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FROM MEASUREMENT TO MISBRANDING: EVALUATING DUAL COMPLIANCE UNDER FSSAI AND LEGAL METROLOGY LAWS

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Abstract

Precise measurement lies at the heart of consumer trust and regulatory credibility in India's packaged food market. This paper explores how discrepancies in the quantitative and compositional information shown on food labels can shift from being simple measurement issues to becoming legal violations under Section 52 of the Food Safety and Standards Act, 2006 (FSSA). The study looks at how two regulatory frameworks the Food Safety and Standards (Labelling and Display) Regulations, 2020 and the Legal Metrology (Packaged Commodities) Rules, 2011 (LMPC) interact when it comes to presenting, checking, and enforcing quantitative details like net quantity, weight, and nutritional content.

By combining a careful reading of the relevant laws with hands-on measurement audits of packaged foods from retail stores in Kolkata and Hyderabad, this research measures the gaps between what labels claim and what products actually contain. These differences are then compared against the error limits allowed under the Legal Metrology rules. The results show that even small inconsistencies in measurement, number rounding, or nutrient calculations can lead to conflicting actions by food safety and legal metrology officials, especially when there are no shared standards for acceptable variation.

This paper discusses that without a single, integrated compliance framework, there is unnecessary duplication and confusion about when a product crosses the line into misbranding. A combined approach that brings together measurement traceability, uncertainty calculation, and information sharing between agencies is put forward as a way to better align measurement verification with food law enforcement. Building this kind of bridge between the two regulatory

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systems is key to maintaining honest labelling, shielding consumers from misleading packaging, and helping India move toward a more evidence-based approach to food regulation.

Keywords: *FSSAI · Legal Metrology · Misbranding · Measurement accuracy · Labelling compliance · Permissible error · Food law harmonisation · Consumer protection*

1. Introduction

When consumers pick up a packaged food item, they place a good deal of trust in the information like nutrition, weight and dietary claims printed on the label. But ensuring that those numbers are accurate is both a scientific challenge and a matter of legal responsibility. Under the Food Safety and Standards Act, 2006 (FSSA) (Government of India 2006) and the Food Safety and Standards (Labelling and Display) Regulations, 2020 (L&D Regulations) (Food Safety and Standards Authority of India 2020), every packaged food product must clearly state its name, ingredients, nutritional breakdown, date of packing and date of expiry, and net weight. At the same time, the Legal Metrology Act, 2009 (LMA) and the Legal Metrology (Packaged Commodities) Rules, 2011 (LMPC) focus on making sure the net quantity is correct. That measurements can be traced back to recognised standards, and that any errors fall within acceptable limits. Together, these laws work to protect consumers from being shortchanged and to keep trade measurements fair and consistent.

The trouble is that these two sets of rules are managed by different authorities FSSAI and the Legal Metrology Department and their superintendence and control is under different Departments of the Central Government and their responsibilities sometimes bump into each other. FSSAI is the regulates the manufacturing and distribution and sale of food and looks after public health and makes sure nutritional information is truthful, while Legal Metrology is more concerned with getting measurements right and checking that weighing equipment is properly calibrated. Because there is no clear system for combining scientific tolerances with legal accountability, businesses can find themselves in murky compliance territory. This becomes especially problematic when a small measurement gap triggers action from both regulators at once.

India's organised food retail sector, now worth over USD 70 billion, and the majority of the business is dominated by prepacked goods (India Brand Equity Foundation 2024). Most shoppers treat what is printed on a package as absolute fact, without realising that all

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measurements carry some degree of uncertainty. When the difference between what the label says and what is actually inside crosses certain limits, what started as a technical measurement problem becomes a legal issue of misbranding or short weight.

This study sets out to examine how measurement variation connects to legal liability, drawing on actual product sampling from retail stores and a close reading of the relevant statutes. The argument here is that bringing together metrological traceability, uncertainty estimation, and coordinated enforcement can make regulation more predictable and strengthen consumer confidence. By testing 50 Stock Keeping Units (SKUs) across five product types and checking the measured differences against both LMPC and FSSAI tolerance limits, this work puts numbers to the risk of double penalties and points toward ways the system might be brought into better alignment.

2. Objectives

This research pursues the following specific goals:

1. To assess how accurately packaged food labels reflect actual quantities, measured against the tolerance levels set out in the LMPC Rules 2011.
2. To identify where the LMPC Rules and FSSAI L&D Regulations overlap or contradict each other regarding quantity.
3. To work out at what point a measurement discrepancy turns into a misbranding offence under Section 52 FSSA.
4. To put forward a unified compliance approach that ties metrology verification together with food law enforcement.

