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KULASTHREE MOM & *NALLA KUTTY* DAUGHTER: SOCIO-CULTURAL PATHWAYS AND ENVIRONMENTAL ENABLERS OF OBESOGENIC BEHAVIOR AMONG MOTHER-DAUGHTER DYADS KERALA, INDIA

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ABSTRACT

Background: Kerala faces a paradox of high literacy with rising obesity, especially among women. Mother-daughter dyads are critical units for transgenerational transmission of obesogenic behavior.
Objective: To examine socio-cultural pathways and environmental enablers of obesogenic behavior among mother daughter dyads in three districts of Kerala
Methods: Exploratory sequential mixed-methods study. 120 mother-daughter dyads from Thiruvananthapuram, Kochi, and Thrissur were classified into 4 BMI clusters. Data included surveys, in-depth interviews, reminiscence narratives, and ANGELO environmental audit of food and built domains . Six stakeholders were interviewed.
Results: Four pathways emerged: 1) Sedentariness-Inertia, 2) Academic-Stress-Eating, 3) Gendered PhysicalActivity (PA)Restriction, and 4) Synchronized Food Consumption. Food and Built environments were rated "Poor" in TVM and Kochi, "Average-Poor" in Thrissur. Key enablers: *Kulasthree* food-as-care norms, Superhero Mom work stress, and *Nalla Kutty* academic pressure + PA taboos. Binge eating was 59.7% in daughters; emotional eating 74.3% in mothers. Dyadic Sedentary Index was highest in Kochi, OR=11.82, 95% CI.
Conclusion*:* Obesogenicity is structurally produced. Interventions must address ANGELO domains and reframe gendered cultural norms around food, work, and movement.

Keywords: *Obesogenic environment; ANGELO; mother-daughter dyad; binge eating; gender norms; Kerala; trans generational*

1. INTRODUCTION

Kerala has achieved remarkable success in literacy, healthcare access, and social indicators. Paradoxically, it also reports the highest prevalence of overweight and obesity among women in India according to NFHS-5. This contradiction suggests that health knowledge alone is insufficient to prevent non-communicable disease risk.Within Malayali households, behaviors are not adopted in isolation. They are learned, modeled, and reinforced within families, particularly between

mothers and daughters. Three cultural archetypes continue to organize daily life in Kerala. The *Kulasthree r*epresents the traditional homemaker whose identity and social respect are derived from cooking and feeding. The Superhero Mom represents the modern working woman who navigates paid employment, domestic labor, and caregiving simultaneously. The *Nalla Kutty* daughter represents the adolescent girl whose value is measured by academic achievement, obedience, and adherence to conservative public conduct.Swinburn's ANGELO framework provides a lens to understand how environments shape obesity risk. It argues that the "sum of influences" in physical, economic, political, and sociocultural domains promotes energy intake and reduces expenditure. Despite its utility, ANGELO has rarely been applied to Indian family dyads, and never with an explicit focus on culture-specific gender roles. This paper therefore asked how *Kulasthree,* Superhero, and *Nalla Kutty* roles interact with Kerala's urban environments to create obesogenic pathways across generations.

METHODS

2.1 Study Design & Setting

Exploratory sequential mixed-methods study conducted in 3 centers: Thiruvananthapuram - Capital, Kochi - Metro, Thrissur - Cultural.

2.2 Participants

120 mother-daughter dyads with daughters aged 14-18y, stratified into 4 clusters by BMI:
C1: Obese-Obese, C2: Obese-Non Obese, C3: Non Obese-Obese, C4: Non Obese-Non Obese
Plus N=6 stakeholders: ward councillor ,school principals, Kudumbasree(womens forum) leaders, grocery store owners , gym owner.

2.3 Data Collection

Data were collected using three complementary methods. For the qualitative component, in-depth interviews and reminiscence analysis were conducted with mothers. The core prompt used was: "Tell me about your teenage days compared to your daughter's life now." This approach allowed participants to reflect on generational changes in diet, activity, family structure, and social norms, and provided rich narrative data on transgenerational shifts

For the quantitative component, a structured questionnaire was administered to both mothers and daughters. The questionnaire captured key behavioral variables including physical activity levels, sleep duration, eating behaviors such as binge and emotional eating, perceived stress, screen time, and the Dyadic Synchrony Index which measured the extent to which mother and daughter engaged in the same health behaviors.

