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Beyond taste: Food safety, hygiene, and labeling in Indore's namkeen sector

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Abstract

This study investigates the food safety and quality status of namkeen manufacturing in Indore, India, using the Geographically and Industry-Stratified Sampling Method (GISSM). A total of 25 samples from local, medium, and national manufacturers were analyzed for physicochemical parameters (moisture, ash, acid insoluble ash, total polar compounds), hygienic and sanitary practices, and label artwork verification. Results were compared against FSSAI standards to assess compliance, consumer acceptability, and food safety risks. Findings reveal significant disparities across manufacturing scales, with local units showing weakest compliance, medium units mixed performance, and national units generally stronger control and labeling. The study underscores the urgent need for standardized monitoring, regulatory enforcement, and awareness programs to ensure safe, high-quality namkeen production.

Keywords: Namkeen industry, food safety, FSSAI standards, GISSM methodology, quality assurance, consumer acceptability

Introduction

Indore, often referred to as the “Snack capital of India” is home to a thriving namkeen industry that ranges from small-scale local units to large national brands. Despite its cultural and economic significance, the industry faces challenges in maintaining food safety, hygiene, and regulatory compliance. This research aims to provide a systematic evaluation of the industry's current practices, highlighting strengths and gaps that influence consumer trust and regulatory enforcement.

Methodology

Samples were collected across three categories

- **Local manufacturers (12 Samples):** Small-scale, unorganized units.
- **Medium manufacturers (10 Samples):** Semi-organized, regionally distributed units.
- **National manufacturers (3 Samples):** Large-scale, branded producers.

Parameters analyzed included moisture content, ash, acid insoluble ash, total polar compounds (TPC), hygienic practices, and label artwork verification. Statistical tools (mean, standard deviation, coefficient of variation, ANOVA under GISSM) were applied to determine significant differences across categories.

Results and Discussion

Moisture Content: Local units showed high variability (0.5-3.3%), medium units moderate control, and national units consistent compliance (1.5-2.1%). Excess moisture (>3%) risks microbial growth and reduced shelf life.

- **Ash content:** Local units occasionally exceeded 4%, suggesting contamination. Medium units showed moderate control, while national units maintained stable values within safe limits.

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- **Acid insoluble ash:** All samples remained within permissible limits ($<0.1\%$), though local units showed slightly higher variability. National units demonstrated best control.
- **Total Polar Compounds (TPC):** Local units frequently exceeded the 25% safety threshold, medium units showed mixed compliance with one severe outlier (45%), while national units consistently remained below limits. Unsafe TPC levels indicate harmful oil degradation and poor frying practices.
- **Hygienic and sanitary practices:** Local units scored lowest (16-38), medium units mixed (23-70), and national units highest (80-96). Poor hygiene increases microbial contamination risks, while strong practices enhance consumer trust.

- **Label artwork verification:** Compliance was inconsistent across all scales. Local units showed moderate adherence, medium units mixed performance, and national unit's shows strong compliance, highlighting lapses in packaging oversight.

Implications

The findings reveal that food safety and compliance are uneven across scales of production. Local and medium manufacturers require stricter monitoring, training, and enforcement of Good Manufacturing Practices, while national manufacturers are maintaining compliances. For consumers, these differences translate into varying levels of product safety, trust, and acceptability. For regulators, GISSM provides a robust framework to capture variability and guide targeted interventions.

