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RESEARCH ARTICLE

The reporting quality of abstracts of randomized controlled trials on *Curcuma longa* L.: A cross-sectional study based on the MEDLINE database

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Aim: To analyze the quality of abstracts of the randomized controlled clinical trials on *Curcuma longa* L.

Methods: We queried MEDLINE *via* PubMed for abstracts of randomized controlled trials on *Curcuma longa* L. and evaluated their reporting quality according to the criteria from the CONsolidated Standards Of Reporting Trials (CONSORT) statement. The collected data were analyzed using the χ^2 statistical test to examine a correlation between the presence of CONSORT checklist items and the structure of the abstract.

Results: The search retrieved 170 scientific articles, of which 138 met our inclusion criteria. The median total score of the abstracts was 7, out of 17 checklist items, with most scores ranging between 6 and 9. We found significant differences regarding the presence of CONSORT items depending on the abstract structure: objective and primary outcomes appeared the most frequently, while source of funding and randomization process appeared the least frequently.

Conclusion: According to CONSORT criteria, abstracts of randomized controlled trials on *Curcuma longa* L. exhibit suboptimal quality. Most worryingly, there is a lack of information on funding sources and randomization processes in most of the abstracts, significantly impacting the transparency and trustworthiness of the clinical trials.

Keywords: abstract, item, CONSORT, *Curcuma longa* L., curcumin

Curcuma longa L., commonly known as turmeric, Indian saffron, or yellow root, is a tropical perennial native plant of the *Zingiberaceae* family, also called the ginger family. Currently, 133 distinct species of the *Curcuma* genus are found around the world. The first records for *Curcuma longa* L. go back to Vedic civilization around 4,000 years ago, where it was not just treated as a spice, but was also thought to possess medicinal values and religious significance (*1*). While originating from China, *Curcuma longa* L. is now also cultivated in India, western Pakistan, and Indonesia (*2*, *3*). Optimal conditions for its cultivation include moist soil, high levels of humidity, and air temperatures between 20°C and 30°C, with high exposure to sunlight (*1*). Phytochemical analysis of species within the genus *Curcuma* has identified around 720 secondary metabolites; most of these compounds are from the dried rhizome of the plant, which, upon drying and grinding, results in a dark yellow powder with bitter-sweet flavor (*2*-*4*). The curcuminoids are present in concentrations between 2% and 9% in rhizome (*2*). The isolated compound curcumin and its chemical analogues demethoxycurcumin and bisdemethoxycurcumin, whose structures are given in **Figure 1**, are identified as the major pharmacological compounds derived from *Curcuma longa* L., as they have an effect on various metabolic processes (*6*). Curcumin, which is identified as the major curcuminoid, accounts for about 77% of total curcuminoid content, while its metabolites demethoxycurcumin and bisdemethoxycurcumin account for 18% and 5% of total curcuminoids (*7*). Chemical structures of the most important curcuminoids are shown in **Figure 1**. The chemical instability of curcumin means it has to be stored at temperatures below 70°C and in amber glass bottles that protect against light (*8*).

