

Ski Conditioning Program

Knee Strength & Injury Prevention | 12-wk Pre-Season Plan

55 years old | Masters Athlete | No Current Injury | Goal: Ski Season Prep | Program: 12-wks | Freq: 4x / week



Program Overview

Alpine skiing places exceptional demands on the knee joint — sustained quadriceps contractions in a semi-flexed position (30–90°), rapid eccentric loading during moguls and variable terrain, rotational forces through the tibio-femoral joint, and prolonged duration of effort across a full ski day. At 55, several physiological factors deserve specific attention: reduced type II muscle fibre mass, slower neuromuscular recruitment, diminished proprioception, and longer recovery requirements. This 12-week program is structured across **three progressive phases** to build the knee strength, stability, and power required for safe, high-performance skiing.

Primary targets	Quadriceps (VMO emphasis), hamstrings, gluteal complex, hip abductors, calf-ankle complex
Secondary targets	Core stability, hip flexor mobility, thoracic rotation — all critical for ski posture
Key principles	Progressive overload; eccentric control; single-leg stability; sport-specific positions
Age considerations	Longer warm-up; higher protein intake post-session; 48-hr recovery between heavy days; sleep prioritised
Equipment needed	Squat rack or dumbbells, leg press, resistance bands, step/box, foam roller, balance disc

Phase 1 — Foundation & Activation (Weeks 1–4): Base Strength, movement quality, neuromuscular control

The foundation phase establishes movement patterns, identifies any asymmetries, and builds baseline knee extensor and gluteal strength. Volume is moderate; intensity is controlled. Emphasis on form over load — correct patterns now prevent compensations on snow.

Strength Sessions (3x per week – Mon / Wed / Fri)

Exercise	Sets x Reps	Tempo / Rest	Coaching Cue
Goblet Squat	4 x 12	3:1:3 / 90 sec	Chest tall; knees track toes; depth to 90 degrees
Romanian deadlift (dumbbells)	3 x 12	3:1:2 / 90 sec	Hip hinge; soft knee; feel hamstring load
Step-up (20 cm box) – alternating	3 x 10 each	Controlled / 60 sec	Drive through heel; full hip extension at top
Lateral band walk	3 x 15 each	Slow / 45 sec	Band above knees; hips level; don't hike pelvis
Wall squat hold (isometric, 60 degrees)	4 x 30 sec	Hold / 60 sec	Critical ski position; VMO burn is the goal

Single-leg balance; flat surface	3 x 30 sec each	Eyes open / 30 sec	Minimal sway; slight knee bend; arms relaxed
Calf raise – double leg (step edge)	3 x 15	2:1:3 / 60 sec	Full ROM; slow descent; controlled
Glute bridge (double leg)	3 x 15	2:1:2 / 45 sec	Drive hips fully; squeeze glutes at top

Mobility & Recovery Session (1x per week – Saturday)

Exercise	Sets x Reps	Tempo / Rest	Coaching Cue
Hip flexor lunge stretch	3 x 45 sec each	Static / relaxed	Pelvic neutral; lean forward to intensify
90/90 hip rotation stretch	3 x 45 sec each	Static	Sit tall; weight evenly distributed
Foam roller – quads, ITB, calves	2 min each area	Slow rolling	Pause on tender spots; breathe through
Thoracic rotation (seated or on roller)	3 x 10 each way	Controlled	Ski posture requires upper back mobility
Ankle circles & dorsiflexion mobility	3 x 10 each	Slow & full range	Critical for ski boot fit and deep squat

Aerobic base	Add 2–3 × 30-min moderate cycling or brisk walking on off-days (Zone 2 HR ~65% HRmax)
Advance when	Wall squat 60 sec pain-free; step-up 10 kg dumbbell each hand; single-leg balance 30 sec stable

Phase 2 — Strength & Ski-Specific Loading (Weeks 5-9): Heavy load, single-leg dominance, eccentric control

Phase 2 is the primary strength-building block. Loads increase substantially; single-leg work becomes the dominant modality. The eccentric phase is emphasised throughout — skiing is predominantly an eccentric task, with the quadriceps working hard to absorb rather than produce force. Wall squat holds are progressed to match ski-specific joint angles (60–80°).

