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Efficacy of a Prescription Diet Containing Achyranthes japonica (5%) on Degenerative Joint Disease in Working Dogs

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Abstract:
Degenerative joint disease (DJD) accounts for a significant proportion of musculoskeletal disorders in working dogs, such as German Shepherds, and is characterized by chronic inflammation of joints and cartilage. Although various functional feeds and supplements are commercially available, clinical research evaluating their therapeutic efficacy remains insufficient. In this study, working dogs diagnosed with DJD were fed a prescription diet containing 5% Achyranthes japonica (Radix Achyranthis) for 12 weeks in place of standard feed. Physical examinations, gait assessments, blood tests, and diagnostic imaging (X-ray, CT, MRI) were performed at 6-week intervals (weeks 0, 6, and 12). Body weight decreased by an average of 9.2% (range: 8.4%–11.2%), and visual gait performance improved by one grade in all subjects. WBC counts and C-reactive protein (CRP) levels remained within normal reference ranges without noticeable changes. However, transforming growth factor-beta (TGF-β) levels decreased by 40%–50% at 6 weeks before returning near baseline at 12 weeks. Radiographs showed no overt structural changes, CT confirmed minor degenerative progression, and MRI demonstrated preserved muscle mass without acute inflammatory changes. In conclusion, dietary intake of a 5% Achyranthes japonica diet supports weight management, provides anti-inflammatory/analgesic effects, improves gait, and retards osteoarthritis progression, representing a viable conservative option alongside medical therapy when surgery is unfeasible.
***Key Word**: Degenerative joint disease; Achyranthes japonica; Veterinary nutrition; Cytokines; Working dogs, Osteoarthritis.*

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I. Introduction

Arthritis is one of the most common musculoskeletal diseases in adult dogs, affecting approximately 20% [1]. It involves pathological changes across the entire joint structure—including subchondral bone, periarticular ligaments, joint capsule, synovium, and surrounding muscles—causing pain originating from multiple tissues [1]. Degenerative joint disease (DJD) is the most prevalent non-inflammatory joint disorder, characterized by chronic, progressive cartilage destruction leading to cartilage erosion and proliferative changes in surrounding tissues [2-4]. Affected joints develop osteophytes alongside structural remodeling, causing chronic pain, synovial effusion, and periarticular fibrosis [4].

Unlike companion pets, working dogs (such as military, police, search and rescue, and guide dogs) undergo intense physical training and high workloads. Group housing, exposure to seasonal temperature extremes, potential nutritional variances, and physical stress increase their vulnerability to musculoskeletal diseases. Limitations in veterinary facilities and personnel often prevent prompt intensive care, resulting in prolonged recovery or early retirement. Consequently, early joint damage frequently progresses unnoticed to severe stages.

In military working dogs, musculoskeletal management relies heavily on analgesics and rest; when recovery is insufficient, dogs are retired. Developing practical, non-invasive preventive and management strategies for entire working dog populations is crucial. Nutritional therapy in veterinary medicine offers a non-invasive, cost-effective solution that avoids invasive procedures and animal transport while delivering long-term prophylactic benefits.

Although commercial joint diets exist, clinical evaluations via oral administration in working dogs are scarce. Most previous studies injected high active compound concentrations directly into intra-articular spaces in laboratory rodents, limiting their real-world applicability [5-8]. Therefore, this study evaluated the therapeutic effects of an oral prescription diet containing 5% Achyranthes japonica in working dogs with DJD over a 12-

week period using physical exams, blood/cytokine analyses, and imaging (X-ray, CT, MRI) to confirm its potential as a conservative therapeutic alternative.

II. Materials and Methods

1. Materials

Animals and Screening: From 200 military working dogs presented to a military veterinary hospital, 20 dogs showing gait impairment were screened. Diagnostic imaging identified 5 dogs with moderate DJD. Following adoption (N=1) and death (N=1), 3 dogs completed the 12-week trial.