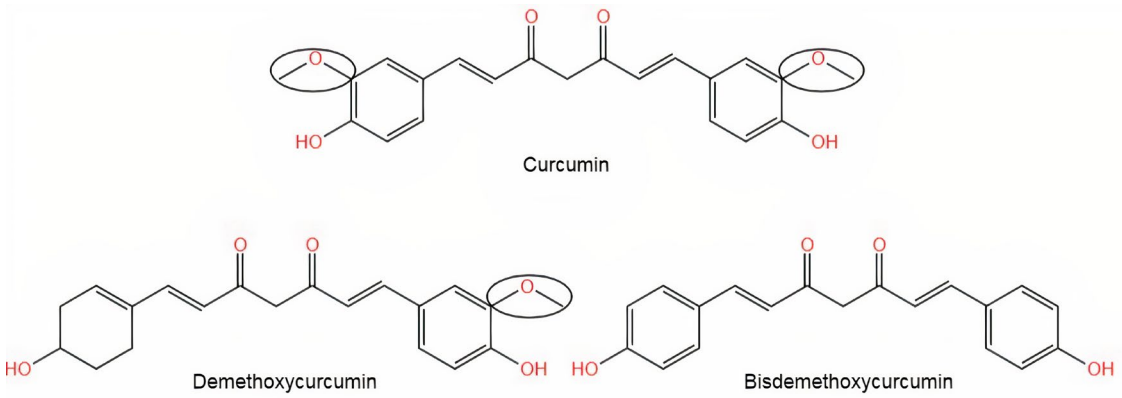

Figure 1. Chemical structures of the major curcumionids (*5*).

Several animal and clinical studies have shown the therapeutic benefits associated with different natural polyphenols, especially curcumin, in the treatment of mental health disorders, such as improvements in brain plasticity, behavior, mood, antidepressant activity, and cognition (*9*, *10*). Curcumin is a highly lipophilic molecule that easily crosses the blood-brain barrier and possesses neuroprotective effects thanks to the inhibition of lipid peroxidation, neutralization of reactive oxygen species, and inhibition of pro-inflammatory COX-1 and COX-2 enzymes (*11*). Due to its neuroprotective effect, curcumin, in addition to its conventional and traditional use in the treatment of osteoarthritis, can also be

used as a supportive therapy for psychiatric illnesses such as schizophrenia. Midownik and colleagues, for example, investigated the potential synergistic effect of antipsychotics and curcumin in hospitalized patients with a history of chronic schizophrenia and observed a statistically significant improvement in the index measuring negative pathophysiological symptoms in the group receiving curcumin dietary supplements compared to the placebo group, where participants used only antipsychotics (*12*). A more recent randomized controlled trial (RCT) by Masumeh and colleagues confirmed these findings, showing a statistically significant difference in the treatment of positive symptoms of schizophrenia (*13*).

Despite evidence supporting the potential therapeutic properties of the curcumin molecule, concerns remain regarding its extremely low oral bioavailability (*7*) and the even lower topical bioavailability of curcumin, which presents significant limitations in its application in dermatology (*14*). The latter can be improved by combining it with chitosan-alginate sponge, polymeric dressing, nano-emulsion, hydrogel, alginate foam, and collagen film, and by complexation with β-cyclodextrin into nanoparticles (*15*). Kulac and associates observed a paradoxical effect of curcumin in the process of burn wound healing in a rat model, where it demonstrated a pro-inflammatory effect by increasing the production of nitric oxide, which is considered one of the most important pro-inflammatory factors (*16*). Additional studies indicated that nitric oxide plays a significant role in accelerating the rate of wound healing (*17*).

Here we aimed to assess the adherence of abstracts of RCTs involving the plant *Curcuma longa* L. to the CONsolidated Standards Of Reporting Trials (CONSORT) guidelines (*18*), which presents a set of standards for the structuring of RCT abstracts. Our findings could highlight potential shortcomings and provide grounds for improving the methodology of future research on *Curcuma longa* L. Studies analysing the quality of abstracts are important because abstracts often serve as the only accessible part of a publication. Although numerous studies have assessed the quality of abstracts across scientific domains, this cross-sectional study is the first to specifically evaluate the quality of abstracts of RCTs on *Curcuma longa* L.

Methods

We searched the MEDLINE database *via* PubMed in July 2023 by combining the keywords "*Curcuma longa*" and "turmeric", with the filters "randomized controlled trial" applied in both searches before their merging using the "AND" Boolean operator. We included all abstracts fully available in English reporting on research published in the last 20 years, *i.e.*, from 2003 onwards. We excluded animal studies, other non-clinical research, and duplicate records. The screening process was done by one researcher (AK).

