

## Weather Conditions Can Influence Rheumatic Diseases

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### ABSTRACT

In daily clinical practice, many patients attribute joint pain to weather conditions. There is little information published on this subject and most of it is contradictory. The objective of this study was to evaluate the effect of climatic conditions in rheumatic patients. The present work was carried out with patients attending the Instituto Poal de Reumatología of Barcelona and the data were analyzed by Bioibérica Farma (Spain). It was a prospective, double-blind study including 92 patients with rheumatic disorders (80 with osteoarthritis, 12 with rheumatoid arthritis) compared to a control group of 42 subjects. The evaluation of pain (Huskisson VAS) and functional capacity (Health Assessment Questionnaire, HAQ) were determined daily during one month. The climatic variables studied were temperature, humidity and barometric pressure. The results obtained have been subject to binary regression analysis. Our data demonstrate that osteoarthritic patients experience increased joint pain in response to a decrease in pressure, indicating that low atmospheric pressure conditions exacerbate joint pain in these patients. Our work also suggests that some meteorological variables affect the occurrence of pain in rheumatoid arthritis, since we have found that low temperature increases the risk of joint pain. Therefore, these data suggest that in the future it may be possible to modulate pharmacological and non-pharmacological treatments for some osteoarthritic patients depending on the predictable weather conditions in order to avoid, as much as possible, the disease-associated joint pain and functional incapacity, thus improving patients' quality of life.

### INTRODUCTION

In daily clinical practice, it is commonly known that many patients relate joint pain and/or functional incapacity to certain weather conditions. Who has never had in its practice a rheumatic patient who is able to predict when it will rain? The perceived relationship between changes in weather and pain has been recorded since the classical Roman age. Notwithstanding, the effect of different weather conditions on rheumatic diseases has been scarcely studied. After reviewing the existing literature on the matter, we confirmed that there were only a few studies conducted with an adequate methodology, correlating meteorological variables with the symptomatology of rheumatic diseases. Opinions for and against a role for meteorological conditions altering the symptomatology of rheumatic diseases, such as joint pain, functional incapacity, etc. have been expressed [1-8]. Laborde et al. [9], for instance, found that precipitation affected the degree of pain for urban osteoarthritic patients who identified weather as a pain-generating factor, and that some weather features influenced pain-related stress. However, Sibley did not find any significant correlation of weather conditions on arthritis symptoms [3], whereas, recently, Hashkes [10] observed at least a temporary improvement of patients with inflammatory arthritis which included climatic and hot springs therapy.

The aim of this study was to investigate whether there is a significant relationship between some meteorological variables (temperature, humidity and barometric pressure) and the presence of

**Table I.** Binary regression model for the relationship between joint pain (Huskisson VAS) and meteorological variables in patients with osteoarthritis (n=80). OR (Odds Ratio) is the statistic that measures the relationship between the weather variables and the pathologic conditions. 95% CI (Confidence Interval) values not lower than or not greater than 1.00 are indicative of a statistically significant relationship.

|             | OR    | 95% CI        | P value |
|-------------|-------|---------------|---------|
| Temperature | 1.042 | (0.854-1.270) | 0.688   |
| Pressure    | 0.793 | (0.647-0.972) | 0.026*  |
| Humidity    | 0.963 | (0.784-1.183) | 0.720   |

**Table II.** Binary regression model for the relationship between functional incapacity (HAQ) and meteorological variables in patients with osteoarthritis (n=80). OR (Odds Ratio) is the statistic that measures the relationship between the weather variables and the pathologic conditions. 95% CI (Confidence Interval) values not lower than or not greater than 1.00 are indicative of a statistically significant relationship.

|             | OR    | 95% CI        | P value |
|-------------|-------|---------------|---------|
| Temperature | 0.973 | (0.945-1.002) | 0.069   |
| Pressure    | 0.986 | (0.970-1.003) | 0.109   |
| Humidity    | 0.990 | (0.980-0.999) | 0.037*  |

symptomatology (joint pain and functional incapacity) in patients with certain rheumatic conditions such as osteoarthritis and rheumatoid arthritis, who attended a rheumatologic clinic in the Barcelona metropolitan area.