Figure 1 : Experimental group screening & selecting process

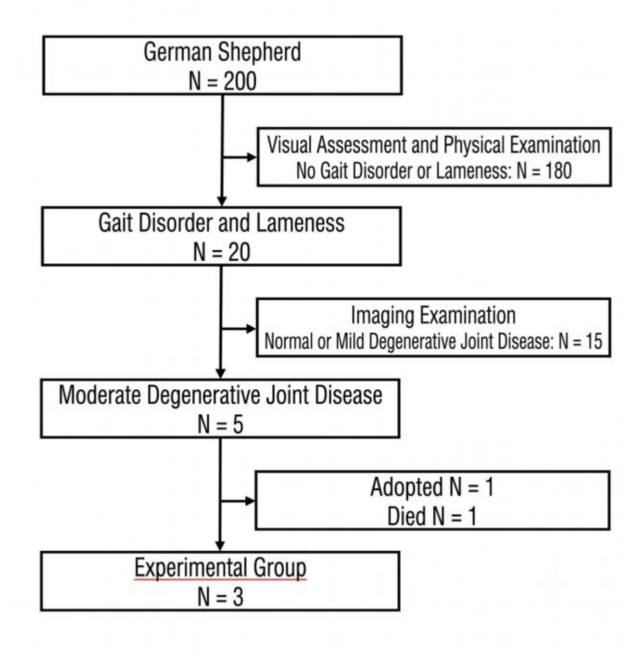


Table 1 : List of Experimental Groups

Subject	Species / Breed	Age (years)	Gender
Patient 1	German Shepherd	12	Female
Patient 2	German Shepherd	11	Female
Patient 3	English Springer Spaniel	4	Male

Diet: A prescription diet supplemented with 5% Achyranthes japonica (Radix Achyranthis) and chondroitin for joint/cartilage protection was fed for 12 weeks.

2. Methods

Physical & Gait Assessment: Body weight and visual gait grade (6-point scale) were recorded at weeks 0, 6, and 12.

Table 2 : Visual gait evaluation criteria

Grade	Evaluation Criteria
Grade 1	Mild lameness observable during weight shifting at a fast gait.
Grade 2	Lameness detectable by expert observers during weight bearing.
Grade 3	Head-bobbing lameness evident during weight bearing.
Grade 4	Distinct and pronounced lameness during weight bearing.
Grade 5	Severe lameness; limb touches ground with toes only.
Grade 6	Non-weight-bearing lameness even when standing.

Blood & Cytokine Analyses: Blood collected at weeks 0, 6, and 12 was evaluated for WBC (Abaxis HM5) and CRP (Bionote Vcheck). Serum cytokines (IL-6, IL-10, TNF-α, TGF-β) were measured via ELISA (GC Labs).

Diagnostic Imaging: Radiography (VD, Lateral views), CT, and MRI were performed at weeks 0 and 12.

III. Result

1. Physical and Gait Evaluation

Over 12 weeks, experimental subjects lost 3.5 kg (11.2%), 1.5 kg (8.57%), and 2.1 kg (8.4%) of body weight, respectively, with an average reduction of 2.3 kg (9.2%). Visual gait scores improved by 1 grade across all subjects.

Table 3 : Weight Change in Experimental Groups.

Subject	0 week (kg)	6 week (kg)	12 week (kg)	Weight Change (%)
Patient 1	31.0	29.5	27.5	-11.2% (-3.5 kg)
Patient 2	21.0	20.0	19.5	-8.57% (-1.5 kg)
Patient 3	25.0	24.0	22.9	-8.40% (-2.1 kg)

Figure 2 : Weight change in experimental groups.

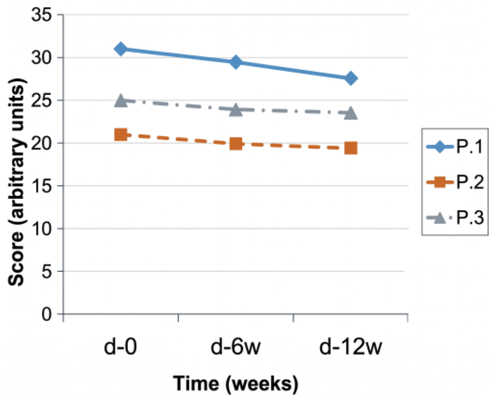


Table 4 : Changes in Visual Gait Evaluation Grade of the Experimental Groups

Subject	0 week	6 week	12 week	Gait Improvement
Patient 1	3 / 6	3 / 6	2 / 6	Improved 1 Grade
Patient 2	4 / 6	3 / 6	3 / 6	Improved 1 Grade
Patient 3	3 / 6	3 / 6	2 / 6	Improved 1 Grade

2. Blood and Cytokine Analysis

WBC and CRP remained within reference ranges. Serum concentrations of IL-10 (<0.220 ng/mL), IL-6 (<0.204 ng/mL), and TNF-α (<7.800 pg/mL) were below lower detection thresholds. TGF-β decreased significantly at 6 weeks (40%–50% reduction) and returned near baseline levels at 12 weeks.

