

Innovative Design of Kitchen Storage Space: A Research Report on the Usage Behavior of Urban Family in China

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Abstract—In 2025, a collaborative field survey was conducted by Vgreen Smart Home Co., Ltd. together with faculty and students from Central South University of Forestry and Technology, aiming to investigate kitchen usage behavior in urban households across selected first- and second-tier cities in China. Given China's vast territory and the considerable regional diversity in cooking habits, food storage practices, and kitchen organization, this study seeks to capture real-life user behaviors and provide empirical evidence for the design of innovative kitchen storage solutions. A total of 460 urban households were examined through an in-home investigation employing two complementary methods: photographic documentation of actual kitchen storage conditions and a structured questionnaire covering demographic characteristics, daily lifestyle habits, and detailed kitchen storage status. All collected data were compiled and analysed using SPSS software to generate descriptive statistics and identify recurring patterns. The analysis focuses on three core aspects—user basic information, lifestyle and cooking routines, and current kitchen storage practices—from which common problems are extracted. The findings reveal typical inefficiencies and bottlenecks in existing kitchen storage systems across different household types and regions. This research report therefore provides a robust set of raw, empirically grounded reference data to support the design and development of kitchen storage spaces that are genuinely tailored to Chinese users' behavioral patterns and spatial constraints, thereby contributing to improved kitchen organization and enhanced daily living quality.

Keywords—Kitchen, Storage, Household Survey, Kitchen Cabinets, Lifestyle

I. INTRODUCTION

In the context of rapidly growing urbanisation and rising living standards in China, the kitchen has evolved from a mere cooking space into a core functional area that significantly influences household quality of life. However, despite this transformation, kitchen storage design has often lagged behind actual user needs—particularly in first- and second-tier cities, where living spaces are relatively compact and storage efficiency is critical. Existing kitchen storage solutions are frequently derived from Western design philosophies, which do not fully accommodate the unique cooking habits, lifestyle patterns, and storage behaviours of Chinese households. Given China's vast geographical expanse, there exist notable regional differences in dietary customs, food preparation methods, and

kitchen organisation practices. These variations pose significant challenges for designing a “one-size-fits-all” storage system.

To address these challenges, empirical research grounded in real-world kitchen usage is urgently needed. Zhang et al. analyzed the man-machine factors involved in users' interaction with kitchen cabinet storage systems, noting that kitchen storage systems are primarily composed of wall cabinets, floor cabinets, and countertops^[1]. By examining user storage behaviors, they identified elements that do not conform to ergonomic principles and proposed optimization strategies. Their optimized cabinet storage system not only increases storage space but also provides users with a more comfortable behavioral experience. Taohas carried out research on the design of kitchen storage space based on storage behavior, analyzed the behavior of kitchen storage, the way of goods storage and the ergonomics of kitchen storage, and sums up the storage principles of kitchen cabinets^[2]. Zhenget al. studied the standard unit cabinet design and product coding rules of integral kitchen cabinets, and applied the modular design of kitchen cabinets to the harmonious relationship between integral kitchen cabinets and kitchen space dimensions^[3]. Niesummarized the basic characteristics of “modern” kitchens, and put forward the unique spatial layout, island form and storage characteristics of Chinese kitchens, trying to provide new ideas for industrialized and digital kitchen design in China. More recently, the intersection of sustainability and smart technology has introduced new possibilities for kitchen storage design^[4]. Cheng, R. et al. explored resilient kitchen storage design from a sustainability perspective, proposing strategies to improve space utilization through innovative design, evaluated via comparative analysis and user research^[5]. In summary, existing research in kitchen design encompasses multiple dimensions. However, a notable gap remains: most studies rely on single-method approaches or limited-sample investigations, and large-scale, systematic field research integrating both photographic documentation and structured questionnaires—particularly one that captures detailed user demographics, lifestyle habits, and actual storage conditions—is still lacking. The present study aims to fill this gap by conducting an in-home comprehensive field investigation into the actual kitchen usage and storage conditions of urban Chinese households, using mixed methods, providing raw data to inform the design of kitchen storage solutions tailored to the behavioral patterns and spatial constraints of Chinese users.

