effect of various MMW therapies, other studies on balneotherapy have not yet been found that quantitatively evaluate clinical improvement to allow us to compare the results of this study, so it would be interesting to further investigate the issue with sound methodologically studies.

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