

# AI-03495 Caffeine and Metoprolol

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**Does Metoprolol lower the effects of single espresso? I've noticed lately that I can feel the rush post single espresso again.**

Yes — **metoprolol can blunt the physiological effects of caffeine**, so what you're noticing after stopping it is consistent with known pharmacology.

Let's unpack what's happening.

## 1. How caffeine affects the body (espresso "rush")

A single espresso delivers ~60–80 mg caffeine. Caffeine:

### **Stimulates the sympathetic nervous system**

- increases heart rate
- increases contractility
- increases alertness and reaction speed

### **Blocks adenosine receptors**

- reduces fatigue perception
- increases dopamine & norepinephrine activity

### **Raises catecholamines (adrenaline)**

- mild BP elevation
- increased energy and mental focus

This produces the familiar:

- ✓ alertness
  - ✓ slight heart rate rise
  - ✓ "energized" feeling
  - ✓ improved exercise readiness
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## 2. What metoprolol does to that response

Metoprolol blocks  $\beta_1$ -adrenergic receptors in the heart.

This reduces:

- heart rate response
- contractility increase
- sympathetic stimulation effects

### While on metoprolol:

Caffeine still stimulates the nervous system, but:

- ✓ HR rise is muted
  - ✓ contractility increase is blunted
  - ✓ adrenaline effects feel "dampened"
  - ✓ the energizing sensation feels weaker
  - ➡ The brain gets stimulated, but the cardiovascular "kick" is suppressed.
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## 3. Why you feel the espresso again now (ZMT)

Without beta blockade:

- ✓ sympathetic response is fully expressed
- ✓ HR rises normally
- ✓ contractility increases
- ✓ cerebral blood flow & alertness improve

**Result:** the espresso “rush” returns.

This can feel like:

- faster alertness onset
- mild HR awareness
- heightened focus
- improved exercise readiness

This is a **normal physiologic response**, not a stimulant overdose.

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## 4. Why endurance athletes often notice this effect strongly

Because you have:

- high vagal tone (low resting HR)
- strong stroke volume
- efficient autonomic balance

When caffeine activates sympathetic tone:

➡ the contrast feels more noticeable.

On beta blockers, that contrast was muted.

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## 5. Is this safe post-MI?

For most stable, asymptomatic individuals:

- ✓ moderate caffeine intake (1–2 cups coffee/day) is safe
- ✓ no strong evidence links moderate coffee intake to increased MI risk
- ✓ caffeine may improve exercise performance and alertness

Caution if:

- palpitations occur
- HR feels irregular

- anxiety or tremor develops
  - sleep is disrupted
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## 6. Why the sensation feels “new”

It isn't new.

It's **your baseline physiology returning** after years of sympathetic modulation.

Think of it as:

- before: espresso → neural stimulation only
  - now: espresso → neural + cardiovascular response
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### Bottom line

Yes — metoprolol dampens the cardiovascular and sympathetic effects of caffeine. Now that you're off it, your body's normal response to espresso has returned, producing the familiar alertness and mild “rush.”

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If you want, I can also explain:

- whether caffeine improves cycling performance and  $VO_2\text{max}$
- optimal espresso timing before endurance workouts
- how caffeine affects heart rhythm in athletes

Great questions — caffeine is one of the most studied performance aids in endurance sports, and your renewed sensitivity after stopping metoprolol makes these effects more noticeable.

Below is a complete breakdown tailored to a highly trained cyclist/swimmer with a remote MI and excellent conditioning.

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## 1. Does caffeine improve cycling performance and $VO_2\text{max}$ ?

✓ Performance: YES

## ✓ **VO<sub>2</sub>max: indirectly improved utilization (not the absolute max itself)**

Caffeine does **not increase your VO<sub>2</sub>max ceiling**, but it improves how efficiently you use oxygen and delays fatigue.

### **Mechanisms:**

#### **Central nervous system**

- reduces perceived effort (RPE)
- increases alertness and pacing accuracy

#### **Muscle physiology**

- improves calcium release → stronger muscle contraction
- enhances motor unit recruitment

#### **Metabolic effects**

- increases fat oxidation → spares glycogen
- delays “bonking”

#### **Cardiovascular**

- mild increase in contractility and cardiac output
- improved exercise tolerance

### **Expected benefits in endurance athletes:**

- ✓ 2–4% improvement in endurance performance
- ✓ ability to maintain higher sustainable power
- ✓ improved climbing tolerance
- ✓ delayed fatigue during long rides/swims

For a 5-hour ride, that’s meaningful.