3. Literature Review

Around the world, measurement standards in trade have come to be seen as essential for protecting consumers. The International Organisation of Legal Metrology (OIML) has developed model recommendations like OIML R 87 (Quantity of Product in Pre-Packages) (International Organization of Legal Metrology 2019) and OIML G 19 (General Guidelines for Metrological Control of Pre-Packaged Products) (International Organization of Legal Metrology 2022). These set out the basics, how to sample, what error margins are allowed, and how to account for measurement uncertainty all of which are fundamental to fair trade.

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In India, most studies on food labelling have focused on the qualitative side of things nutrient claims, health warnings, front-of-pack nutrition scores, and the like (Sharma, Mishra and Patel 2021; Gupta and Singh 2021). Research into whether quantities are actually correct is much harder to find. FSSAI inspection reports from 2019 to 2023 show that less than 2% of prosecutions were about net quantity problems, which hints at how little the food and metrology authorities have been working together (Food Safety and Standards Authority of India 2023).

Very few scholars have looked at where food law and legal metrology meet. Journals like MAPAN have published little that bridges the legal and scientific sides of measuring packaged food. One article from 2024, titled "The Intersection of Food Laws and Legal Metrology Laws in India" (Srikkanth GR, Yadav 2024), offered a legal overview on conflicts and harmonization of food laws and legal metrology laws but stopped short of any empirical work. The present study builds on that foundation by combining on the ground measurement audits filling an important gap in the literature on measurement law and packaging regulations of food products.

Looking beyond India, other countries provide useful models. The European Union's Directive 76/211/EEC (European Commission 1976) and the US NIST Handbook 133 (National Institute of Standards and Technology 2020) use consistent tolerances for verifying net content across all product categories, which cuts down on confusion for industry and consumers alike. India's patchwork approach, by contrast, has bred uncertainty a problem that calls for careful study and reform.

4. Methodology

4.1 Research Design

This study uses an interdisciplinary approach that blends measurement verification, legal analysis, and policy evaluation. The research was organised into three parts:

1. Regulatory Mapping – A side-by-side comparison of every provision relating to quantity declarations in the L&D Regulations 2020 and the LMPC Rules 2011, looking for points of agreement and conflict.
2. Empirical Measurement Audit – Physical checks on selected packaged foods from major retail chains in Kolkata and Hyderabad to test whether net quantities and nutrient panels match what is declared.
3. Legal Correlation – Linking the measurement findings to statutory penalties and court decisions to pinpoint when a discrepancy crosses the line into misbranding.

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4.2 Sampling and Measurement Procedure

Fifty Stock Keeping Units (SKUs) were randomly chosen from five product categories cereals, edible oils, snack foods, beverages, and ready-to-eat meals from well known food manufacturers. Each package was weighed using a NABL-calibrated precision balance (with an uncertainty of ±0.01 g) in controlled conditions designed to minimise any effect from moisture loss or absorption.

The deviation percentage was worked out using:

$D = ((M - Dc) / Dc) \times 100$

where M is the measured net content and Dc is what the label declares.

These measured deviations were then compared to the tolerances in Table 1A of the LMPC Rules 2011. Any sample that fell outside these limits was flagged for further assessment of potential dual liability.

4.3 Legal and Documentary Data

Secondary sources included:

- Adjudication and compounding orders available online at Food Safety Appellate Tribunals.
- High Court Judgements

Circulars from the Controller of Legal Metrology on how permissible error should be interpreted.

4.4 Data Analysis

The quantitative data were analysed using descriptive statistics (mean, standard deviation, variance). Results were sorted into three groups:

1. Compliant (within tolerance);
2. Minor noncompliance (beyond tolerance by up to 2%);
3. Significant noncompliance (more than 2% beyond tolerance).

Each category was then matched to the relevant legal outcome: no action, compounding, or prosecution under the applicable statute.

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5. Results

5.1 Net Quantity Compliance

Category	n	Mean Declared (g/ml)	Mean Measured (g/ml)	Deviation %	LMPC Tolerance %	Status
Cereals & Pulses	10	1000	988	−1.2	±1.5	Compliant
Snack Foods	12	100	96	−4.0	±5.0	Compliant
Edible Oils	8	1000	975	−2.5	±3.0	Compliant
Beverages	10	500	496	−0.8	±1.0	Compliant
Ready-to-Eat Meals	10	300	284.9	−5.03	±5.0	Borderline /Non compliant
Overall Mean	50	—	—	−2.77	—	82% compliance

The analysis revealed that cereals and pulses, comprising ten samples with a declared quantity of 1000 grams, exhibited a mean measured quantity of 988 grams, reflecting a negative deviation of 1.2 percent. This deviation remained well within the permissible tolerance of ±1.5 percent stipulated for this category, thereby indicating satisfactory compliance among manufacturers of staple food products.

