# Comparative Bioavailability of Curcumin Delivered via Zolvia Encapsulation Technology in Powder and Aqueous Liquid Formats versus a Native Curcumin Extract

*A Randomized, Double-Blind, Comparator-Controlled Single-Dose Pharmacokinetic Study*

**Clinical trial**: Atlantia Food Clinical Trials Ltd, Cork, Ireland·

**Independent pharmacokinetic & statistical analysis**: Dr Tom Jameson, Chief Scientific Officer, StudySetGo

*20 July 2026*

## *Abstract*

**Background:** Native curcumin extract is poorly absorbed into the body following oral administration, limiting systemic exposure and its associated health benefits. Zolvia's proprietary encapsulation technology, available in powder and liquid formats, is designed to enhance the oral bioavailability of curcumin. In this study, Zolvia's technology was applied to curcumin extract in both powder and liquid format, and the resulting pharmacokinetic profiles were evaluated against native curcumin extract.

**Methods:** An independent, randomized, double-blind, comparator-controlled, parallel-group pharmacokinetic study was conducted by Atlantia Food Clinical Trials Ltd (Cork, Ireland). Healthy adults aged 18–45 years received a single 500 mg dose of curcumin extract as either Zolvia powder or Zolvia aqueous liquid, each compared against 500 mg of native curcumin extract in HPMC capsules (n = 5 per arm, per study). Venous blood was sampled at T0 (pre-dose) and T15, T30, T45, T60, T90, T120, T180, T240 and T360 minutes post-dose. Plasma total curcumin was quantified and the maximum concentration (Cmax), time to maximum concentration (Tmax) and area under the concentration–time curve from 0–360 minutes (AUC0–360) were derived and compared between each Zolvia arm and its control by an independent statistician (StudySetGo).

**Results:** Both Zolvia formats produced markedly higher and earlier peak plasma curcumin exposure than native curcumin extract. Zolvia powder achieved a geometric mean Cmax of 285.6 ng/mL versus 4.6 ng/mL for control ($p < 0.0001$), a median Tmax of 60 minutes versus 360 minutes ($p = 0.008$), and an AUC0–360 of 46,381 ng·min/mL versus 656 ng·min/mL ($p < 0.0001$) — a ≈**71-fold** relative increase in plasma exposure. Zolvia liquid achieved a geometric mean Cmax of 305.5 ng/mL versus 4.6 ng/mL for control ($p < 0.0001$), a median Tmax of 45 minutes versus 360 minutes ($p = 0.008$), and an AUC0–360 of 43,035 ng·min/mL versus 656 ng·min/mL ($p < 0.0001$) — a ≈**66-fold** relative increase in plasma exposure.

**Conclusion:** Applying Zolvia encapsulation technology to curcumin extract substantially increases oral bioavailability by **71x** and **66x** relative to native curcumin extract, regardless of whether the technology is presented in powder or liquid format.

**Keywords:** *curcumin; bioavailability; pharmacokinetics; encapsulation; Zolvia; randomized controlled trial*

# 1. Introduction

Curcumin, the principal bioactive polyphenol of Curcuma longa (turmeric), has attracted sustained scientific and commercial interest for its antioxidant and anti-inflammatory properties. Its health benefits, however, are constrained by a well-documented pharmacokinetic limitation: native curcumin extract is hydrophobic, undergoes rapid intestinal and hepatic metabolism, and is eliminated quickly, resulting in very low and variable systemic exposure after oral dosing.

Zolvia developed a proprietary encapsulation technology which was applied to a single, consistent core curcumin extract. Critically, the same core extract underlies both formats evaluated in this study: a dry powder format and an aqueous liquid format. The two formats therefore differ only in the physical delivery matrix presented to the gastrointestinal tract, not in the technological identity or source of the curcumin extract itself, allowing a direct comparison of how format influences absorption when the underlying encapsulation chemistry is held constant.

To characterize the bioavailability benefit of each format, Zolvia commissioned Atlantia Food Clinical Trials Ltd, an independent clinical research organization, to conduct a randomized, double-blinded, comparator-controlled pharmacokinetic (PK) study, benchmarking a single 500 mg dose of Zolvia curcumin (powder or liquid) against 500 mg of a commercially available native curcumin extract in a classic HPMC capsule shell. Independent statistical analysis of the resulting concentration–time data was performed by Dr Tom Jameson, Chief Scientific Officer of StudySetGo. This report consolidates the findings of the study into a comparative summary and presents the study procedures, results and interpretation in a structured format.

# 2. Materials and Methods

## *2.1 Study Design and Oversight*

A single-dose, randomized, double-blind, comparator-controlled, parallel-group study was conducted at a single center (Atlantia Food Clinical Trials Ltd, Heron House Offices, Blackpool, Cork, Ireland) under the principles of ICH Good Clinical Practice (ICH-GCP). Independent data analysis was performed in GraphPad Prism (v10.5.0) and Microsoft Excel (v16.110.3).