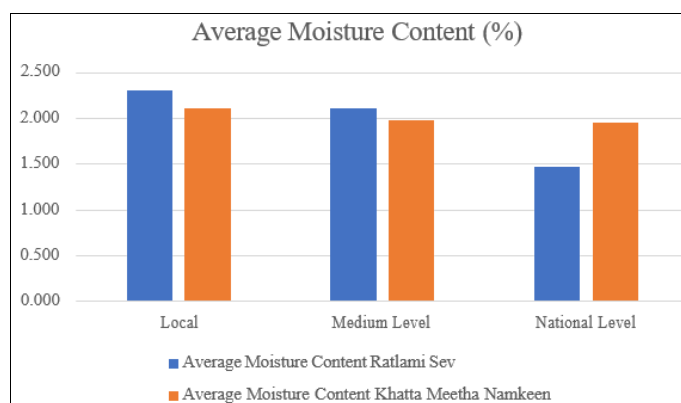


Fig 1: Average moisture content across local, medium, and national manufacturers

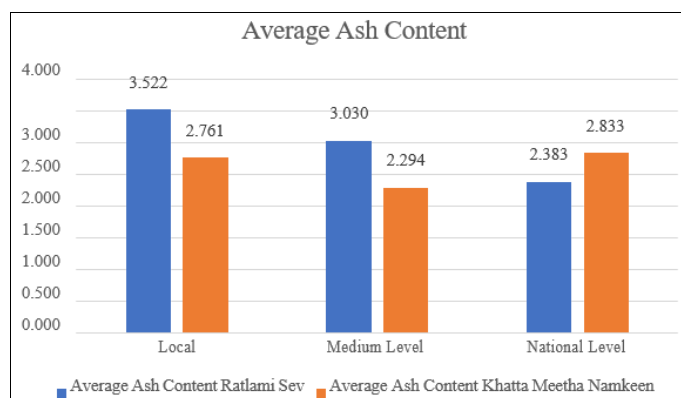


Fig 2: Comparative ash content

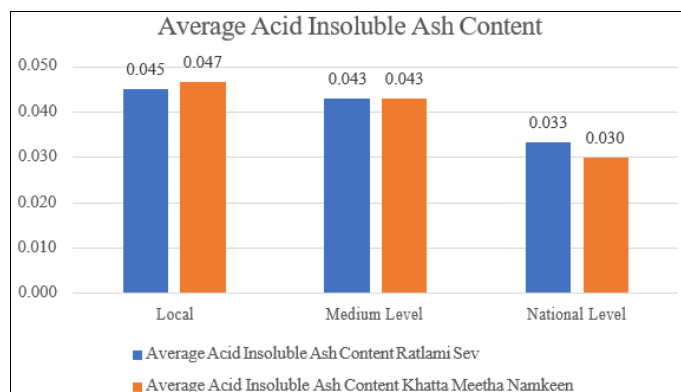


Fig 3: Comparative Acid Insoluble Ash Content

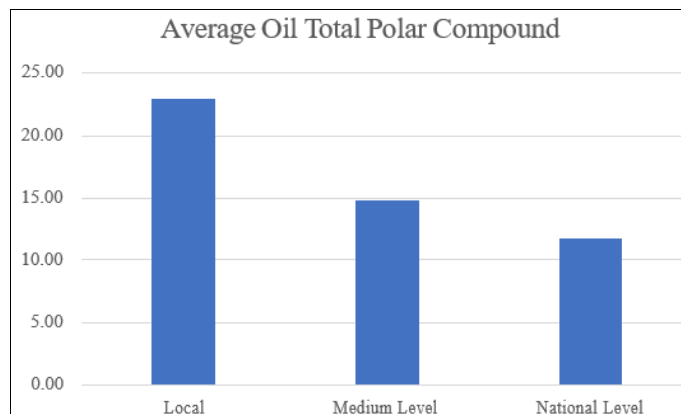


Fig 4: Total Polar Compounds (TPC) compliance chart

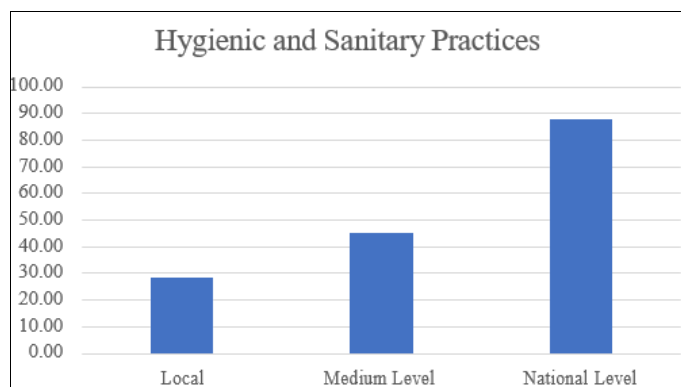


Fig 5: Hygienic and sanitary practices score comparison as per FSSAI schedule 4, part II