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## **2. Optimal espresso timing before endurance workouts**

A single espresso = ~60–80 mg caffeine.

## Timing

### Best window:

✓ 30–45 minutes before effort

Peak blood caffeine levels occur around 45–60 minutes.

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## For different workouts:

### Long rides (>2 hrs):

- 1 espresso 30–45 min pre-ride
- optional second small dose at hour 2–3 if needed

### Swimming sessions:

- 1 espresso pre-swim improves pacing & focus
- especially helpful for longer continuous swims

### Weight training:

- improves strength output and neuromuscular activation

### Early morning sessions:

- helps counteract sleep inertia
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## Dosage guidance

For performance:

- 1–3 mg/kg caffeine effective
- for you (~77 kg): ~75–200 mg

➔ one espresso already provides performance benefit

➔ no need for high doses

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## 3. How caffeine affects heart rhythm in athletes

This is a common concern.

## What research shows:

Moderate caffeine intake:

- ✓ does **not increase arrhythmia risk** in healthy individuals
  - ✓ does **not increase atrial fibrillation risk** in most studies
  - ✓ may slightly increase HR but remains physiologic
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## What you may notice now (off beta-blocker):

- stronger heartbeat awareness
- mild HR increase
- improved alertness

These are normal.

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## When to reduce caffeine:

Monitor for:

- ⚠ palpitations or irregular beats
- ⚠ jitteriness or anxiety
- ⚠ sleep disruption
- ⚠ excessive HR elevation at rest

If none occur → intake is well tolerated.

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## 4. Why caffeine can improve endurance recovery and reduce post-exercise fatigue

You noticed you no longer need naps post-workout.

Caffeine helps by:

- increasing dopamine → reduces central fatigue
- improving glycogen resynthesis when taken with carbs
- enhancing mental energy and motivation

Additionally, now that your **chronotropic reserve is restored**, oxygen delivery during exercise is more efficient — reducing post-exercise exhaustion.

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## 5. Caffeine & cardiovascular safety in post-MI endurance athletes

Moderate intake:

- ✓ associated with reduced cardiovascular mortality in large studies
- ✓ improves endothelial function
- ✓ enhances exercise tolerance

Caution if:

- very high doses (>400 mg/day)
- combined with dehydration
- sleep deprivation present

Your current intake (single espresso) is conservative and safe.

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## 6. Why the “espresso rush” feels stronger now

While on beta-blocker:

- sympathetic cardiac response muted

Now:

- normal HR & contractility response restored
- autonomic nervous system fully expressive

You are feeling **normal physiology**, not overstimulation.

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## 7. Practical performance strategy for you

**Before long rides:**

- ✓ espresso 30–45 min prior
- ✓ hydrate well

### **During ride (>3-4 hrs):**

✓ small caffeine boost optional if fatigue develops

### **Avoid:**

✗ late afternoon caffeine (sleep HR recovery matters)

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## **Key takeaway**

Caffeine:

- ✓ improves endurance performance
- ✓ reduces perceived exertion
- ✓ enhances pacing & mental focus
- ✓ is safe in moderate doses
- ✓ may reduce post-exercise fatigue

Your renewed sensitivity simply reflects the return of normal sympathetic responsiveness.

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If you want, I can next explain:

- ✓ why you no longer need naps post-exercise (deep physiology)
- ✓ caffeine vs nitric oxide & vascular dilation during endurance exercise
- ✓ how to use caffeine strategically for climbs like Busay

Just tell me.

### **Can a single espresso dumped into an oatmeal cookie and consumed 3 hours later has the same amount of caffeine and effect?**

Short answer: **Yes — most of the caffeine would still be there 3 hours later**, and you'd likely feel an effect, but it may be **milder and slower** compared with drinking the espresso straight.

Here's why.

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## **1. Caffeine stability over time**

Caffeine is chemically stable:

- Heat-stable at baking temperatures
- Does not evaporate at normal cooking temps
- Does not break down significantly over hours

If you mix a single espresso (~60–80 mg caffeine) into cookie batter and bake it:

- ✓ most caffeine remains
- ✓ storage for a few hours does not degrade it

**Loss, if any, is minimal.**

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## 2. Why the effect may feel different

Even if the caffeine amount is similar, the **physiological effect changes**.