## *2.2 Participants*

Eligible participants were healthy adult men and women aged 18–45 years in general good health, as determined by the investigator based on medical history, vital signs and routine laboratory screening. Volunteers with clinically significant gastrointestinal, metabolic (including diabetes) or immunocompromising conditions, current or recent use of anticoagulants, antidepressants, NSAIDs or curcumin/turmeric-containing products, or who were pregnant, lactating, or of childbearing potential without effective contraception, were excluded. Across the wider study programme, 91 volunteers were telephone pre-screened, 33 attended an in-person screening visit, and 25 were randomized across the study arms (5 participants per arm). This report addresses the two arms dosed with 500 mg Zolvia curcumin powder and 500 mg Zolvia curcumin liquid, each analyzed against its own contemporaneous native curcumin control arm (n = 5).

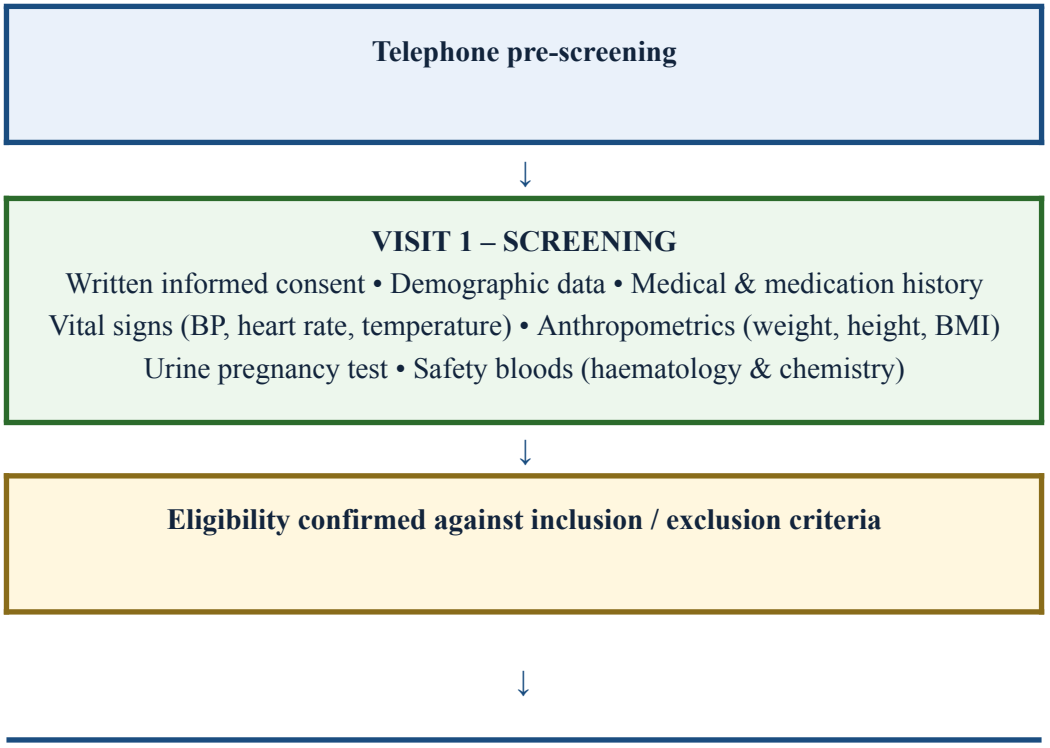
### *2.3 Study Products*

Each participant received a single 500 mg dose of curcumin extract, taken with 200 mL of sparkling water, as one of the following: (i) Zolvia curcumin encapsulation technology in powder format; (ii) Zolvia curcumin encapsulation technology in aqueous liquid format; or (iii) a commercially available native curcumin extract in classic HPMC capsules, serving as the comparator for both formats. The core curcumin extract was identical across all three arms; only the delivery format differed. Products were administered under double-blind conditions, and all participants received standardized breakfast and lunch meals at fixed points in the sampling schedule.

### *2.4 Study Procedure*

Figure 1 summarizes the sequence of study procedures from initial telephone pre-screening through to completion of post-dose blood sampling. Following telephone pre-screening, eligible volunteers attended a screening visit comprising written informed consent, demographic data collection, medical and medication history, vital signs, anthropometric measurements (weight, height, BMI), a urine pregnancy test where applicable, and safety haematology and chemistry blood tests. Eligible participants returned for the baseline/dosing visit (Day 1) following an overnight fast of at least 10 hours (water permitted). On arrival, adverse events and concomitant medications were reviewed and vital signs repeated. A pre-dose (T0) fasting blood sample was drawn before breakfast, after which participants were randomized and received their allocated study product under double-blind conditions. Serial venous blood samples were then collected at T15, T30, T45, T60, T90 and T120 minutes while participants remained fasted, followed by a standardized light meal, with further samples collected at T180, T240 and T360 minutes and a standardized lunch provided between draws.