In 2025, this research was carried out by Vgreen Smart Home Co., Ltd. in collaboration with faculty and students from Central South University of Forestry and Technology. A total of 460 urban households across selected first- and second-tier cities were recruited for an in-depth, in-home investigation. The fieldwork employed two primary data collection methods: photographic documentation (to capture real-life storage arrangements, spatial configurations, and clutter patterns) and structured questionnaires (to gather detailed information on user demographics, cooking habits, and storage practices). All collected data were then coded, entered, and analysed using SPSS software to generate descriptive statistics and identify recurring patterns.

The specific objectives of this study are threefold:

- To profile the basic demographic characteristics, daily cooking routines, and current kitchen storage status of urban Chinese kitchen users.
- To identify common problems and bottlenecks in kitchen storage behavior across different household types and regions.
- To propose targeted design recommendations based on empirical findings, thereby improving kitchen storage efficiency and enhancing users' overall kitchen experience.

By presenting a robust set of primary data derived from real-life usage scenarios, this report seeks to provide design practitioners and home furnishing companies with actionable insights. Ultimately, the findings are intended to support the development of kitchen storage solutions that are genuinely tailored to the behavioural patterns and spatial constraints of Chinese urban households, thus contributing to a more functional, organised, and pleasant cooking environment.

II. RESEARCH DESIGN AND METHODS

A. Sample Selection

From July to September of 2025, the survey was conducted in 23 cities in 10 provinces, including Beijing, Sichuan, Liaoning, Guangdong, Fujian, Henan, Hunan, Hubei, and Zhejiang. A total of 460 questionnaires were distributed during the survey, and 460 valid questionnaires were returned with an efficiency of 100% (filled by auxiliary users to increase the efficiency of the questionnaires).

B. Basic User Information

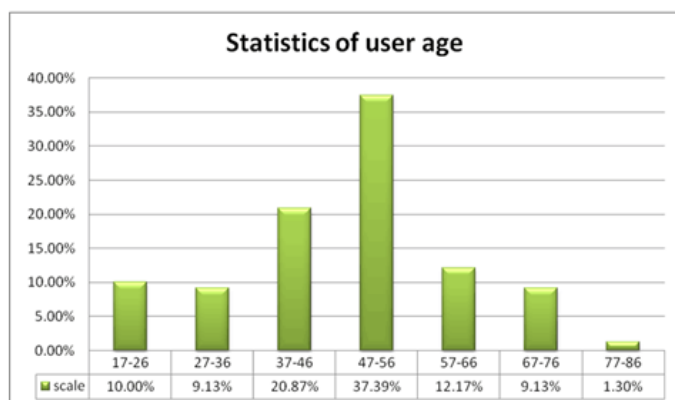


Figure 1. Kitchen User Age Statistics

The respondents were divided into 7 age groups, of which "17-26 years" accounted for 10%, "27-36" accounted for 9.13%, "37-46" accounted for 20.87%; "47-56" accounted for 37.39%;

"57-66" accounted for 12.17%; 77-86 "accounted for 1.3%. The majority of the kitchen users are in their middle ages, with elderly and children in the family, and they are the pillars of their family. Even though the elderly people over the age of 67 can help families share some of the chores, they are limited by their physical health and dexterity. (See Figure 1)

The household size information is divided into 6 types, of which "single" accounted for 4%; "married couple" accounted for 17%; "family of three" accounted for 52%; "family of four" accounted for 15%; "family of five" accounted for 10%; "More than five people" accounted for 3%; among them, "family of three" is the majority. In terms of occupational distribution, 40.43% are full-time employees, 20% are housewives/househusbands, 15.22% are other, 11.30% are retired part-time employees, 11.30% are full-time self-employed, 1.74% are part-time self-employed. The proportion of full-time employees is the largest, and working-class workers are relatively less likely to have meals at home due to work hours. (See Figure 2)