Heavy Strength Sessions (3x per week – alternate days)

Exercise	Sets x Reps	Tempo / Rest	Coaching Cue
Barbell back squat or leg press	4 x 6-8	3:1:3 / 2 min	85% effort; full depth; no knee cave
Bulgarian split squat (rear foot elevated)	4 x 8 each	3:1:2 / 90 sec	Front shin vertical; eccentric control
Single-leg Romanian deadlift	3 x 8 each	3:1:2 / 90 sec	Hinge from hip; back flat; soft stance knee
Step-down (30cm) – eccentric focus	4 x 8 each	4 sec descent / 60 sec	Lower single-leg slowly; control knee tracking
Wall squat hold – weighted (70-80 degrees)	4 x 45-60 sec	Hold / 90 sec	Target ski-specific joint angle; add DB load
Lateral lunge with reach	3 x 10 each	Controlled / 60 sec	Ski lateral edge loading pattern; depth to 90°

Nordic curl progression (eccentric)	3 x 5-8	Slow 4 sec / 2 min	Hamstring injury prevention; critical for ACL risk
Single-leg balance – foam pad	3 x 30 sec each	Eyes closed / 30 sec	Eyes closed challenges proprioception maximally
Hip abduction machine / band	3 x 15	2:1:2 / 45 sec	Abductors stabilise knee in dynamic ski movements
Calf raise – single leg on step	3 x 12 each	2:1:3 / 60 sec	Add weight once 15 reps controlled

Power / Agility Session (1x per week – Saturday)

Exercise	Sets x Reps	Tempo / Rest	Coaching Cue
Box jump (bilateral, 30cm) – land soft	3 x 5	Explosive up / 2 min	Absorb landing for 2 sec; no knee collapse
Lateral shuffle – cone drill (5 m)	4 x 20 sec	Fast / 90 sec	Low athletic stance throughout
Jump squat (bodyweight)	3 x 8	Explosive / 90 sec	Full squat depth; drive arms; soft landing
Ski-tuck sprint on bike or ski erg	6 x 30 sec	Explosive / 90 sec	Mimic ski tuck position; cardiovascular peak

Load targets	Leg press: 1.5–2× bodyweight for 8 reps; Bulgarian split squat: 20 kg dumbbell each hand by end of Phase 2
Recovery	48 hrs minimum between heavy sessions; prioritise 8 hrs sleep; protein ≥1.6 g/kg/day
Advance when	Step-down 4 sec controlled × 8 reps; box jump landing stable; wall squat 60 sec at 80° with load

Phase 3 — Power, Agility & Ski-Specific Prep (Weeks 10-12): Explosive strength, sport transfer, peak readiness

The final phase transitions-built strength into skiing-relevant power and neuromuscular reactivity. Volume reduces slightly; intensity and velocity increase. Sessions should feel demanding but recovery should be rapid — the goal is arriving at the snow rested, strong, and reactive. The final week (Week 12) is a planned deload before the first ski day.

Power Strength Sessions (3x per week)

Exercise	Sets x Reps	Tempo / Rest	Coaching Cue
Trap bar deadlift – explosive concentric	4 x 5	Explosive up / 2 min	Heavy load; max intent; control descent
Single-leg box jump (step-up jump)	3 x 5 each	Explosive / 2 min	Drive through single leg; land balanced
Lateral bound – single leg to single leg	4 x 6 each	Explosive / 90 sec	Mimics edge-to-edge ski transfer; stick landing
Skater squat (single-leg squat to rear)	3 x 8 each	3:1:1 / 90 sec	Eccentric control; build to add load
Reverse lunge with rotation (DB)	3 x 10 each	Controlled / 60 sec	Ski turn = hip hinge + rotation; integrate both

Wall squat hold – 90° position	3 × 60 sec	Hold / 90 sec	Max ski-specific demand; load if tolerated
Depth drop to stick (bilateral)	3 × 5	From 30 cm box / 2 min	Step off; absorb quietly; freeze on landing

Agility & Reactivity Session (1x per week)

Exercise	Sets x Reps	Tempo / Rest	Coaching Cue
Trap bar deadlift – explosive concentric	3 × 30 sec	Fast / 60 sec	Foot speed; low centre of gravity
Resisted lateral shuffle (band)	4 × 20 m	Hard / 90 sec	Abductor and knee control under fatigue
Cone slalom run (tight turns)	4 × 20 sec	Fast / 90 sec	Simulate ski turn timing and direction change
Single-leg hop & hold – forward/lateral	3 × 5 each	Explosive / 60 sec	Land; hold 3 sec; no wobble
Ski erg / bike sprint – tuck position	8 × 20 sec	Max / 60 sec	Replicate race-day cardiovascular demand

Week 12 – deload	Reduce volume 40%; maintain intensity; no new exercises; focus on movement quality and readiness
On-snow readiness	First ski day: warm up 15 min; start with green/blue runs; avoid fatigue-to-failure on day 1

Sample Weekly Schedule

Adapt to personal schedule — the key is alternating heavy sessions with recovery.