**Study Procedure Flow: Screening to Post-Dose Blood Sampling**



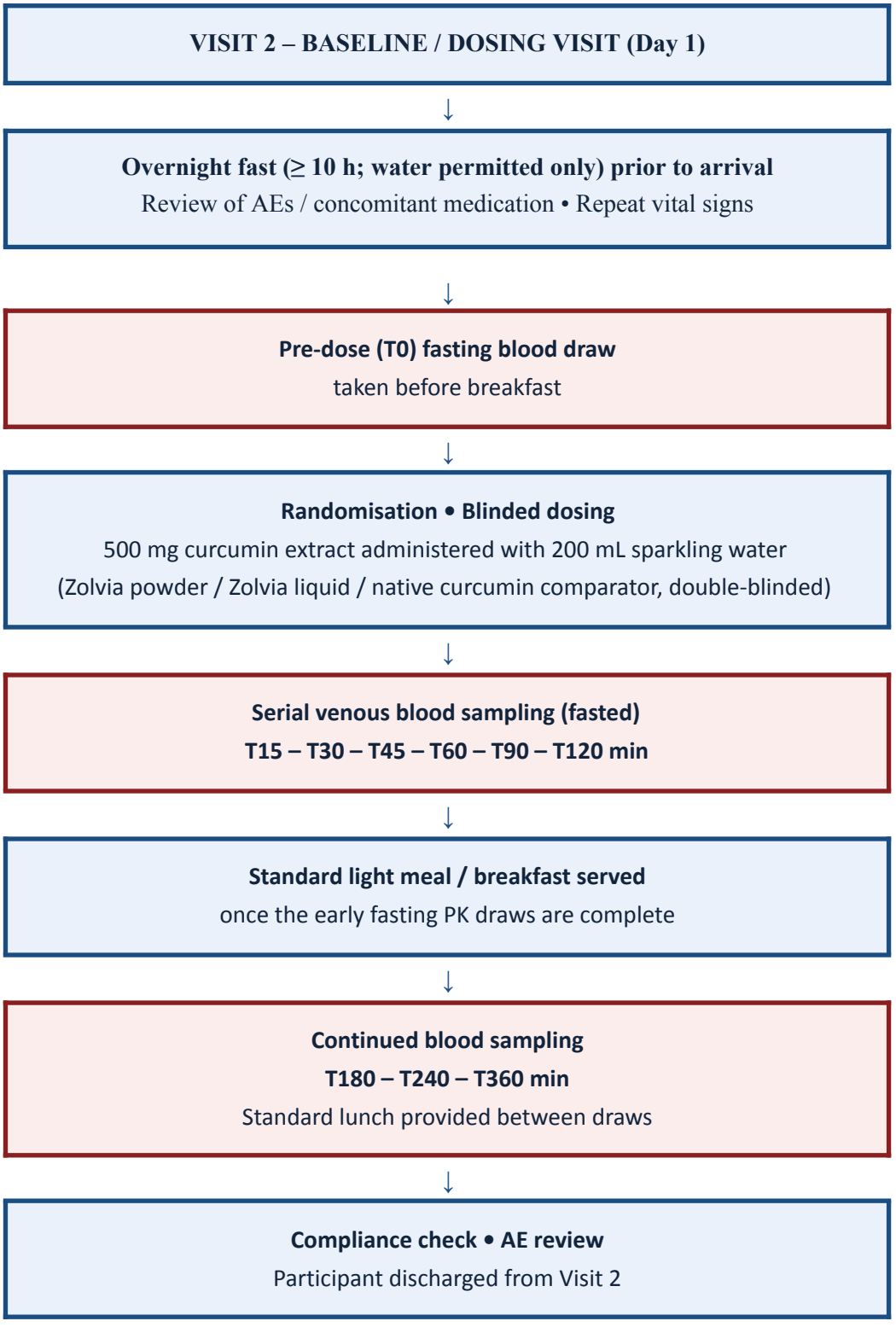



**Figure 1. Study procedure flow from telephone pre-screening through screening, overnight fasting, baseline dosing and serial post-dose blood sampling.**

### *2.5 Bioanalytical Assessment and Pharmacokinetic Parameters*

Plasma total curcumin concentration was quantified using LC-MS/MS (Liquid Chromatography-Tandem Mass Spectrometry) at each sampling timepoint. From the resulting concentration–time profiles, the maximum observed plasma concentration (Cmax), the time to reach Cmax (Tmax), and the trapezoidal area under the concentration–time curve from 0 to 360 minutes (AUC0–360) were derived for each participant and summarized by treatment arm.

