

Database Schema Documentation: Core Entities & Data Flow

Overview

This document covers the core entities in the meal delivery system: Orders, User Subscriptions, Meals, Items, and their relationships.

Core Entities

1. Orders (orders)

Purpose: Manages customer orders and delivery information

Structure

- **Primary Key:** id (UUID)
- **Key Fields:**
 - user_id, subscription_id, order_number (unique)
 - Financial: subtotal, tax_amount, discount_amount, delivery_fee, total_amount
 - Status: status (enum), payment_status, payment_method
 - Delivery: delivery_address_id, scheduled_delivery_date, actual_delivery_date

Constraints & Validation

- **Financial Integrity:** Multiple CHECK constraints ensuring non-negative amounts
- **Payment Status:** Limited to predefined states (pending, paid, failed, refunded, partial_refund)
- **Total Validation:** Ensures $\text{total_amount} = (\text{subtotal} + \text{tax_amount} + \text{delivery_fee}) - \text{discount_amount}$

Indexes

- **Performance:** idx_orders_user_created, idx_orders_status_created, idx_orders_delivery_date
- **Business Logic:** idx_orders_payment_status (filtered on paid status)
- **Unique:** orders_order_number_key for order tracking

Triggers & Data Flow

- **trigger_set_order_number:** Auto-generates sequential order numbers
- **trigger_order_delivery:** Updates subscription meal counts when order is delivered
- **trigger_order_delivery_dates:** Sets delivery dates based on subscription preferences
- **trigger_update_timestamp_orders:** Standard timestamp updates

2. User Subscriptions (user_subscriptions)

Purpose: Manages recurring meal subscription plans

Structure

- **Primary Key:** id (UUID)
- **Key Relationships:** user_id, plan_id, delivery_address_id, payment_method_id
- **Subscription Details:** status, start_date, end_date, price_per_meal, total_meals
- **Progress Tracking:** consumed_meals, preferred_delivery_time
- **Meal Planning:** meals (JSONB array of meal configurations)

Constraints

- **Date Validation:** end_date > start_date
- **Meal Limits:** consumed_meals <= jsonb_array_length(meals)
- **Financial:** Non-negative price validation

Indexes

- **User Management:** idx_subscriptions_user_status (user queries)
- **Active Subscriptions:** idx_subscriptions_status_active (filtered index)

Triggers & Business Logic

- **trigger_validate_subscription:** Validates subscription data before save
- **Integration with Orders:** Subscription consumption updated via order delivery trigger

3. Meals (meals)

Purpose: Central meal catalog with nutritional and dietary information

Structure

- **Primary Key:** id (serial integer)
- **Content:** Multi-language names/descriptions (name, name_arabic, etc.)
- **Nutritional:** calories, protein_g, carbs_g, fat_g, fiber_g, sugar_g
- **Dietary Flags:** is_vegetarian, is_vegan, is_gluten_free, is_dairy_free
- **Business Logic:** rating, rating_count, discount_percentage, is_available

Constraints

- **Nutritional Validation:** All nutritional values ≥ 0
- **Rating Bounds:** rating between 0-5, spice_level 0-5
- **Discount Validation:** discount_percentage 0-100

Indexes

- **Search & Filtering:**
 - idx_meals_rating (descending for popular meals)
 - idx_meals_dietary (dietary restriction filtering)
 - idx_meals_available_featured (active catalog)
 - idx_meals_discount (promotional queries)

Triggers

- `trigger_update_timestamp_meals`: Standard timestamp updates
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4. Items (`items`)

Purpose: Individual food components/additives that compose meals

Structure

- **Primary Key:** `id` (serial integer)
- **Content:** Multi-language names/descriptions
- **Nutritional:** Similar to meals but simpler (`calories`, `protein_g`, `carbs_g`, `fat_g`)
- **Inventory:** `is_available`, `max_free_per_meal`, `is_additive`

Constraints

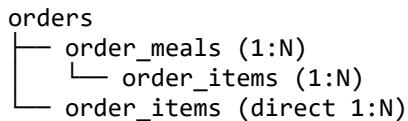
- **Nutritional Validation:** All values ≥ 0
- **Pricing:** `price` ≥ 0

Triggers

- `trigger_update_timestamp_items`: Standard timestamp updates
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⌚ Junction Tables & Relationships

1. Order Composition



`order_meals`:

- Links orders to meal selections
- Stores meal-specific pricing and customization
- **Key:** `order_id`, `meal_id` with quantity and pricing

`order_items`:

- Individual items within orders (additives/sides)
- Can be linked to `order_meals` or directly to orders
- **Key:** `order_id`, `item_id` with quantity and unit pricing

2. Meal Composition

`meal_items`:

- Defines which items compose a meal using integer arrays

- **Index:** GIN index on `items` array for fast lookups
- **Trigger:** `trg_validate_meal_items_array` validates item existence

3. Subscription Planning

`plan_meals`:

- Links subscription plans to available meals
- **Features:** `is_substitutable` flag for meal flexibility

4. Allergy Management

`meal_allergies` & `item_allergies`:

- Many-to-many relationships for allergy tracking
- Cascade deletes for maintenance

Data Flow & Business Logic

Order → Subscription Integration

1. **Order Creation:** `trigger_set_order_number` generates unique order numbers
2. **Delivery Processing:** `trigger_order_delivery` updates subscription meal counts
3. **Subscription Sync:** Increments `consumed_meals` and cycles `next_delivery_meal`

Rating System

1. **Review Creation:** `meal_reviews` triggers update meal ratings
2. **Real-time Aggregation:** `trigger_update_meal_rating_insert/update` recalculates averages
3. **Published Filter:** Only published reviews affect public ratings

Meal Validation Pipeline

1. **Array Validation:** `validate_meal_items_array()` ensures meal items exist
2. **Nutritional Integrity:** CHECK constraints maintain data quality
3. **Availability Filtering:** Indexed queries for active meals

Key Design Patterns

1. Multi-language Support

- Consistent `_arabic` suffix for localized content
- Language preferences in user profiles

2. Temporal Tracking

- Consistent `created_at`, `updated_at` across all tables
- Automated via `update_timestamp()` function

3. Financial Integrity

- Multiple CHECK constraints for amount validation
- Calculated totals with validation

4. Subscription Mechanics

- JSONB `meals` array for flexible meal planning
- Consumption tracking with bounds checking
- Delivery scheduling based on preferences

5. Allergy & Dietary Management

- Comprehensive many-to-many relationships
- User-level overrides for allergy severity
- Cascade deletion for maintainability

This schema supports a sophisticated meal delivery system with subscription management, detailed nutritional tracking, multi-language support, and complex order composition workflows.