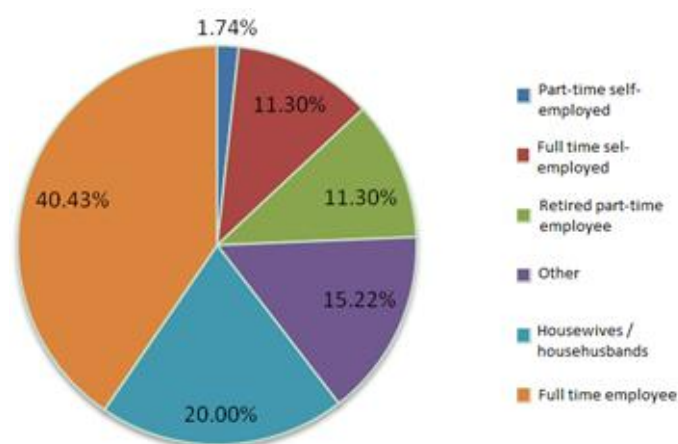


Figure 2. Kitchen User Occupational Statistics

The household monthly income of "5001-10000 yuan" accounted for 40%, "10001-15000 yuan" accounted for 20%, "<5000 yuan" accounted for 19%, "15001-20000 yuan" accounted for 10%, "25001-30000 yuan" and "20001-25000 yuan" both accounted for 3%. (See Figure 3.) This statistic is based on the combined household income, and is not accurate enough for individual income due to not having detailed statistics on the minors, the housewife/ househusband, and other non-income earning individuals in the household. The income statistics can only support analysis of household purchasing power.

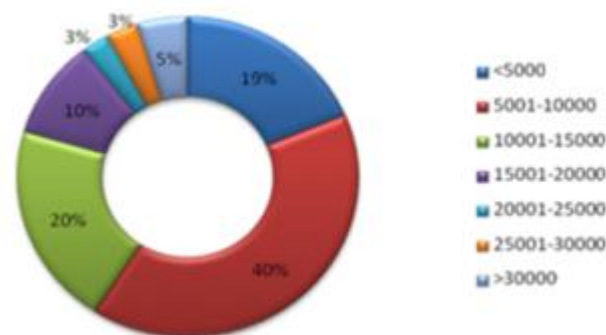


Figure 3. Household Monthly Income Statistics

C. Lifestyle Habits

Age does not have any major impact on the way in which cooking ingredients are purchased. The majority of the users purchase cooking ingredients by choosing nearby food markets and supermarkets. Users' purchase frequency of "everyday" for "fruits and vegetables" reached 42%; purchase of "meats, fish, eggs" at the frequency of "two purchases per week" reached 24%; purchase of "rice flour, cereals and other dried goods" at the frequency of "one or two times a month" reached 54%. From a statistical point of view, vegetables are more popular than meat and eggs. There are 198 households in the north and 262 in the south (definition of south or north depends on the the province where they are located, China usually divides the north and the south with the Qinling-Huaihe River as the boundary). In the north, the number of users who purchase "fruits and vegetables" "everyday" accounts for 35% of the total, while in the south, "everyday" purchases accounts for 48% of the users. The frequency of buying "2 times a week" in the north accounts for 25%, and "3 times per week" is ranked second in the south, accounting for 25%. Drinks and canned foods were purchased less frequently, while cooking oils, seasonings, kitchen cleaning supplies, and paper towels were purchased less than once a month by the majority of the users. Due to eating habits, the buying rate of canned food and beverages is lower than that of fresh fruits and vegetables. The difference between the storage method and the purchase frequency of fresh fruits and vegetables and canned foods which can be stored for a long time brings about the different requirements on the design of the kitchen storage space.