Similarly, the snack foods category, which included twelve samples with a declared content of 100 grams, demonstrated a mean value of 96 grams, corresponding to a deviation of 4.0 percent. Although this represents the deviation observed in the study against the declaration on the package, it nonetheless falls within the relatively liberal tolerance threshold of ±5.0 percent applicable to this product segment.

Edible oils presented a moderate deviation pattern, with eight samples declaring 1000 millilitres yielding an average measured quantity of 975 millilitres, translating to a shortfall of 2.5 percent against the permitted tolerance of ±3.0 percent.

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The beverages category exhibited the strongest compliance performance among all segments examined, with ten samples declaring 500 millilitres returning a mean measured content of 496 millilitres, representing a deviation of merely 0.8 percent against the allowable ±1.0 percent tolerance. This near-complete alignment between declared and actual quantities suggests robust quality control mechanisms within the beverage manufacturing sector.

Courts have read these situations differently: some saw quantity shortfalls as purely a metrology matter, while others treated them as misbranding under FSSA—creating real uncertainty for enforcement. In Nestlé India Ltd v Union of India, the Supreme Court found that measurement gaps falling within scientifically accepted tolerances do not amount to misbranding. Yet lower courts have not always followed this line, particularly with products sitting right at the edge of permissible error.

The ready-to-eat meals category, where ten samples with a declared quantity of 300 grams produced a mean measured value of only 284.9 grams. This constitutes a deviation of 5.03 percent, which exceeds the prescribed tolerance limit of ±5.0 percent for this category. The non-compliance observed in this segment is borderline.

From a regulatory perspective, the overall deviation remaining below the typical tolerance thresholds prescribed under the Legal Metrology (Packaged Commodities) Rules suggests that the existing framework is functioning as intended at a macro level, with the majority of products achieving technical compliance. While the above deviations are legally permissible, but raises questions about whether the manufacturing is adhering to lower tolerance levels.

The overall deviation of 2.77 percent indicates that the packaged food sector in the study area is operating within broadly acceptable parameters of legal metrology compliance.

6. Discussion

6.1 Measurement Variance and Legal Threshold

Every measurement comes with some degree of uncertainty, but Indian food regulations tend to assume perfect accuracy. Because the two sets of rules do not share a common approach to tolerances, the very same deviation can lead to different legal consequences. Take a −6% shortfall in a 100 g bag of chips: it would breach LMPC tolerance but might be ignored by FSSAI if nutritional value stayed intact. The same gap in an energy bar, though, could be

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prosecuted as misbranding because of the effect on nutrient claims.

This inconsistency arises from fundamentally different regulatory outlooks. Legal Metrology is focused on fair trade and stopping economic fraud through accurate measurement, while FSSAI is primarily concerned with public health and nutritional accuracy. Without coordination between these complementary but separate mandates, food businesses face unpredictable exposure to liability.

6.2 Institutional Overlap

Both regulators carry out their own inspections, each using different sampling methods and documentation. Without sharing data, they end up duplicating effort and wasting resources. Controllers of Legal Metrology concentrate on weighing equipment and packaging, while Food Safety Officers look at labels and nutrient panels. There is almost no coordination at the inspection level, which means manufacturers can face multiple compliance audits for what is essentially the same packaging requirement.

The duplication carries over into laboratory testing as well. Legal Metrology departments use calibrated balances traceable to National Physical Laboratory (NPL) standards, whereas FSSAI-notified laboratories may rely on different reference standards without explicit NPL traceability. This opens the door to conflicting measurement results, complicating both enforcement and any legal defence.

6.3 Need for Harmonised Tolerance

A look at international practice shows that regulators elsewhere—such as under EU Directive 76/211/EEC (European Commission 1976) and US NIST Handbook 133 (National Institute of Standards and Technology 2020)—apply uniform tolerances for checking net content across all product types. India's fragmented system leads to confusion for industry and misleading information for consumers. A Unified Quantitative Compliance Matrix (UQCM) that aligns LMPC tolerances with FSSAI nutrient allowances would clear up the ambiguity and give food businesses clearer guidance.

Such a matrix would need to account for several technical factors: natural variation in products (especially agricultural goods), what manufacturing processes can realistically achieve, how packaging materials behave, and environmental influences on net content. International best

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practice suggests that tolerance levels should be set according to risk, balancing consumer protection with what is technically feasible (Codex Alimentarius Commission 2015). Putting this into practice would require joint technical committees of metrology experts, food scientists, and legal professionals to develop standards that are both scientifically sound and legally enforceable.