### *2.6 Statistical Analysis*

Cmax and AUC0–360 are presented as geometric means with 95% confidence intervals; Tmax is presented as median with range, consistent with the non-normal distribution typically observed for time-to-peak data. Between-group differences in Cmax and AUC0–360 were assessed using unpaired t-tests assuming a log-normal distribution; between-group differences in Tmax were assessed using the unpaired Mann-Whitney U test. Each Zolvia arm (powder or liquid) was compared against native curcumin control arm; the two Zolvia formats were not subjected to a formal direct statistical comparison against one another, and any format-to-format contrast presented in Section 3.3 is descriptive only.

## 3. Results

### *3.1 Zolvia curcumin Powder versus Native Curcumin Extract (500 mg)*

Zolvia powder produced a substantially higher and earlier plasma curcumin peak than the native curcumin control. The geometric mean Cmax of Zolvia powder was approximately 62-fold higher than the native curcumin extract control (285.6 ng/mL vs. 4.6 ng/mL; $p < 0.0001$), median Tmax occurred considerably earlier (60 minutes vs. 360 minutes; $p = 0.008$), and geometric mean AUC0–360 was approximately 71-fold higher (46,381 ng·min/mL vs. 656 ng·min/mL; $p < 0.0001$), indicating markedly greater total systemic exposure to curcumin over the 6-hour sampling window.

*[Original pharmacokinetic report from StudySetGO on zolvia curcumin powder vs native curcumin extract can be found in Annex I.]*

**Table 1. Pharmacokinetic parameters : Zolvia Powder (500 mg) vs Native Curcumin Extract (500 mg)**

| Parameter | Control: Native Curcumin Extract (500 mg) | Zolvia Powder Curcumin (500 mg) | P value |
|---|---|---|---|
| **Cmax (ng/mL)** | 4.6 (95% CI: 2.1–9.8) | 285.6 (95% CI: 135.2–603.3) | < 0.0001 |
| **Tmax (min)** | 360 (range: 240–360) | 60 (range: 30–180) | 0.008 |
| **AUC0–360 (ng·min/mL)** | 656 (95% CI: 280–1535) | 46,381 (95% CI: 23,054–93,311) | < 0.0001 |

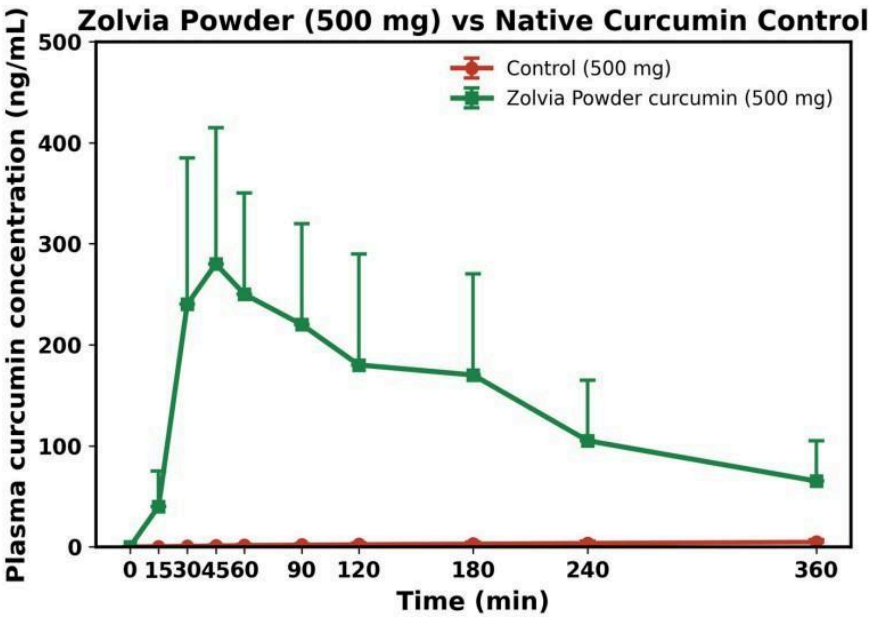



**Figure 2. Mean (± SD) plasma curcumin concentration–time profile: Zolvia Powder (500 mg) versus native curcumin extract control (500 mg), T0–T360 minutes.**

### *3.2 Zolvia curcumin Liquid versus Native Curcumin Extract (500 mg)*

Zolvia liquid similarly produced substantially greater and earlier plasma curcumin exposure than the native curcumin extract. Geometric mean Cmax was approximately 66-fold higher with Zolvia liquid versus the control (305.5 ng/mL vs. 4.6 ng/mL; $p < 0.0001$), median Tmax occurred earlier still than the powder format (45 minutes vs. 360 minutes; $p = 0.008$), and geometric mean AUC0–360 was approximately 66-fold higher (43,035 ng·min/mL vs. 656 ng·min/mL; $p < 0.0001$).

