



# Modifiable Risk Factors of Plantar Fasciitis in Non-Athletic Patients and Proposal of a New Objective Assessment System – RKISP

## *Fatores de risco modificáveis para fasciíte plantar em pacientes não atletas e proposta de um novo sistema de avaliação objetiva – RKISP*

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### Abstract

**Objective** To determine the modifiable risk factors associated with severity of plantar fasciitis and to formulate an objective scoring system for indexing plantar fasciitis in the non-athletic population.

**Methods** This was a prospective observational study. The main outcome measure was the association of a modifiable risk factor, which was measured with the Pearson coefficient (R-value) and the level of significance, which was kept as  $p < 0.05$ .

**Result** In a sample size of 50 patients, the body mass index (BMI) and ill-cushioned shoes were found to be significantly associated with pain in plantar fasciitis. All the other risk factors were either non-modifiable or had no significant association.

**Conclusion** Based on available data and further interpretation, an index was formulated, named as Ranjeet-Kunal Index for Scoring Plantar fasciitis (RKISP), which can be successfully used for not only grading plantar fasciitis but also prognosticating the conservative management of the same, thus deciding the modality of treatment.

### Keywords

- ▶ risk factors
- ▶ plantar fasciitis
- ▶ chronic heel pain

### Resumo

**Objetivo** Determinar os fatores de risco modificáveis associados à gravidade da fasciíte plantar e formular um sistema objetivo de pontuação para indexação da doença na população não atlética.

**Métodos** Estudo observacional prospectivo. A principal medida de desfecho foi a associação de um fator de risco modificável, mensurada pelo valor de R (coeficiente de Pearson) e pelo nível de significância de  $p < 0,05$ .

**Resultados** Em uma amostra de 50 pacientes, o índice de massa corporal (IMC) e calçados com amortecimento inadequado foram associados de maneira significativa à dor na fasciíte plantar. Todos os demais fatores de risco eram não modificáveis ou não apresentaram associação significativa.

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**Palavras-chave**

- ▶ fatores de risco
- ▶ fasciíte plantar
- ▶ dor crônica

**Conclusão** Com base nos dados à disposição e sua interpretação, um índice, denominado Índice de Ranjeet-Kunal de Pontuação da Fasciíte Plantar (RKISP, em inglês), foi formulado e utilizado com sucesso não apenas na classificação da fasciíte plantar, mas também na determinação do prognóstico de seu tratamento conservativo, auxiliando a escolha da modalidade terapêutica.

**Introduction**

Plantar fasciitis (PF) is the most common cause of chronic plantar heel pain.<sup>1</sup> It is a degenerative syndrome of the plantar fascia resulting from repeated trauma at its origin on the calcaneus. Flexible foot, tibia vara, ankle equinus, rear foot varus, forefoot varus, compensated forefoot valgus, and limb length inequality can cause an abnormal pronatory force. Increased pronation produces additional stress on the anatomic central band of the plantar fascia and may ultimately lead to plantar fasciitis.<sup>2</sup> Running has also been found to be a risk factor for developing plantar fasciitis.<sup>3</sup> Weight gain, occupation-related activity, anatomical variations, poor biomechanics, overexertion, and inadequate footwear are contributing factors for the same.<sup>4</sup>

Excessive BMI (especially weight as the contributing factor) has a strong association with PF in the non-athletic population.<sup>5,6</sup> Risk factors can be broadly divided into intrinsic and extrinsic factors. Intrinsic factors can be further subdivided into anatomic and biomechanic, while extrinsic factors include poor alignment, hard surface, walking barefoot, prolonged weight bearing, and low-quality footwear. Anatomic factors include obesity, pes planus, pes cavus and shortened Achilles tendon, and biomechanic factors include over-pronation, limited dorsal ankle flexion, weak intrinsic muscles, and weak plantar flexor muscles.<sup>5,7</sup>

There is no specific scoring system catered to plantar fasciitis for severity of illness and assessment with treatment. Though other common scores, such as the visual analog scale (VAS), the Foot and Ankle Ability Measure (FAAM), the Foot and Ankle Disability Index (FADI), and the American Foot and Ankle Society (AOFAS), have been traditionally used for objective and subjective assessments of plantar fasciitis, they are either too generalized for the foot and ankle (FAAM, FADI and AOFAS) or to pain anywhere else in body (VAS).<sup>8-11</sup>

In the present study, we have attempted to find out modifiable risk factors that could be used for assessment of plantar fasciitis and using those risk factors to formulate a scoring system for quantifying the problem at presentation and in follow-up.

**Methodology (►Figure 1)**

In a study conducted at a tertiary health care facility at LHMC, New Delhi, India, "To evaluate various causes of Heel Pain and Efficacy of Autologous Platelet Rich Plasma Injection in Cases of Proximal Plantar Fasciitis Which Have Failed Conservative Management," the modifiable risk factors were studied with help of Pearson coefficient (R).