#### MATERIALS AND METHODS

This study included 134 consecutive outpatients with rheumatic diseases: 80 patients with osteoarthritis, 12 with rheumatoid arthritis, and a control group of 42 people without history of rheumatic diseases. The study was conducted by the Instituto Poal de Reumatología of Barcelona, together with the Joint Health Unit from the Scientific Medical Department of Bioibérica Farma (Spain) after having obtained written consent from all patients. This study consisted of a prospective, observational, double-blind study conducted in the metropolitan area of Barcelona, Spain. Barcelona is characterised by a typically Mediterranean weather.

Each patient was given a questionnaire that had to be filled in daily for 31 consecutive days; in the questionnaire the patient was requested to evaluate joint pain using a Visual Analogue Scale (Huskisson VAS) from 0 to 100 mm and to measure the degree of difficulty to conduct certain daily activities, such as getting dressed, lying and rising from bed, turning the faucet on and off, etc., by means of the Health Assessment Questionnaire, HAQ (0: being no difficulty; 1: some difficulty; 2: great difficulty and 3: impossible).

The meteorological variables considered were temperature, humidity and barometric pressure. The Joint Health Unit from the Scientific Medical Department of Bioibérica Farma collected these data on a daily basis, provided by the Catalan Meteorological Service (<http://www.gencat.es/servmet/>), throughout the study.

The statistical programs SPSS "Statistical Package for the Social Sciences" and StatXact were used for statistical examination. In the initial descriptive study the differences of the quantitative variables (Huskisson VAS, HAQ, age, weight, therapy hours) were examined with the Kruskal-Wallis and ANOVA test. The Fisher's test was used for qualitative parameters (sex, work conditions, physical exploration). In order to take into account the interrelationship between all the variables involved, a multivariate analysis was performed. The model chosen was the binary regression model, which was conducted to examine the relationship between clinical variables and meteorological parameters.

#### RESULTS AND DISCUSSION

In patients with osteoarthritis (n=80), an increase in pressure resulted in a reduced joint pain, as

determined by the Huskisson VAS, but there was no significant association with either temperature or humidity (Table I). Concerning functional incapacity (HAQ), there were borderline changes which cannot be considered conclusive from a clinical point of view (Table II). With regard to patients with rheumatoid arthritis (n=12), temperature was associated with a reduction in the Huskisson VAS, but this parameter was not changed by either pressure or humidity (Table III).

In a literature review of the effects of weather on pain, Jamison proposed several mechanisms that could account for the effects of weather changes on pain, such as certain physiologic factors associated with changes in weather that could impact people with chronic pain [11]. Changes in barometric pressure and temperature may increase stiffness in the joints and trigger subtle movements that heighten a nociceptive response. Change in barometric pressure could also cause a transient imbalance in body pressure that could sensitize nerve endings and account for increased pain preceding changes in temperature or humidity. Finally, seasonal weather patterns influence mood in some persons and thereby indirectly affect pain perception.

Our results demonstrate that osteoarthritic patients experience increased joint pain in response to a decrease in pressure, indicating that low atmospheric pressure conditions exacerbate joint pain in these patients. Our work also suggests that some meteorological variables affect the occurrence of pain in rheumatoid arthritis, since we have found that low temperature increases the risk of joint pain. Although much of the literature consists of case studies or experimental investigations with few subjects, in our study we enrolled a considerable number of patients, particularly with osteoarthritis. Hence, our results strongly support the influence of weather on joint pain in osteoarthritis, even in a Mediterranean climate, as Barcelona, although large scale studies are still required to further characterize this issue.

**Table III.** Binary regression model for the relationship between joint pain (Huskisson VAS) and meteorological variables in patients with rheumatoid arthritis (n = 12). OR (Odds Ratio) is the statistic that measures the relationship between the weather variables and the pathologic conditions. 95% CI (Confidence Interval) values not lower than or not greater than 1.00 are indicative of a statistically significant relationship.

|             | OR    | 95% CI        | P value |
|-------------|-------|---------------|---------|
| Temperature | 0.944 | (0.896-0.995) | 0.031   |
| Pressure    | 1.015 | (0.981-1.051) | 0.387   |
| Humidity    | 0.998 | (0.979-1.018) | 0.851   |

Therefore, these data suggest that in the future it may be possible to modulate pharmacological and non-pharmacological treatments for some osteoarthritic patients depending on the predictable weather conditions in order to avoid, as much as possible, the disease-associated joint pain and functional incapacity, thus improving patients' quality of life.

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