*[Original pharmacokinetic report from StudySetGO on zolvia curcumin liquid vs native curcumin extract can be found in Annex II.]*

**Table 2. Pharmacokinetic parameters — Zolvia Liquid (500 mg) vs Native Curcumin Extract (500 mg)**

| Parameter | Control: Native Curcumin Extract (500 mg) | Zolvia Liquid Curcumin (500 mg) | P value |
|---|---|---|---|
| **Cmax (ng/mL)** | 4.6 (95% CI: 2.1–9.8) | 305.5 (95% CI: 161.2–579.1) | < 0.0001 |
| **Tmax (min)** | 360 (range: 240–360) | 45 (range: 45–60) | 0.008 |
| **AUC0–360 (ng·min/mL)** | 656 (95% CI: 280–1535) | 43,035 (95% CI: 22,247–83,249) | < 0.0001 |

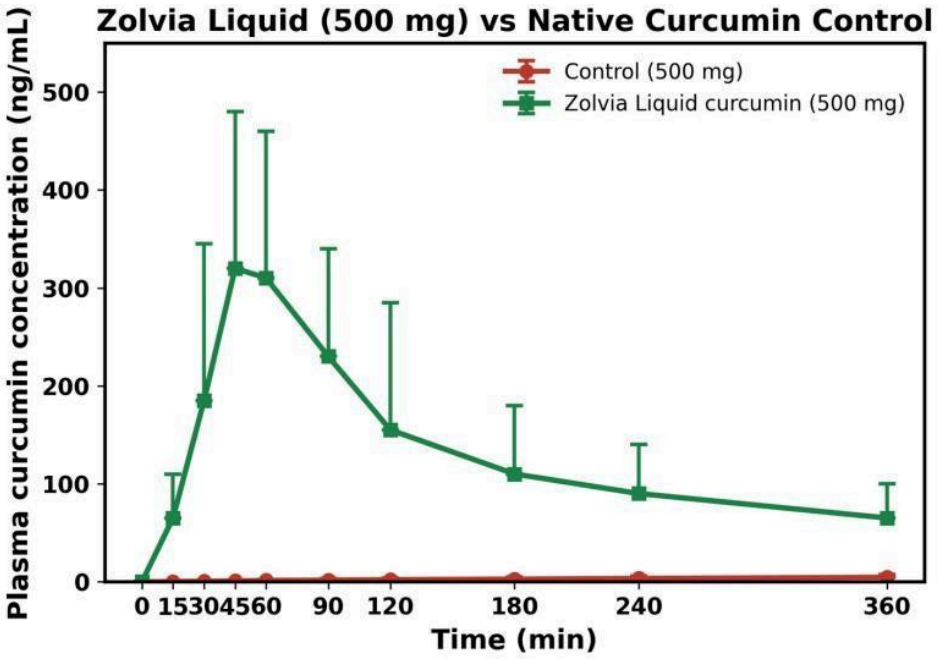



**Figure 3. Mean (± SD) plasma curcumin concentration–time profile: Zolvia Liquid (500 mg) versus native curcumin extract (500 mg), T0–T360 minutes.**

### *3.3 Descriptive Comparison Between Zolvia Formats*

The powder and liquid arms were each benchmarked independently against the native curcumin extract control; direct statistical comparison between formats was therefore not performed, and the following analysis is descriptive in nature.

As presented in Table 3, both Zolvia formats achieved comparable peak plasma concentrations and total systemic exposure, with overlapping 95% confidence intervals for Cmax and AUC0–360. The liquid format reached peak concentration earlier (median Tmax 45 min; range 45–60 min) than the powder format (median Tmax 60 min; range 30–180 min). This difference is consistent with the more rapid disintegration and dispersion of a pre-solubilised liquid matrix relative to a solid powder matrix, which must first undergo dissolution prior to absorption. Notably, despite requiring matrix disintegration, the powder format reached peak concentration only 15 minutes later than the liquid, while sustaining elevated plasma concentrations for a longer duration.

The pharmacokinetic profiles of the two formats were qualitatively distinct. The liquid format exhibited a sharper, earlier, and more uniform absorption profile (Tmax ~45 min; range 45–60 min), whereas the powder format demonstrated a broader, more variable peak with a pronounced plateau phase (Tmax ~60 min; range 30–180 min), consistent with a slower, more sustained release from the solid matrix.

The extended absorption phase observed with the powder format maintained elevated plasma curcumin concentrations over the 60–240 minute post-dose window. Although the powder's Cmax was modestly lower than that of the liquid format, the accumulated systemic exposure during this sustained phase offset the difference in peak concentration, resulting in a marginally higher total AUC and relative bioavailability for the powder format compared to the liquid.