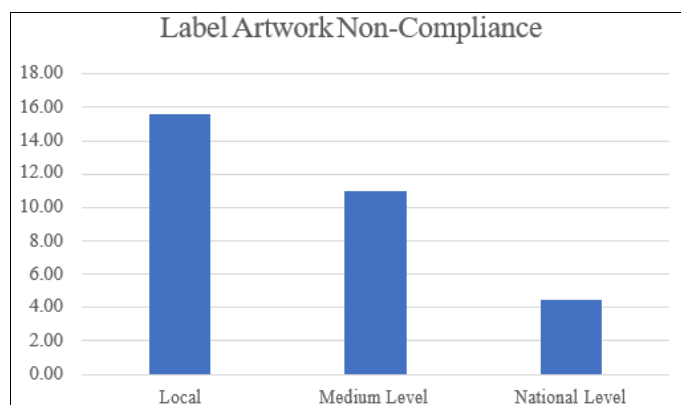


Fig 6: Labelling compliance as per FSS (labelling and display) regulation 2020

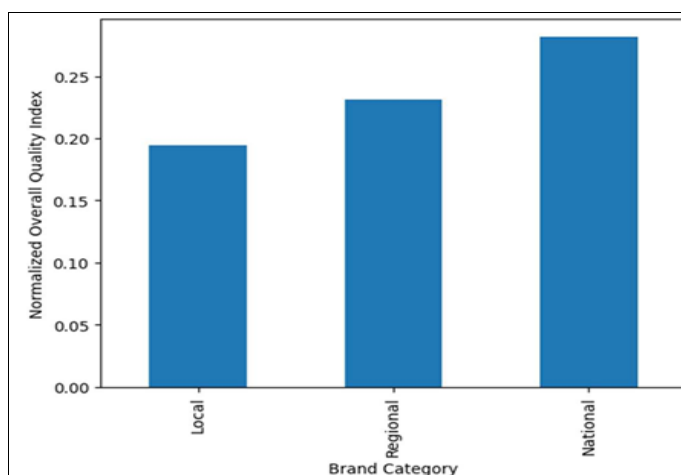


Fig 7: Overall quality comparison among brand categories

Table 1: Statistical summary (Mean, SD, CV %) for all parameters

Parameter	Mean ($\bar{x}$)	Standard Deviation (σ)	Coefficient of Variation (CV%)
Moisture Content (Ratlam Sev)	2.18%	0.72%	33.0%
Moisture Content (KhaLa Meetha Namkeen)	2.02%	0.53%	26.2%
Ash Content (Ratlam Sev)	3.19%	0.73%	22.9%
Ash Content (KhaLa Meetha Namkeen)	2.65%	0.66%	24.9%
Acid Insoluble Ash (Ratlam Sev)	0.045%	0.018%	40.0%
Acid Insoluble Ash (KhaLa Meetha Namkeen)	0.045%	0.021%	46.7%
Total Polar Compounds (Oil)	18.1%	9.8%	54.1%
Hygienic & Sanitary Practices	37.6	20.9	55.6%

Conclusion

This study establishes that while national manufacturers generally demonstrate stronger compliance, systemic improvements are required across all scales to ensure robust food safety, regulatory adherence, and consumer protection. The GISSM methodology effectively highlights structural disparities in the namkeen industry of Indore, offering a scientific basis for policy recommendations, industry training, and consumer awareness initiatives.

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