Since the most frequently reported complaint in plantar fasciitis is chronic heel pain, an attempt was made to find an association between the VAS and risk factors. Body mass index, fitting of shoes, cushioning of shoes, and level of activity were considered as variables that could affect the pain in plantar fasciitis based on the available literature. Age and sex were considered non-modifiable risk factors along with all the other anatomic factors requiring surgical correction. On the basis of significant association, an index was formulated for objective assessment of plantar fasciitis at presentation and following treatment. All those risk factors that are modifiable but need surgical intervention for modification were not considered modifiable due to technical reasons for modifications. Body mass index (values corresponding to obesity I and II i.e., >24.99 and >29.99, by WHO) an VAS are quantitative variables and others are qualitative variables;<sup>12,13</sup> therefore, a quantification was done based on the available literature for grading in the scoring system. On the basis of significance of the above mentioned associations with the symptomatology, a novel index system for quantitative objective assessment of plantar fasciitis is proposed. The purpose of the objective assessment is to create an unbiased assessment system for quantification of the disease during its presentation and treatment process, which cannot be achieved with subjective assessment, that tends to quantify the "problem" associated with disease rather than the disease and may have high inter-observer and intraobserver variation.

**Results**

A total of 50 patients were studied, 23 male and 27 female, with a mean age of 41.94 years and standard deviation (SD) of 8.94. The mean BMI was 28.79 (29.82 for females and 27.57 for males) kg/m<sup>2</sup>. The Pearson correlation of various factors with VAS is shown in ►Table 1.

Body mass index showed a strong positive correlation with VAS, with an R-value of 0.64 and a *p*-value < 0.0001. For footwear, well-fitting shoes showed a negative correlation, with an R-value of - 0.16 and a *p*-value of 0.26, thus showing no significant association. For cushioning of shoes, well-cushioned shoes showed a strong negative correlation, with an R-value of - 0.41, showing a significant association with symptoms of patient, with a *p*-value of 0.0033. Level of activity was divided in 3 tiers: sedentary lifestyle, moderate activity, and heavy activity, and though there was a weak positive correlation, with R-value of 0.05, it showed no significant association with symptomatology (*p*-value = 0.72)

**Table 1** R-value (Pearson coefficient) and level of significance of association between disease severity (pain) and modifiable risk factors

	R-value	p-value
BMI	0.64	< 0.0001
Well-fitting shoes	-0.16	0.26
Well cushioned shoes	-0.41	0.0033
Level of activity	0.05	0.72

Abbreviation: BMI, body mass index.

Based upon the significance levels, a novel index system for quantitative assessment of plantar fasciitis was proposed based on VAS, BMI levels for obesity I and obesity II, and cushioning of shoes (discussed in detail in the Discussion section).

## Discussion

Plantar fasciitis is a cause of chronic heel pain. The chronicity is what makes a person accommodating to the pain and usual late presentations, but what physicians often fail to understand is that not only the disease is chronic and so can be the risk factors—which on one hand may not cause any significant distress to the patient because of chronicity, while on other can be a significant contributor to the progression of disease process. We can understand this in terms of the aforementioned risk factors, such as obesity and ill-cushioned shoes. The shoe a man wears is often a statement of his comfort rather than his status, and, thus, well-cushioned shoes may look inviting to be worn but the person tends to get accommodated to his or her footwear with time—which acts as a slow poison for the plantar fascia and works unremarkably. Similarly, obesity is often slow to acquire and the patient often gets used to it until it starts causing severe health problems, which is often not found in young grade I obesity patients. Thus, it can be understood that though chronicity is itself a statement of plantar fasciitis, this chronicity is the statement of otherwise neglected risk factors, such as ill-cushioned shoes (which in many cases can be rather comfortable for the patient to wear) and obesity—especially in the new onset and early phases—when it is causing less impacts on health. It should also be understood that this scoring system is for the non-athletic population, who usually do not suffer wear and tear of plantar fascia.

Now, let us understand each of the individual components of Ranjeet-Kunal Index for Scoring Plantar fasciitis (RKISP). Based on the above data, it can be understood that BMI, as indicated by earlier studies, has a strong positive correlation with the symptomatology and the VAS in plantar fasciitis. Since obesity shows a very significant association, obesity can be further divided on the basis of the WHO grading of BMI for the Indian population, with BMI > 24.99 defined as obesity I and > 29.99 as obesity II.<sup>12</sup> This grading is for Asian population and might be different in the western population,

**Table 2** Ranjeet-Kunal Index for Scoring Plantar fasciitis (RKISP) (*The patient needs to have a chronic heel pain with a visual analog scale [VAS] > 4.5 in order to qualify for being evaluated by the RKISP*). For more details, see text)

BMI	> 24.99 (obesity I)	1
	> 29.99 (obesity II)	2
Worn out cushion		1
VAS	> 4.5	1
	> 7.5	2
Total		5

Abbreviation: VAS, visual analog scale.

as the grading of obesity is different in their scenario and can be modified based on the WHO grading of obesity for the western population. Based on the severity of obesity, grading in the index can be done by assigning 1 point to the former and 2 points to the latter.