Table 5 : Changes in the Results of the WBC Test in the Experimental Group (10^9/L).

Subject	0 week	6 week	12 week
Patient 1	12.4	12.9	12.7
Patient 2	13.7	13.2	13.4
Patient 3	13.6	13.3	13.5

Table 6 : Changes in the Results of the C-Reactive Protein (CRP) Test (mg/L).

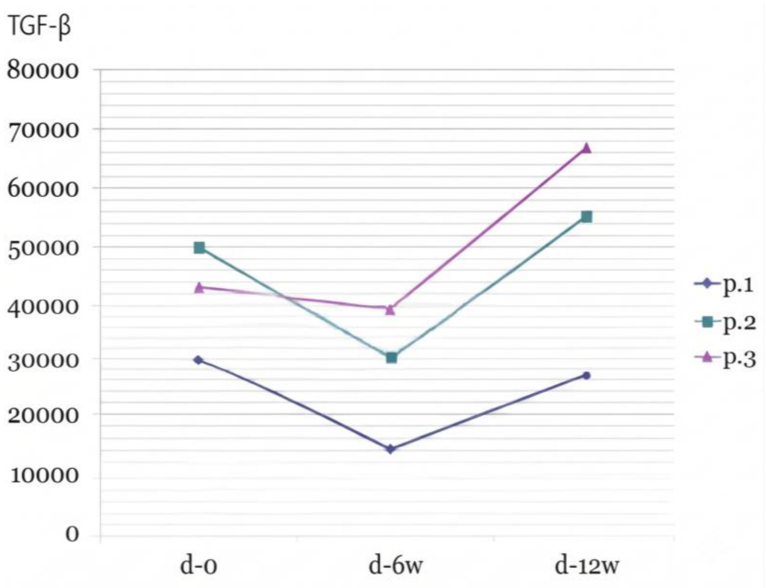
Subject	0 week	6 week	12 week
Patient 1	13.0	12.0	13.0
Patient 2	14.0	13.0	13.0

Subject	0 week	6 week	12 week
Patient 3	15.0	13.0	14.0

Table 7 : Changes in the Results of the Cytokine Test in the Experimental Group.