**Table 3. Descriptive comparison of Zolvia Powder and Zolvia Liquid (500 mg each), both derived from the same core curcumin extract**

| Parameter | Zolvia Powder (500 mg) | Zolvia Liquid (500 mg) |
|---|---|---|
| **Cmax (ng/mL)** | 285.6 (95% CI: 135.2–603.3) | 305.5 (95% CI: 161.2–579.1) |
| **Tmax (min)** | 60 (range: 30–180) | 45 (range: 45–60) |
| **AUC0–360 (ng·min/mL)** | 46,381 (95% CI: 23,054–93,311) | 43,035 (95% CI: 22,247–83,249) |
| **Bioavailability enhancement vs native curcumin extract** | **71-fold** | **66-fold** |

## 4. Discussion

The two independently conducted, randomized, double-blind, comparator-controlled studies demonstrate that Zolvia encapsulation technology confers a substantial and consistent bioavailability advantage over native curcumin extract, irrespective of whether the technology is delivered in a powder or an aqueous liquid format. Both formats increased geometric mean Cmax by more than sixty-fold, and geometric mean AUC0–360 by 71 and 66-fold relative to native curcumin extract, while shortening median Tmax from 6 hours to under 1.5 hours. Given that the core curcumin extract was identical across all three study arms, these findings support the interpretation that the encapsulation technology, rather than any difference in the underlying active ingredient, is responsible for the improved absorption profile.

The modestly earlier Tmax observed with the liquid format (median 45 minutes, narrow range) relative to the powder format (median 60 minutes, wider range extending to 180 minutes) is consistent with expected differences in absorption kinetics between a pre-dispersed liquid matrix and a powder matrix that released the active in a sustained manner. Despite this difference in the rate of absorption, the extent of absorption as reflected in overlapping Cmax and AUC0–360 confidence intervals were broadly comparable between the two formats, suggesting that format choice may be guided primarily by customer preference and application, rather than by differences in overall bioavailability.

These findings are consistent with the broader literature that native curcumin is poorly absorbed after oral dosing and that a variety of delivery-technology approaches can meaningfully improve systemic exposure. The magnitude of improvement observed here for both Zolvia formats is comparable to, or exceeds, improvements reported in the literature for other bioavailability-enhancement curcumin technologies.

## 5. Conclusion

Applying Zolvia encapsulation technology to a single, consistent core curcumin extract produces a marked improvement in oral bioavailability (71x for powder and 66x for liquid) relative to native curcumin extract, whether the technology is delivered as a powder or as an aqueous liquid. Both

formats achieved substantially higher peak plasma concentrations, faster time to peak, and greater overall systemic exposure than the comparator, with the liquid format reaching peak concentration modestly faster than the powder format. These independently conducted and analyzed findings support Zolvia technology as an effective approach to overcoming the well-recognized absorption limitations of native curcumin.

## 7. Acknowledgements

The clinical studies described in this report were conducted by Atlantia Food Clinical Trials Ltd (Cork, Ireland) under a clinical trial study agreement with Zolvia. Independent pharmacokinetic data analysis was performed by Dr Tom Jameson, Chief Scientific Officer, StudySetGo, using GraphPad Prism (v10.5.0) and Microsoft Excel (v16.110.3).

## 8. Data availability statement

Original statistical analysis report from StudySetGo can be found in Annex I and Annex II.

## 9. References

1. Anand P, Kunnumakkara AB, Newman RA, Aggarwal BB. Bioavailability of curcumin: problems and promises. Mol Pharm. 2007;4(6):807–818.
2. Jäger R, Lowery RP, Calvanese AV, Joy JM, Purpura M, Wilson JM. Comparative absorption of curcumin formulations. Nutr J. 2014;13:11.
3. Jameson T. Zolvia curcumin PK analysis — powder format vs control. StudySetGo;
4. Jameson T. Zolvia curcumin PK analysis — aqueous liquid format vs control. StudySetGo;

# Zolvia curcumin PK analysis

## Background and Methods

This was a double blinded, comparator controlled, randomized clinical trial on healthy individuals (male and female) aged between 18 and 45 years old. Each individual received 500 mg of curcumin extract, delivered either via Zolvia encapsulation technology in powder format or classic HPMC capsules in native form (control) (n=5 per group). Each supplement was consumed with 200 mL of sparkling water. All participants received a standard breakfast and lunch.

Blood samples were collected at T0 (before consuming the study product) and T15, T30, T45, T60, T90, T120, T180, T240, and T360 following supplement ingestion.

Analysis of $C_{max}$, $T_{max}$ and trapezoidal area under the curve (AUC) was performed and compared separately between each group versus control. Data are presented as median and range ($T_{max}$) and geometric means with 95% confidence intervals ($C_{max}$ and AUC).