For the environmental component, an audit was conducted using the ANGELO checklist, focusing specifically on the Food and Built environment domains. Each setting was assessed and then given an overall rating based on the percentage score. Environments scoring less than 40% were classified as "Poor," those between 40% and 60% were classified as "Average," and those scoring above 60% were classified as "Good."The combination of narratives, survey data, and environmental ratings allowed for triangulation and the development of an integrated model of socio-cultural and environmental influences.[1]

2.4 Analysis

Quantitative data were entered and analyzed using R.Descriptive statistics, chi-square tests, and odds ratios were calculated to examine patterns of physical activity, eating behaviors, sleep, screen time, and dyadic synchrony across the four clusters and three cities.For the qualitative data, thematic analysis was conducted using NVivo. Interview transcripts and reminiscence narratives were coded inductively to identify recurring themes related to lifestyle, stress, gender norms, and generational change. Codes were then grouped into broader themes and validated through repeated reading.To integrate findings across methods, a triangulation matrix was developed. This matrix

mapped the results of the ANGELO environmental audit against the key themes emerging from dyad narratives and survey data. Through this process, it was possible to link "Poor" ratings in the food and built domains directly to the behavioral patterns described by mothers and daughters, thereby producing an integrated interpretation of how culture and environment interact to shape obesogenic behavior

Ethics: SCTIMST IEC approval was obtained

RESULTS

3.1 Cluster-Specific Obesogenic Pathways

Cluster 1: Obese-Obese

Dominant theme: Sedentariness and inertia. Mothers: 84% sat 7-8h/day, 91.8% slept <5h, 86.3% had high anxiety/depression. Daughters: 94.3% sat up to 10h/day due to school classes &tuition. Eating differed: Mothers reported more emotional eating 74.3%. Daughters had more binge eating 59.7%. Family support for behavior change was reported as "unsupportive" by both."*I just fall on food to relieve my stress.. its so relaxing after you eat.. rice and meen curry.. as soon as I reach home I eat heavily and lie down"* – Mother, C1

Cluster 2: Obese-Non Obese

Mothers controlled daughters' diet with home-cooked food. Yet 45.3% daughters were in overweight-normal margin, indicating transition risk. Mothers snacked 78.1% during office hours

Cluster 3: Non Obese-Obese

Daughters: 87.3% had emotional eating, 97.4% had >10h sitting. Discord noted: mothers prioritized academics over weight management.

Cluster 4: Non Obese-Non Obese

Protective factors: Cycling to school, manual chores, less kitchen mechanization in rural pockets.

3.2 Transgenerational Analysis:

The reminiscence narratives revealed a marked contrast between the childhood environment of mothers and the current reality of daughters. In terms of diet, mothers recalled growing up on predominantly home-cooked vegetarian meals. Non-vegetarian food was consumed rarely and was usually seasonal. Food was prepared fresh at home using ingredients from household yards. In contrast, daughters described a diet dominated by fast food, biryani, fried items, and meals ordered through Swiggy and other delivery apps. Home cooking has been largely replaced by convenience.Regarding family structure, mothers grew up in joint families where household chores were shared among multiple members. This provided both social support and incidental physical activity. Daughters, however, now live in nuclear and often isolated households where domestic work is mechanized and support systems are limited.In terms of transport, mothers walked 3 to 6 kilometers to school every day. This daily walking contributed significantly to their physical activity. Daughters today are typically dropped to school by vans or private vehicles directly from apartment complexes, with almost no walking involved in their daily commute.With respect to dress, mothers wore the traditional pavada which functioned as a flexible abdominal binder. This style of clothing did not restrict movement and was changed infrequently. Daughters now wear jeans and shorts, but these are changed every 6 months due to fashion trends and body image concerns. More importantly, tight clothing and social norms have made physical activity in public spaces uncomfortable for many girls.The school environment has also transformed. Mothers described their school years as relatively stress-free, with ample time for play and community activities. Daughters now face intense academic pressure. Their schedule includes 24-hour coaching for NEET and other entrance exams. Learning is mediated through laptops and mobile phones, and food is available 24/7 through delivery apps. This constant connectivity and competition has reduced time for rest, play, and family meals.This generational contrast was captured in one daughter's statement: "*My mom is fat so I'm scared I'll become like her even if I'm healthy."* This reflects a process of internalized stigma, where daughters have observed their mothers' struggles

with weight and have come to associate body size with fear and shame, even in the absence of their own obesity.Overall, the data suggest a clear degradation across generations. The "Good-Average" environment of 1985 characterized by movement, joint family support, and home food has shifted to a "Poor-Poor" environment in 2026 characterized by sedentariness, isolation, and commercialized food.