Phase 1 & 2 — Week Template

Day	Session Focus	Duration	Intensity
Mon	Lower body strength (squats, RDL, step-up, wall hold)	50–60 min	Moderate–Hard (RPE 7–8)
Tues	Aerobic cross-training (cycle or walk) + foam rolling	30–40 min	Easy (RPE 4–5)
Wed	Lower body strength (split squat, step-down, Nordic curl, balance)	50-60 min	Moderate-Hand (RPE 7-8)
Thu	Rest or light mobility / yoga / pool	30 min	Very easy (RPE 3)
Fri	Lower body strength + upper body / core accessory	50-60 min	Moderate-Hard (RPE 7-8)
Sat	Power / agility session (Phase 2) or mobility (Phase 1)	40-50 min	Moderate (RPE 6-7)
Sun	Full rest or easy walk	-	Rest

Phase 3 — Week Template

Day	Session Focus	Duration	Intensity
Mon	Power strength (trap bar DL, lateral bounds, skater squat)	45–55 min	Hard (RPE 8)
Tues	Easy aerobic + mobility	30–40 min	Easy (RPE 4)
Wed	Power strength (box jumps, reverse lunge, wall hold, depth drop)	45-55 min	Hard (RPE 8)
Thu	Rest	-	Rest
Fri	Power strength + core	45-55 min	Moderate–Hard (RPE 7–8)
Sat	Agility & reactivity session	40-50 min	Moderate (RPE 6–7)
Sun	Full rest	-	Rest

12-Week Load Progression Overview

Week	Phase	Primary Focus	Session RPE	Wall Squat Hold	Key Milestone
1	1	Movement quality; activation	6–7	30 sec @ 60°	Patterns established; no pain
2	1	Volume increase; add load	7	40 sec @ 60°	Step-up with 5 kg dumbbell
3	1	Consolidation; balance progression	7–8	50 sec @ 60°	Single-leg balance 30 sec stable
4	1	Phase 1 peak; Phase 2 preview	8	60 sec @ 60°	Goblet squat 20 kg × 12
5	2	Heavy load introduction	7–8	30 sec @ 70°	Leg press 1.2× BW × 8
6	2	Split squat load build	8	40 sec @ 70°	Bulgarian SS 12 kg DB × 8
7	2	Eccentric emphasis	8	50 sec @ 75°	Step-down 4 sec × 8 controlled
8	2	Nordic curl & hamstring strength	8–9	55 sec @ 75°	Nordic curl 5 reps slow
9	2	Phase 2 peak	9	60 sec @ 80°	Leg press 1.5× BW; box jump stable
10	3	Power conversion	8–9	45 sec @ 90°	Lateral bound 1 m stick landing
11	3	Agility & sport transfer	8	60 sec @ 90°	Slalom agility + plyometric power
12	3	Deload — taper for snow	5–6	40 sec @ 80°	Rested, sharp, ready for ski day 1

Knee Care & Injury Prevention

Pain monitoring	Any sharp knee pain or swelling: cease session; review within 48 hrs. Soreness \leq 3/10 after exercise is acceptable; pain during exercise is not.
ACL risk factors	Common in masters skiers — address with Nordic curls, hip abductor strength, landing mechanics, and helmet wear. Know your binding settings.
Patellofemoral pain	If anterior knee pain develops with squats or step-downs: reduce depth, reduce load, add VMO-targeted quad sets and step isometrics.
Ski boot assessment	Consider a boot fitting review with a fitter familiar with medical orthotics — improper cant angle loads the medial compartment.
On-snow warm-up	10–15 min easy skiing before hard runs; wall squat 2 \times 30 sec in boot room before first chairlift.

Nutrition & Recover for Masters Athletes

Protein	\geq 1.6–2.0 g/kg/day; distribute across 4 meals; 30–40 g protein within 2 hrs post-session
Creatine monohydrate	3–5 g daily; well-evidenced for masters athletes for muscle mass preservation and power output
Collagen + Vit C	15 g collagen peptides + 50 mg Vit C 30–60 min before exercise; supports cartilage and tendon health
Omega-3	2–3 g EPA/DHA daily; anti-inflammatory; may support muscle protein synthesis in older athletes
Hydration	Ski days: 500 ml before first run; 200 ml per hour on slope; altitude accelerates dehydration
Sleep	8 hrs target; muscle protein synthesis is predominantly nocturnal; sleep debt increases injury risk
Recovery tools	Foam rolling post-session; cold water immersion optional; contrast showering; compression garments on ski days

Clinical Disclaimer

This exercise prescription is tailored to the described clinical profile and should be initiated under the guidance of a sports medicine physician or accredited exercise physiologist. If knee pain, swelling, or unusual symptoms arise at any stage, cease the program and seek prompt clinical review. Document prepared by Sydney Sportsmed Specialists.