Group differences in $C_{max}$ and AUC were identified using unpaired t-tests assuming lognormal distribution. Group differences in $T_{max}$ were identified using unpaired Mann-Whitney U tests.

The study was performed by Atlantia Clinical Trials. Independent data analysis was performed in Prism (version 10.5.0) and Microsoft Excel (version 16.110.3) by Dr Tom Jameson, Chief Scientific Officer, StudySetGo.

Study Set Go

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## Results

| **Table 1**: Pharmacokinetic analysis | | | |
|---|---|---|---|
| | **Control: Native curcumin (500mg)** | **Zolvia powder curcumin (500mg)** | ***P* value** |
| **$C_{max}$ (ng/mL)** | 4.6 (95% CI: 2.1-9.8) | 285.6 (95% CI: 135.2-603.3) | <0.0001 |
| **$T_{max}$ (min)** | 360 (range: 240-360) | 60 (range: 30-180) | 0.008 |
| **AUC (0-360; ng·min/mL)** | 656 (95% CI: 280-1535) | 46381 (95% CI: 23054-93311) | <0.0001 |

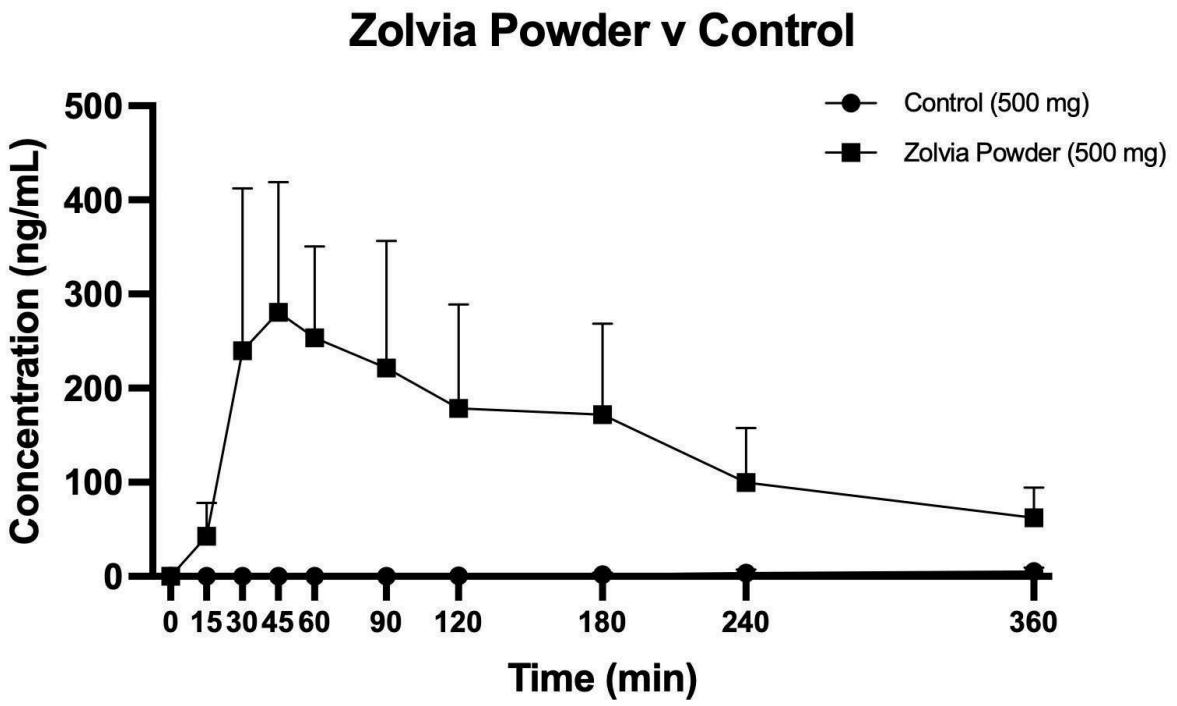


**Figure 1**: The time course of Zolvia Powder curcumin concentration in blood compared with a control (native curcumin). Data are presented as mean ± standard deviation.

## Conclusions

In this study, 500mg of curcumin extract delivered using Zolvia technology in powder format demonstrated a significant **~71-fold** higher relative bioavailability than 500mg of native curcumin extract.

Dr Tom Jameson

2026-07-17

# Zolvia curcumin PK analysis

## Background and Methods

This was a double blinded, comparator controlled, randomized clinical trial on healthy individuals (male and female) aged between 18 and 45 years old. Each individual received 500 mg of curcumin extract, delivered either via Zolvia encapsulation technology in aqueous liquid format or classic HPMC capsules in native form (control) (n=5 per group). Each supplement was consumed with 200 mL of sparkling water. All participants received a standard breakfast and lunch.