3.3 ANGELO Environmental Audit

Table 1: ANGELO Scoring – Food & Built Domains Across 3 Cities

Environment component	Thiruvanathapuram	Kochi	Thrissur	Key drivers
Food environment	Poor	Poor	Average	8 fast food/500m, 24/7 apps, ease foods 30-40% cheaper, no school zoning
Built environment	Poor	Poor	Poor	Footpath <2.5km/1000, turfs "boys only", *Nalla Kutty* 7PM curfew, shorts taboo

Setting Narratives:

- TVM: *"37 bakeries, 2 vegetable shops in 4km. We ban gutka near schools, not shawarma"* – village Officer. Political-Macro failure.
- Kochi: *200 gyms, <5% teen girls. Girl in shorts = WhatsApp status"* – Gym Owner.
- Sociocultural-Macro barrier.
- Thrissur: *Pooram(* the great temple fest of the area Thrissur) calls for home s*adya*(heavy feast with more than 10 dishes) in all households still. But Lulu food court is new weekend habit. Tradition fighting transition

3.4 Integrated Model

The ANGELO environmental audit revealed that both the food and built environments across the three cities were consistently rated as "Poor." This dual deficiency created conditions where healthy choices became difficult and unhealthy behaviors became the default for entire households. Because the built environment was poor, with a lack of safe footpaths, parks, and women-friendly exercise spaces, both mothers and daughters had limited opportunities for physical activity. As a result, they spent most of their day in similar sedentary contexts such as sitting at work, in tuition, in cars, and at home. This led to synchronized sitting across the dyad.Similarly, because the food environment was poor, with easy access to cheap, delivered, and ultra-processed foods and limited access to fresh produce, both generations turned to the same convenient food sources. Mothers relied on Swiggy and cloud kitchens due to time pressure, while daughters consumed the same foods for taste and convenience. This produced synchronized eating patterns within the household.This environmental pressure toward synchrony helps explain the very high sccore observed in the study, with an odds ratio of 11.82. When both members of the dyad live in the same obesogenic setting, their behaviors tend to align.When viewed across time, this also reflects a transgenerational shift. The reminiscence data suggest that in 1985 the environment was closer to "Good-Average." There were more opportunities for walking, home-cooked meals were the norm, and food was less commercialized. By 2026, the environment had degraded to "Poor-Poor." This decline in the food and built domains parallels the rise in synchronized obesogenic behaviors observed in the current mother-daughter dyads.In short, the environment did not just influence individuals. It forced mothers and daughters to behave alike.

4. DISCUSSION

This study identifies how culture and city structure together produce obesity.

4.1 The Four Pathways

The Inertia Pathway links Superhero Mom desk jobs to sleep loss and emotional eating. The **Academic-Stress Pathway** links *Nalla Kutty* coaching to binge eating. The **Gendered Space Pathway** shows built infrastructure exists but is culturally inaccessible to girls. The **Food Transition Pathway** shows economic forces making Swiggy cheaper than cooking time.

4.2 ANGELO and the Kerala Paradox

No city scored "Good". Even Thrissur's "Average" food score is precarious. This supports global evidence that built environment is the most distal but most powerful driver. The universal "Poor" built score explains why 100% daughters had inadequate PA despite inter-city variation.[2]

4.3 Binge Eating in Context

Binge eating clustered in daughters, emotional eating in mothers. This aligns with coping theory: daughters use food for academic stress, mothers for role overload. The home food environment, driven by Kulasthree norms, makes high-calorie foods constantly available.[3]

4.4 Strengths & Limitations

Strength: First ANGELO + dyad + cultural archetype study in India.
Limitation: Only 2 ANGELO domains audited; rural areas excluded

5. CONCLUSION AND IMPLICATIONS FOR POPULATION THERAPEUTICS

The findings make it clear that obesity among Kerala mother-daughter dyads is not primarily due to lack of knowledge. Kerala has high literacy and high health awareness, yet it also has the highest obesity rates among Indian women. This paradox is best explained by a "Poor by design" environment that interacts with deeply gendered cultural roles to produce obesogenic behavior.

Using the ANGELO framework, four population-level policy recommendations emerge, one for each domain:

Physical Domain: Local Self-Government Departments must mandate that at least 30% of ward budgets be allocated to women-only parks and safe footpaths. A "Ward Walkability Index" should be published annually to create accountability for urban design that enables rather than restricts movement for girls and women.

Economic Domain: Tax policy should be used to reshape the food environment. There should be 0% GST on millets and fruits sold within 500 meters of schools, and a 28% tax on ultra-processed foods. This would make healthy food the default and affordable choice, while disincentivizing the cheap, energy-dense foods currently dominating the market.

Political Domain: The Education Department must revalue physical health. Physical Education should carry 100 marks in board examinations to signal its importance. Additionally, a "No Tuition 8PM to 6AM" Act is needed to protect sleep and free up time for family meals and activity, directly addressing the time poverty faced by the Superhero Mom and the academic pressure on the Nalla Kutty daughter.

Sociocultural Domain: The Health Department should lead monthly "City Walks in Shorts" with women officers and public representatives. This visible, state-supported activity would directly challenge stigma and normalize public physical activity for girls, addressing the fear and shame that currently keeps them indoors.In summary, population therapeutics must move beyond individual counseling.

Until the *Nalla Kutty* daughter has safe public space to move, and the Superhero Mom has time to cook and rest, clinical interventions alone will continue to fail. Obesity in Kerala is not a personal failure. It is the predictable outcome of environments and norms that must now be redesigned.

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