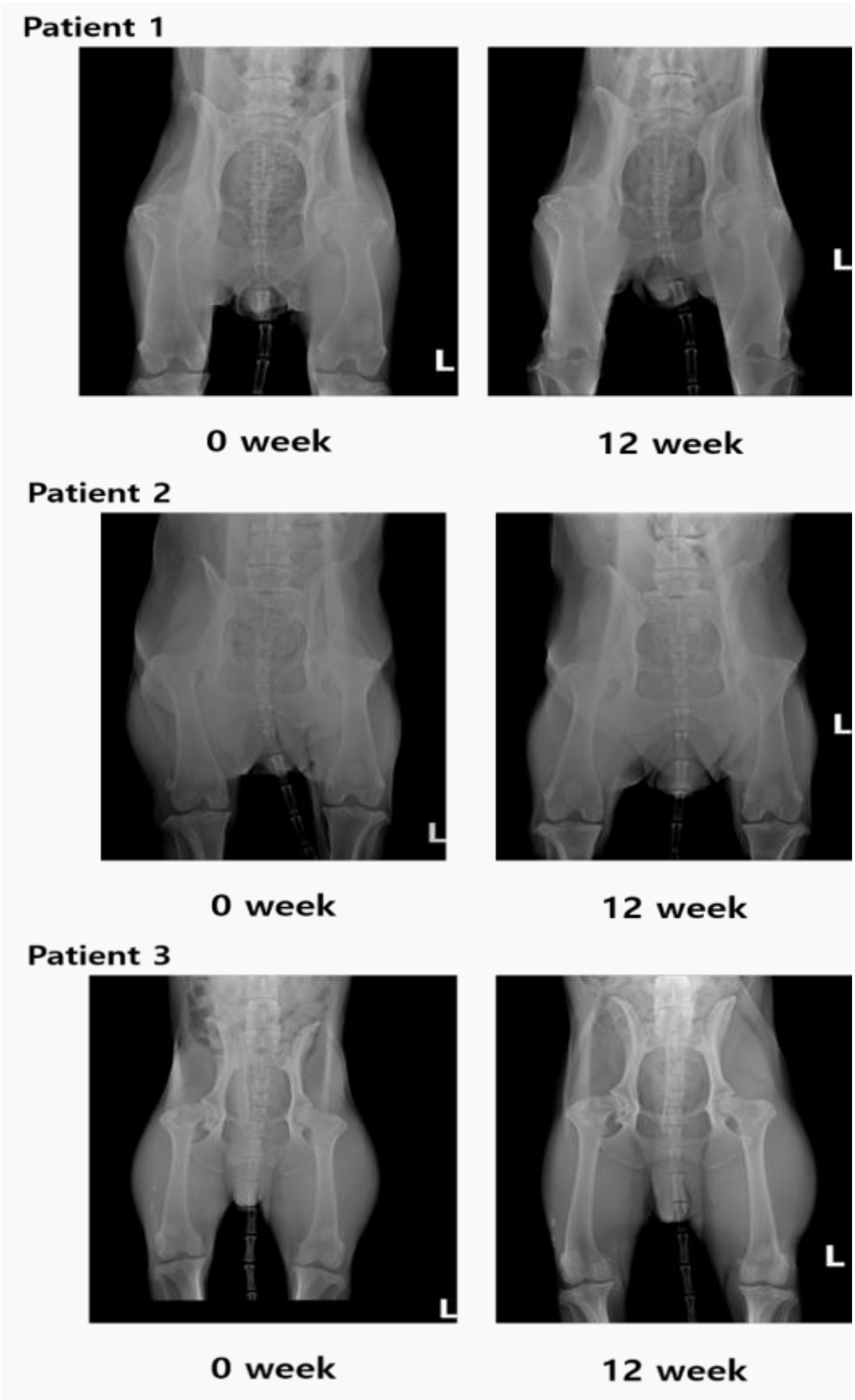
Subject	Week	IL-10 (ng/mL)	IL-6 (ng/mL)	TGF-β (pg/mL)	TNF-α (pg/mL)
Patient 1	0	<0.220	<0.204	29,883.262	<7.800
	6	<0.220	<0.204	14,115.040	<7.800
	12	<0.220	<0.204	26,845.962	<7.800
Patient 2	0	<0.220	<0.204	49,891.238	<7.800
	6	<0.220	<0.204	30,493.610	<7.800
	12	<0.220	<0.204	55,229.241	<7.800
Patient 3	0	<0.220	<0.204	43,220.188	<7.800
	6	<0.220	<0.204	39,324.048	<7.800
	12	<0.220	<0.204	66,787.800	<7.800

Figure 3 : Changes in the results of the Cytokine test (TGF-β) in the experimental groups.