We assessed the quality of reporting of the included abstracts according to the CONSORT statement (**Table 1**) (*18*), extracting the following data into an Excel 2021 spreadsheet (Microsoft Corp., San Francisco, USA): study title, year of publication, name of the journal where study is published, description of the intervention, total number of participants, country where the study was conducted, data on pharmacological testing, multicentricity,

Table 1. CONSORT items list included in research

Item	Description
Title	Identification of the study as randomized
Authors*	Contact details for the corresponding author
Trial design	Description of the trial design (*e.g.*, parallel, cluster, non-inferiority)
Participants	Eligibility criteria for the participants and the settings where the data were collected
Interventions	Interventions intended for each group
Objective	Specific objective or hypothesis
Outcome	Clearly defined primary outcome for this report
Randomization	How participants were allocated to interventions
Blinding (masking)	Whether or not participants, caregivers, and those assessing the outcomes were blinded to group assignment
Numbers randomized	Number of participants randomized to each group
Recruitment	Trial status
Numbers analyzed	Number of participants randomized to each group
Outcome	For the primary outcome, a result for each group and the estimated effect size and its precision
Harms	Important adverse events or side effects
Conclusions	General interpretation of the results
Trial registration	Registration number and name of trial register
Funding	Source of funding

*This item is specific to conference abstracts. CONSORT – Consolidated Standards of Reporting Trials (*18*).

significance of the study, industry funding, hospital-based research, number of authors, and the structured format of the abstract.

Each item on the CONSORT checklist was scored as either 0 (“not present”) or 1 (“present”). We then performed a descriptive statistical analysis, where the total CONSORT score, indicating the quality of each abstract, was obtained by summing the values of all 17 items on the CONSORT checklist for each abstract. We presented the results of the statistical analysis as medians, whole numbers, and proportions. We then used the χ^2 test to explore the association between the presence of specific CONSORT checklist items and the structure of the scientific abstract. An abstract is considered structured if it is organized under the subheadings “Introduction”, “Methods”, “Results”, and “Discussion”, and unstructured if it is presented as a single paragraph without clear division of sections .

All analyses were done in MedCalc, version 11.5.1.0 (MedCalc Software, Ostend, Belgium).

Results

We identified 170 abstracts of RCTs on the efficacy of *Curcuma longa* L. in the MEDLINE database. There were no duplicate records. After the literature screening, 138 abstracts remained for further analysis. Thirteen abstracts were excluded because the studies were using animal models, sixteen because the studies were not designed as RCTs, and three due to the unavailability of abstracts.

The highest proportion of turmeric RCT abstracts (15.2%) was published in the final year of the observed period (2022), while from 2004 to 2022, an increasing trend in the number of turmeric research abstracts can be observed, albeit with a slight decline in 2020 and 2021 (**Figure 2**). Most of the research studies were conducted in India (21.2%), followed by Iran (20.4%) and the USA (8.8%). The median total score according to the CONSORT criteria was 7 (interquartile range = 6–9). The highest recorded score was 13 items, which was observed in only one abstract.

Out of the total 138 analyzed RCT abstracts, 85 followed the general CONSORT structure, while 53 were characterized as unstructured (**Table 2**). We examined the association between the presence of CONSORT checklist items and the structure of the abstract (*i.e.*, whether it was structured or unstructured) using the χ^2 test. We found that 7 of the 17 CONSORT checklist items showed a statistically significant association with abstract structure ($P < 0.05$). Three items demonstrated a significant statistical difference depending on abstract format: the inclusion of author and contact information, the study objective, and the study conclusion. We also found marginally significant differences for the reporting of study design, outcomes by group with effect estimates, adverse effects, and trial registration. We found no statistically significant differences for any of the remaining items.