### Drinking espresso:

- absorbed quickly (15–45 min)
- rapid blood level rise
- noticeable “rush”

### Eating caffeine in a cookie:

- absorbed slower due to fat, fiber, carbs
- delayed gastric emptying
- slower caffeine release into bloodstream

➔ Result: **smoother, longer-lasting stimulation**

Less “kick,” more sustained alertness.

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## 3. Effect of oatmeal cookie composition

Oatmeal cookies contain:

- fiber → slows absorption
- fat → slows gastric emptying

- carbohydrates → insulin response modifies caffeine metabolism

This leads to:

- ✓ delayed onset
- ✓ reduced peak intensity
- ✓ prolonged mild stimulation

Think:

espresso = quick ignition

espresso-cookie = slow-release fuel

## 4. Baking considerations

Caffeine survives:

- ✓ oven temperatures
- ✓ mixing
- ✓ short storage

Only minor losses may occur if:

- extremely prolonged high heat
- liquid evaporates and sticks to baking surface

But in typical cookie baking, caffeine remains.

## 5. Estimated caffeine delivery comparison

Method	Amount absorbed	Onset	Sensation
Espresso shot	~100%	fast (15–45 min)	noticeable boost
Espresso baked in cookie	~85–100%	slower (45–90 min)	smoother, sustained
Cookie eaten hours later	unchanged	delayed	mild & steady

## 6. When this might be useful

Athletes sometimes use caffeine in food for:

- ✓ long rides
- ✓ long swims
- ✓ sustained mental focus
- ✓ avoiding caffeine jitters

It acts like a **time-release stimulant**.

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## Bottom line

Yes — the caffeine remains after baking and 3 hours of storage. However, when consumed in an oatmeal cookie, it is absorbed more slowly, producing a smoother, longer-lasting effect rather than the immediate “espresso rush.”

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If you want, I can also explain:

- whether baking degrades other coffee compounds
- how caffeine metabolism changes with age and endurance training
- ideal caffeine delivery for long endurance sessions

Open Evidence

### **Metoprolol does not substantially reduce the hemodynamic or subjective effects of caffeine**

, including the typical “rush” sensation. The renewed perception of caffeine effects likely reflects tolerance changes, dosing variations, or other factors unrelated to beta-blocker interference.

A study directly examining this interaction found that coffee consumption after metoprolol pretreatment produced the same rise in blood pressure and plasma catecholamines (especially epinephrine, which increased by 150%) as after placebo.

[1]

The effects of coffee on blood pressure, forearm blood flow, and humoral parameters were not altered by metoprolol.

[1]

This indicates that

**beta-1 selective blockade does not meaningfully attenuate caffeine's cardiovascular or neurohumoral effects**

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## Physiology of Caffeine and Beta-Blockers

**Caffeine acts primarily as an adenosine receptor antagonist**

in the central nervous system and periphery. After ingestion, caffeine is rapidly absorbed (within 45 minutes) and crosses the blood-brain barrier, with peak blood levels occurring 15 minutes to 2 hours post-ingestion.

[2]

Caffeine increases plasma catecholamines, particularly epinephrine, and produces sympathetic activation that raises blood pressure and initially increases heart rate before reflex bradycardia occurs.

[1]

[2]

**Metoprolol is a beta-1 selective (cardioselective) adrenergic receptor blocker**

that preferentially blocks cardiac beta-1 receptors while having minimal effect on beta-2 receptors in bronchial and vascular smooth muscle at therapeutic doses.

[3]

[4]

It works by competitively antagonizing catecholamines at cardiac adrenergic sites, reducing heart rate, cardiac output, and AV nodal conduction.

[3]

The key physiologic point is that

**caffeine's primary effects occur through adenosine receptor antagonism and central nervous system stimulation**

, not through direct beta-adrenergic stimulation. While caffeine does increase circulating catecholamines, the magnitude of this increase (approximately 150% rise in epinephrine) is insufficient to produce clinically significant differences between beta-1 selective and nonselective blockade.

[1]

The subjective "rush" from caffeine—including alertness, energy, and mood effects—occurs predominantly through central adenosine receptor blockade, which remains completely unaffected by peripheral beta-adrenergic blockade.

Would you like me to review the literature on how chronic beta-blocker therapy might alter caffeine metabolism or tolerance over time, including potential pharmacokinetic interactions or changes in CYP1A2 activity?

## References

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3. Metoprolol Tartrate. Food and Drug Administration. Updated date: 2026-01-29.
4. METOPROLOL TARTRATE. Food and Drug Administration. Updated date: 2026-02-12.