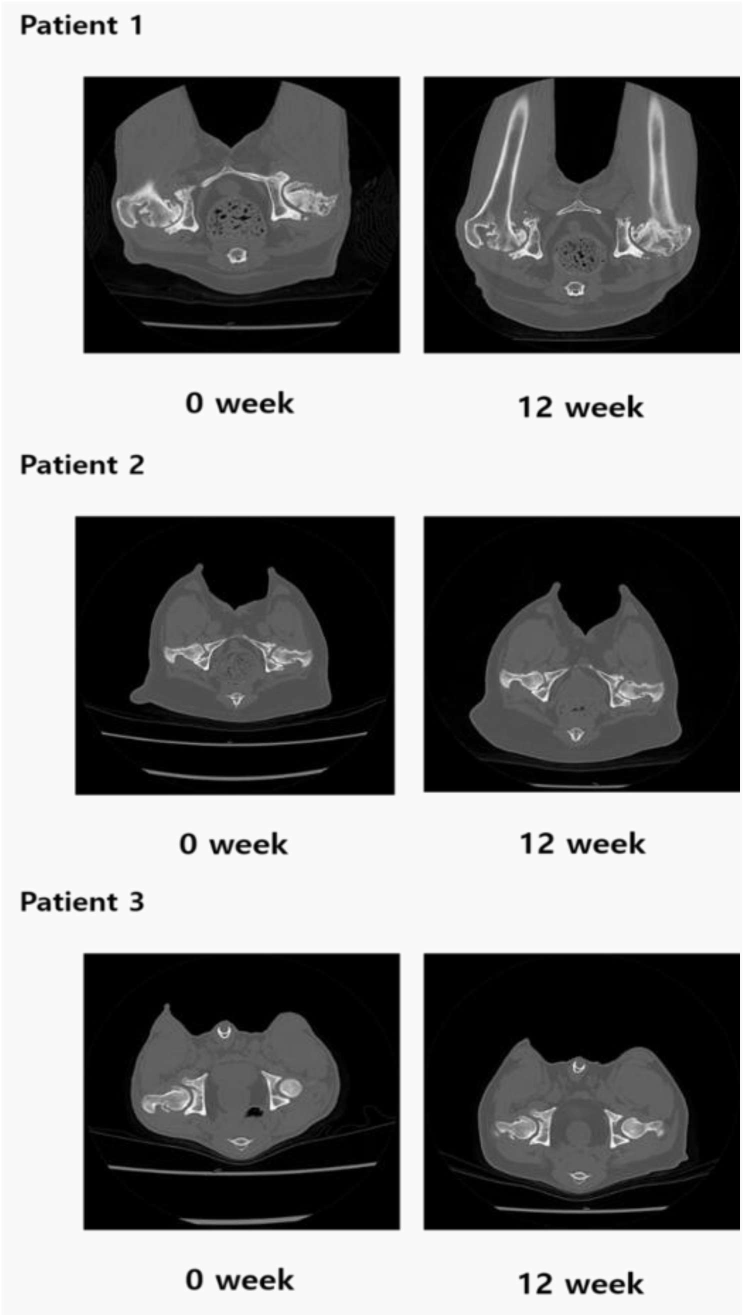
3. Diagnostic Imaging Findings

Figure 4 : X-ray results (Ventrodorsal View) of Patient 1 at 0 and 12 weeks.