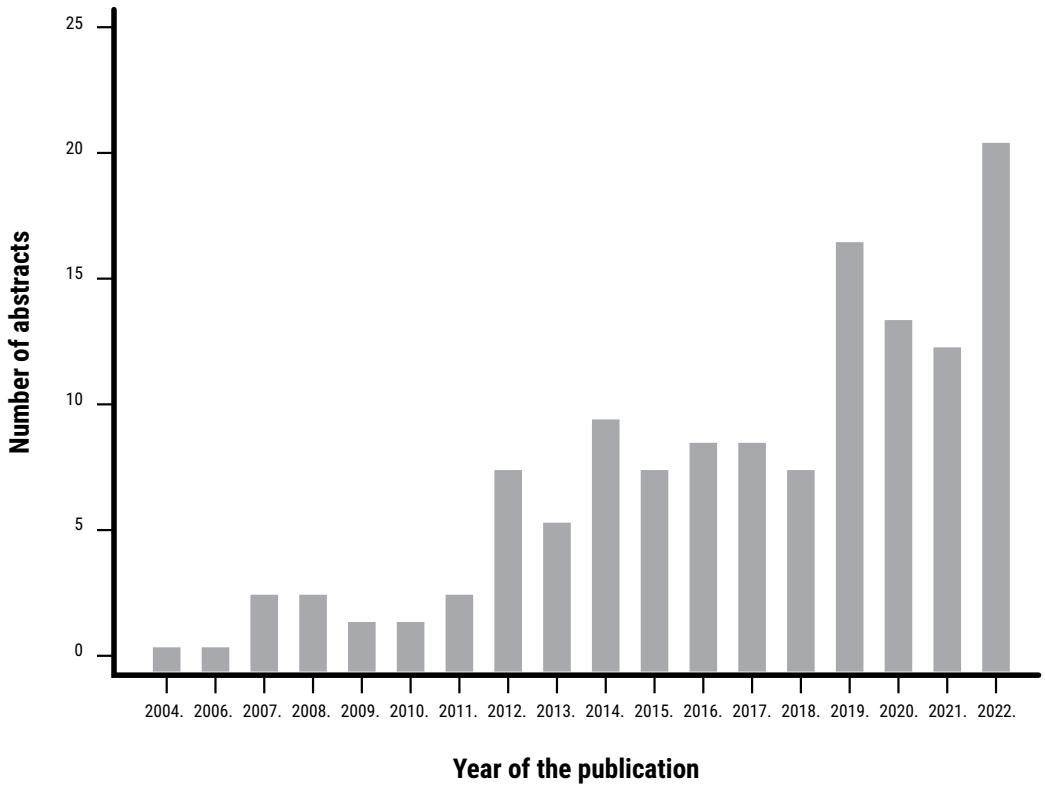

Figure 2. Total number of turmeric-related research abstracts over the study period.

Table 2. Differences in the frequency of CONSORT items in turmeric research abstracts between structured and unstructured abstracts, n (%)*

CONSORT item	Overall (n = 138)	Unstructured (n = 53)	Structured (n = 85)	*P*-value†
Title	76 (55.1)	27 (50.9)	49 (57.6)	0.069
Authors	55 (39.9)	11 (20.8)	44 (51.8)	<0.001
Trial design	56 (40.6)	17 (32.1)	39 (45.9)	0.043
Participants	15 (10.9)	4 (7.5)	11 (12.9)	0.478
Interventions	106 (76.8)	38 (71.7)	68 (80.0)	0.359
Objective	120 (87.0)	40 (75.5)	80 (94.1)	<0.001
Outcome (primary)	118 (85.5)	43 (81.1)	75 (88.2)	0.365
Randomization	4 (2.9)	1 (1.9)	3 (3.5)	0.969
Blinding	71 (51.4)	25 (47.2)	46 (54.1)	0.536
Numbers randomized	67 (48.6)	23 (43.4)	44 (51.8)	0.434
Recruitment		8 (15.1)	14 (16.5)	0.981
Numbers analyzed		14 (26.4)	30 (35.3)	0.367
Outcome (secondary)		30 (56.6)	60 (70.6)	0.013
Harms		5 (9.4)	25 (29.4)	0.011
Conclusions		18 (34.0)	84 (98.8)	<0.001
Trial registration		5 (9.4)	20 (23.5)	0.042
Funding		2 (3.8)	3 (3.5)	0.694

* CONSORT – Consolidated Standards of Reporting Trials (*18*).
†χ^2 test.