Blood samples were collected at T0 (before consuming the study product) and T15, T30, T45, T60, T90, T120, T180, T240, and T360 following supplement ingestion.

Analysis of $C_{max}$, $T_{max}$ and trapezoidal area under the curve (AUC) was performed and compared separately between each group versus control. Data are presented as median and range ($T_{max}$) and geometric means with 95% confidence intervals ($C_{max}$ and AUC).

Group differences in $C_{max}$ and AUC were identified using unpaired t-tests assuming lognormal distribution. Group differences in $T_{max}$ were identified using unpaired Mann-Whitney U tests.

The study was performed by Atlantia Clinical Trials. Independent data analysis was performed in Prism (version 10.5.0) and Microsoft Excel (version 16.110.3) by Dr Tom Jameson, Chief Scientific Officer, StudySetGo.

Study Set Go

Document Ref: OFTR9-CVXUV-UT7UC-FJEFE

## Results

| **Table 1**: Pharmacokinetic analysis | | | |
|---|---|---|---|
| | **Control: Native curcumin extract (500mg)** | **Zolvia liquid curcumin (500mg)** | ***P* value** |
| **$C_{max}$ (ng/mL)** | 4.6 (95% CI: 2.1-9.8) | 305.5 (95% CI: 161.2-579.1) | <0.0001 |
| **$T_{max}$ (min)** | 360 (range: 240-360) | 45 (range: 45-60) | 0.008 |
| **AUC (0-360; ng·min/mL)** | 656 (95% CI: 280-1535) | 43035 (95% CI: 22247-83249) | <0.0001 |

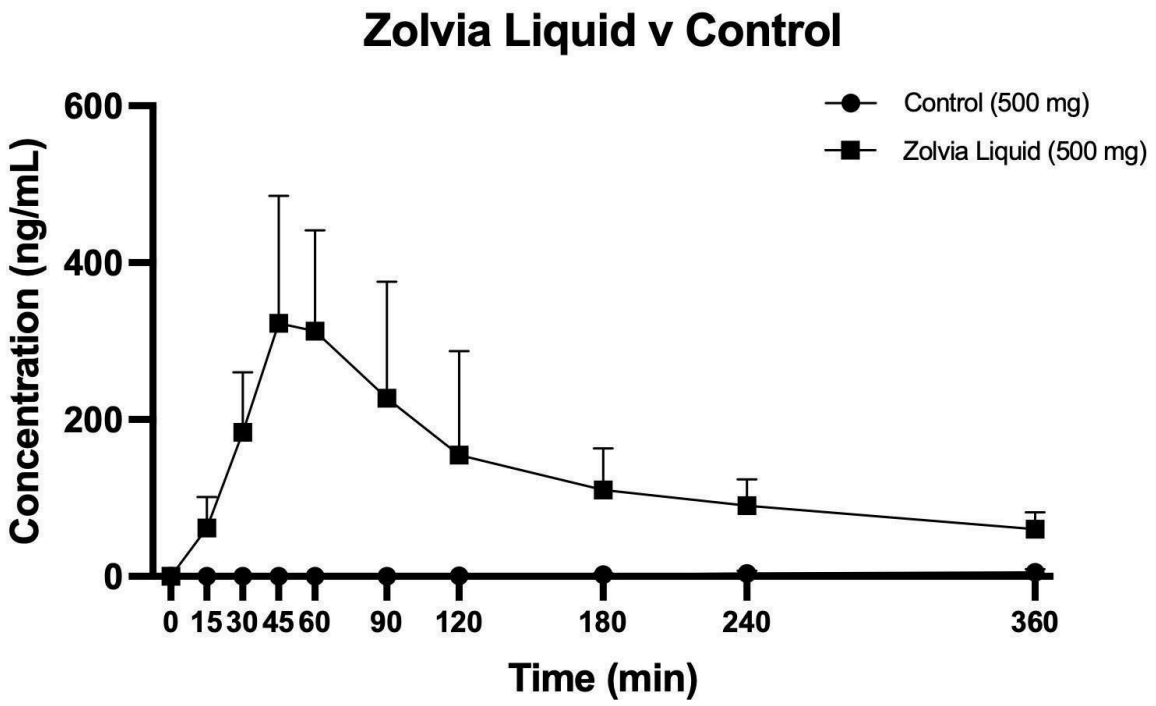


**Figure 1**: The time course of Zolvia Liquid curcumin extract concentration in blood compared with a control (native curcumin extract). Data are presented as mean ± standard deviation.

## Conclusions

In this study, 500mg of curcumin extract delivered using Zolvia technology in aqueous liquid format demonstrated a significant **~66-fold** higher relative bioavailability than 500mg of native curcumin extract.

Dr Tom Jameson

2026-07-17