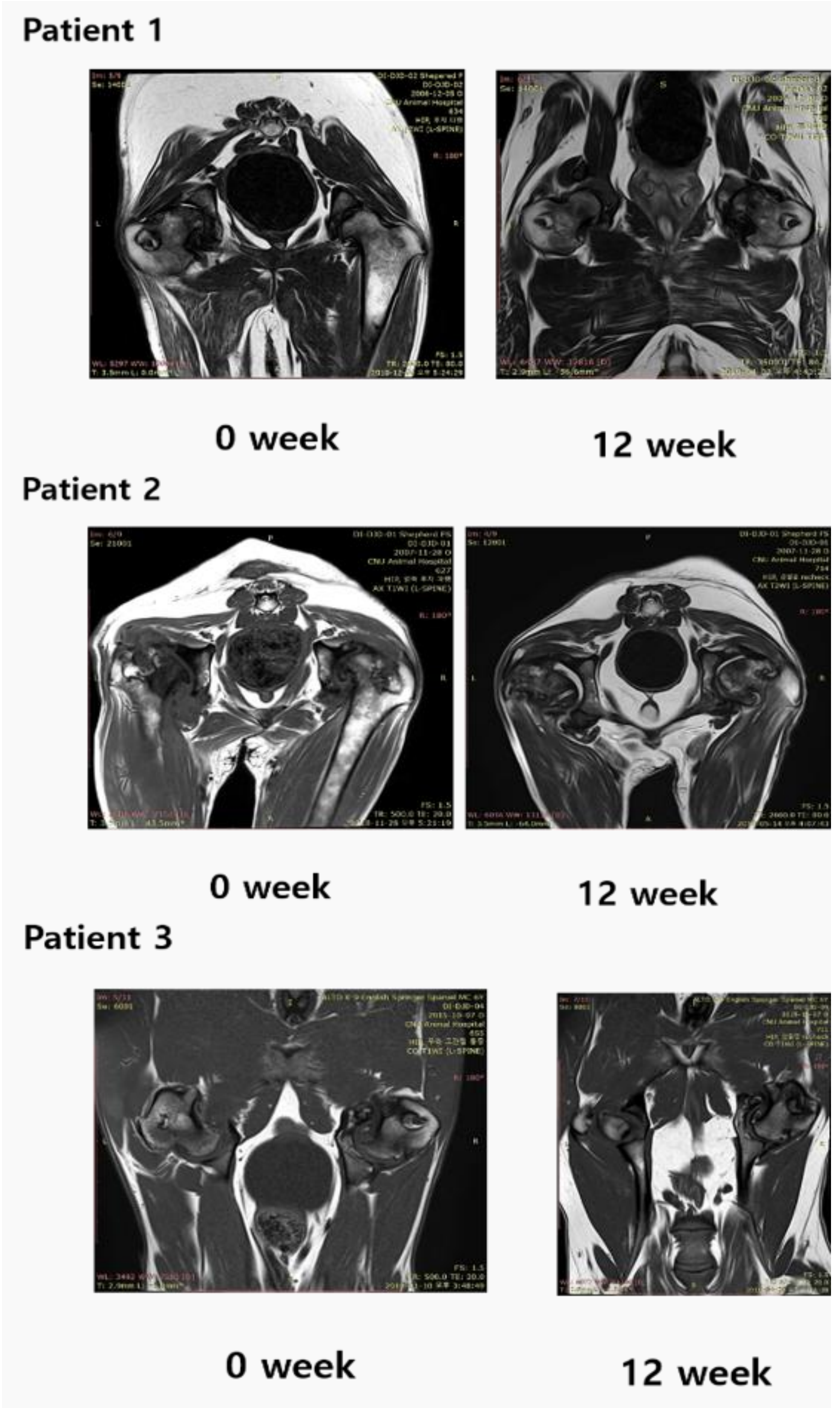
X-ray: Ventrodorsal and lateral view X-rays obtained at 0 and 12 weeks showed no overt structural changes between weeks 0 and 12 across subjects.

Figure 5 : CT results of Patient 1 at 0 and 12 weeks.



CT : In Patient 1, CT images demonstrated severe degenerative changes including subchondral sclerosis, remodeling, osteophytes, and cyst formation around the femoral head, femoral neck, and acetabular rim. Comparing 0 and 12 weeks showed only minimal progression of DJD in bilateral coxofemoral joints. Patient 2 showed slight degenerative changes around the femoral head/neck without major alterations in overall acetabulum or thigh muscles. Patient 3 showed stable joint structure with minimal degenerative progression.

Figure 6 : MRI results of Patient 1 at 0 and 12 weeks.



MRI : MRI evaluations at 0 and 12 weeks confirmed no significant decrease in muscle mass across all experimental subjects.

IV. Discussion

The 12-week dietary intervention using a 5% Achyranthes japonica diet led to consistent body weight reduction (average 9.2%) and gait improvement. Despite activity limitations from DJD, the high-protein, low-calorie prescription diet facilitated weight loss while preserving muscle mass. Obesity exacerbates mechanical joint strain, so weight reduction directly alleviates joint load and slows DJD progression [9, 10].

Gait scores improved by 1 grade due to reduced mechanical strain and anti-inflammatory/analgesic properties of Achyranthes japonica. WBC and CRP levels remained stable, reflecting the chronic localized nature of DJD where systemic acute-phase markers are insensitive [11-13].

Serum TGF-β decreased by 40%–50% at week 6, similar to glucosamine efficacy studies in arthritic rats [8]. The week 12 rebound in TGF-β may reflect increased physical activity following initial pain relief, increasing joint loading [17]. Diagnostic imaging confirmed retardation of disease progression rather than structural reversal. Utilizing Achyranthes japonica as an oral adjunctive therapy reduces reliance on long-term NSAIDs, offering a scalable, non-invasive management strategy for working dog populations [18, 19].

V. Conclusion

Dietary supplementation with 5% Achyranthes japonica in working dogs with DJD resulted in weight reduction (mean 9.2%), gait improvement, muscle mass preservation, temporary TGF-β suppression, and delayed structural degeneration. This diet represents an effective conservative management option for canine DJD.

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