Discussion

The abstracts of RCTs included in our analysis partially adhered to the CONSORT checklist, with none having all 17 elements of the guidelines. The CONSORT items most commonly present in the abstracts were the specification of objectives and primary outcomes, while the least represented were those on the method of randomization and study funding.

This study contributes to the general understanding of the quality of abstracts of RCTs on *Curcuma longa* L. available in the MEDLINE database. It emphasizes that even high-quality biomedical research may suffer from poor reporting, and as such, should be interpreted with appropriate critical judgment. Aside from the CONSORT guidelines for abstracts used here (*17*), which have been accepted as a standard in reporting on RCTs, the modern Grading of Recommendations Assessment, Development, and Evaluation (GRADE) method (**Table 3**) has also been adopted by most relevant biomedical organizations as a means of evaluating the quality of biomedical research (*19*). Our results could therefore positively impact the quality of published biomedical content by highlighting current shortcomings and thus functioning as a call to researchers and editors of biomedical journals to adopt quality standards such as the CONSORT checklist when reporting on or publishing research findings.

Table 3. GRADE – a modern method for assessing the quality of scientific research

Quality of evidence	Study design	Lower quality if*	Higher quality if*
High Moderate Low Very low	Randomized trial Observational study	Study limitations: −1 = serious, −2 = very serious. Inconsistency: −1 = serious, −2 = very serious. Indirectness: −1 = serious, −2 = very serious. Imprecision: −1 = serious, −2 = very serious. Publication bias: −1 = likely, −2 = very likely.	Large effect: +1 = large, +2 = very large. Dose response: +1 = evidence of gradient. All plausible cofounders: + = would reduce a demonstrated effect or + = would suggest a spurious effect when results show no effect.

*Quality of study moves down one or two grades (*19*).
†Quality of study moves up one or two grades (*19*).

Our findings align with those of other research. For example, one cross-sectional conducted in 2022 examined the effect of CONSORT guidelines on abstract quality related to RCTs of *Helicobacter pylori* infections and demonstrated a shortfall in abstract quality (*20*), whereby the lowest two of these CONSORT checklist items reported were funding (2.0%) and randomization (2.7%). This correlates with our findings, where the least represented items were also funding (3.6%) and randomization (2.9%). The findings show that biomedical research abstracts related to *Curcuma longa* L. are not appropriately structured, and the most frequently missing CONSORT items are related to funding and randomization methods, which reduces the transparency and credibility of the research. These findings suggest that a significant portion of the content published on *Curcuma longa* L. in the MEDLINE database might suffer from suboptimal reporting.

The study has limited value as it was conducted exclusively using the MEDLINE database, which is only one of many databases containing biomedical research. To increase the relevance of findings, it is recommended to use other databases such as Google Scholar or Scopus, which also contain biomedical studies. This could be explained by the MEDLINE database imposing a word limit of 1000 for abstracts, which may present challenges in structuring abstracts appropriately. It could also be related to a lack of awareness regarding which biomedical journals recommend adherence to the CONSORT checklist in their submission guidelines, thus influencing the structure and quality of published abstracts. An additional limitation is the relatively small sample size: when searching the PubMed database using the keywords "*Curcuma longa*" and filtering for "randomized controlled trial", only 170 articles were available for analysis. Lastly, another potential limitation of the study lies in the fact that the evaluation of CONSORT abstract items was carried out by a single reviewer, potentially introducing subjective interpretation, despite standardized criteria being applied.

However, to further support this claim, additional research is needed focusing on abstracts from studies with other subjects. This study, along with similar ones, can aid in the methodology of writing scientific content in the biomedical field and thus significantly contribute to the general quality of scientific material.

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