6.4 Measurement Traceability and Uncertainty

Proper enforcement depends on measurements being traceable to SI units through calibration chains certified by the National Physical Laboratory (NPL) or BIS-accredited laboratories. Many state laboratories still use uncalibrated balances or gravimetric methods without any uncertainty evaluation, which weakens the legal credibility of their findings. Bringing ISO 17025-compliant uncertainty reporting into FSSAI's analytical labs would make measurements more trustworthy and provide a stronger foundation for prosecutions.

The Codex Alimentarius Commission's Guidelines on Measurement Uncertainty in Food Analysis (Codex Alimentarius Commission 2004) offer a ready framework that India could adapt. Uncertainty budgets should take into account sampling variability, analytical method precision, calibration uncertainty, and environmental conditions. This systematic approach would help courts tell the difference between genuine measurement uncertainty and deliberate short-filling, leading to better-quality decisions in food labelling disputes.

6.5 Consumer and Industry Implications

For businesses, having to comply with two sets of rules drives up costs through separate inspections, dual compounding fees, and the uncertainty that comes with unclear legal expectations. For consumers, patchy enforcement chips away at confidence that labelled quantities mean what they say. Clear declarations backed by traceable measurement would boost both consumer trust and ease of doing business.

The economic burden goes beyond direct costs. Food manufacturers must keep up separate documentation systems, sit through multiple audits, and may even face penalties from both regulators for the same underlying problem. Small and medium enterprises feel this weight most heavily, which can discourage new entrants and slow innovation. A harmonised system would create a more level playing field and lower the barriers to compliance.

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7. Policy Recommendations

Drawing on the empirical findings and legal analysis, the following policy changes are recommended:

1. Unified Quantitative Compliance Matrix (UQCM): FSSAI and the Legal Metrology Division should jointly draft a matrix specifying harmonised permissible errors for both net quantity and nutrient values. This should be developed through broad consultation with industry, consumer groups, and scientific experts.
2. Joint Inspection and Data Exchange Portal: A digital platform should be created for real-time sharing of inspection reports, sampling data, and laboratory results between the two agencies. This would prevent duplicated inspections, allow for coordinated enforcement, and give manufacturers a single compliance dashboard.
3. Metrological Traceability Requirement: ISO 17025-compliant calibration should be made compulsory for all laboratory instruments used in enforcement under both laws. A network of accredited calibration laboratories with NPL traceability should be set up to ensure measurement consistency across the country.
4. Standardised Reporting Templates: Uniform forms should be developed that capture measured value, declared value, deviation, uncertainty, and the legal provision breached. This would ensure consistent documentation across jurisdictions and improve the quality of legal proceedings.
5. Capacity Building: Joint training programmes for field officers should be rolled out, covering uncertainty estimation, statistical sampling, and how to interpret both laws together. Training should stress the complementary nature of the two frameworks and proper coordination protocols.
6. Consumer Communication: Public awareness campaigns should be launched to explain permissible variation ranges, so consumers do not mistake minor deviations for fraud. Educational materials should make the science of measurement uncertainty accessible.

8. Conclusion

This study provides empirical evidence of how measurement variation in packaged foods, when judged under two separate statutory frameworks, can escalate from a technical tolerance breach to a formal misbranding offence. Close to one-fifth of the category tested exceeded LMPC tolerance, highlighting a real risk of double penalties. Differences in how tolerances are defined, how samples are collected, and how laboratories are calibrated all undermine the

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coherence of India's food labelling enforcement.

The research brings to light a basic tension between the precision demanded by metrology and the expectations of food safety regulation a tension that needs systematic attention. Measurement science accepts that uncertainty is inevitable, yet legal frameworks often insist on absolute compliance, setting an unrealistic bar that neither protects consumers effectively nor allows for fair enforcement.

Moving from a punitive to a preventive approach means regulators must weave metrological rigour into the fabric of food safety governance. Building a unified quantitative compliance framework, underpinned by traceable measurement and open data exchange, would bring India's system into line with international best practice and strengthen consumer confidence in labelled quantities. The proposed Unified Quantitative Compliance Matrix offers a workable route to resolving jurisdictional conflicts while keeping standards high.

Future research could explore AI-driven image recognition and IoT-enabled smart weighing to automate verification and cut down on human error in enforcement. Longer-term studies tracking compliance trends would also help gauge how well harmonisation efforts are working and flag new challenges as the food retail landscape evolves. The use of blockchain technology for tamper-proof records of measurement data is another promising direction for boosting transparency and accountability in this dual compliance environment.

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