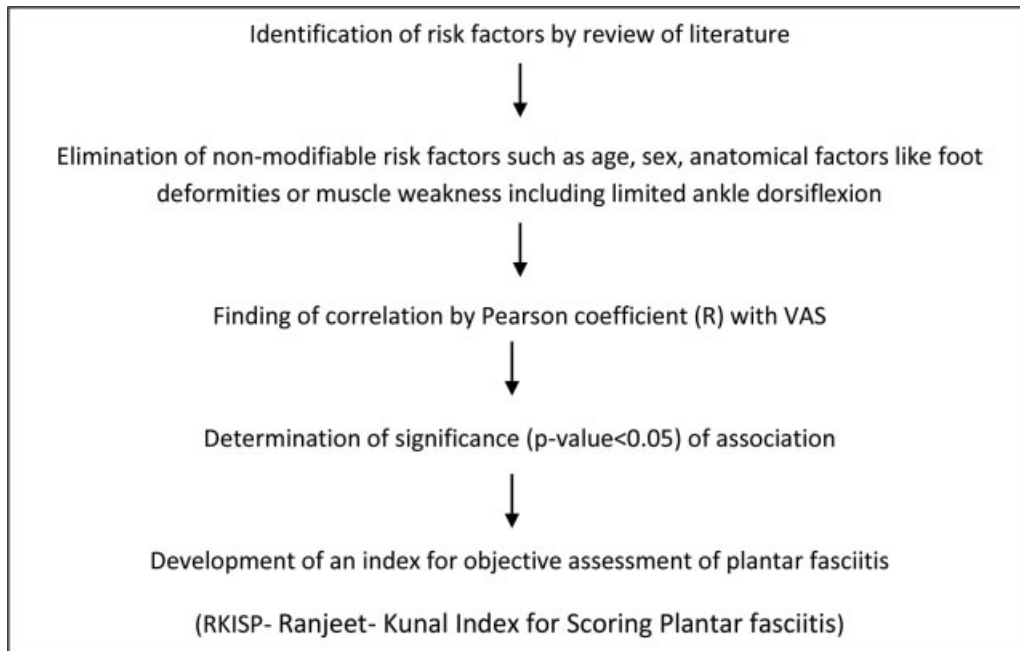
The VAS is a scale that has been commonly used for quantifying pain in patients with different etiologies. A VAS > 7.5 is a measure of severe torment for the patient.<sup>13</sup> A VAS < 4.5 usually defines unremarkable pain and, hence, has not been included in the index. Severe pain, with VAS > 7.5, has been assigned 2 points in the score.

Since cushioned footwear showed a strong negative correlation to the symptomatology, it becomes obvious that changing an ill-cushioned shoe will provide a dramatic response in both prevention and treatment of symptomatology of plantar fasciitis. A change in footwear, thus, becomes an obvious part of management, and, not only that, it shall become an important part in the quantifying assessment of the disease.

As shown in ►Table 2, three parameters have been considered for objective assessment of plantar fasciitis in the pre and posttreatment periods. The RKISP includes these three parameters that add up to a maximum value of 5 and a minimum value of 1 (the minimum criteria for indexing was considered VAS > 4.5, which is the criteria for remarkable pain by Hawker et al.<sup>13</sup>). The RKISP can be used for grading plantar fasciitis.

## Implications of the RKISP

- Objective assessment at the time of presentation of plantar fasciitis and at consecutive follow-ups. Objective assessment not only helps in unbiased quantification of disease but also leads to uniformity of treatment and research protocols.
- Grading of plantar fasciitis. Grading can be done based on additional parameters which may worsen the pain in plantar fasciitis patients.
- Prognosis of conservative management is inversely proportional to index. This can be understood in a way that a higher index is prone to have more conservative ways of management that can be used. For example, a patient that presents with an index of 2 with a VAS of 9/10 but wears a well-cushioned shoe and has a BMI < 24.99 will have a



**Fig. 1** Flowchart of the methodology employed to determine the objective scoring system for evaluation of plantar fasciitis in non-athletic patients.

worse prognosis than a patient with an index of 4 wearing worn out shoes and classified with obesity II with a VAS of 5 with conservative management.

## Conclusion

An objective assessment can be achieved with RKISP, quantifying the disease in terms of problem and risk factors. This index can be further used for grading and prognosticating plantar fasciitis at the time of presentation and during treatment, as explained above. Further research needs to be done on larger samples for validation of RKISP. The authors also recommend the use of objective assessment systems for plantar fasciitis in addition to the widely used subjective systems.

## Conflict of Interests

The authors have no conflict of interests to declare.

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