D. Kitchen Layout

The kitchen layout statistics are as follows: L-shape (54%), U-shape (26%), single-wall (15%), corridor (4%), G-shape (1%) (see figure 4). Due to cooking methods, most of the domestic kitchen are closed kitchens, and 91% of the surveyed users have closed kitchen. Among them, 80% uses gas stoves.

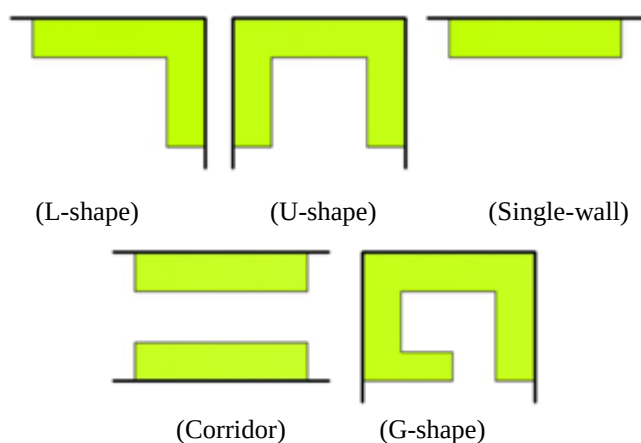


Figure 4. Kitchen layout

E. User Recognition of the Importance of Kitchen Cabinet Factors

The survey for the importance of kitchen cabinet efficiency is based on: the convenience of working in the kitchen, kitchen cabinet exterior design, color, storage capacity, operation experience, ease of storage access, quality of materials used, impact of cabinet material on human health, product brand, cabinet hardware etc. The degree of importance is divided into five types: absolutely necessary, very important, relatively important, not too important, and very unimportant. With the importance rating as reference, the results are

summarized for the absolutely necessary and very important categories. The survey results are as follows:

- Factor importance distribution. Using SPSS correlation analysis, the Pearson correlation coefficient for age and kitchen exterior design is -0.246**, and for age and color is -0.143*, both have a significant correlation. The surveyed users' importance emphasis is as follows: kitchen cabinet design 67%, color 59%, storage capacity 88%, workflow convenience 90%, ease of access 85%, operation experience 81%, quality of cabinet material 91%, impact of cabinet material on human health 93%, cabinet brand 60%, and cabinet hardware 68%.
- According to the statistical results, users pay more attention to the storage capacity and workflow convenience, material quality and environmental impacts, and less emphasis on the cabinet design, color, brand, and supporting hardware. 60% of users agree that the practicality is more important than the appearance. The life expectancy for kitchen cabinets (excluding vandalism) is directly related to the quality of material used, manufacturing process, and hardware quality. Through statistical analysis, it is found that users know very little about the kitchen hardware, because the hardware is mostly selected by cabinet manufactures. Users who use famous foreign brand accounts for 9.6%, most well-known domestic brand is DTC, accounting for 5.3% of domestic brand, and the rest use not well-known domestic brands. The quality of hardware directly affect cabinets' use experience and life expectancy.

III. ANALYSIS OF INVESTIGATION RESULTS

The aim of the survey is to observe the Chinese urban kitchen users' storage habits and problems while using the kitchen, such as water stains around sink, clutter around kitchen, different heights for objects stored in cabinet, waste of space between cabinet partitions. There are regional differences in diets and cooking methods throughout the country. The household samples of the study are collected from various regions: 40 from Beijing, 32 from Liaoning, 58 from Guangdong, 38 from Fujian, 86 from Hunan, 26 from Hubei, 20 from Zhejiang, 60 from Shandong, 40 from Sichuan, and 60 from Henan. Factors such as surveyed users' residential environment, how the users get upstairs, the positional relationship between the users' dining area and kitchen, the kitchen placement status, storage content status etc. were recorded. This section focuses on surveyed data of the kitchens.

A. Façade Analysis

Wall Cabinets: The wall cabinets utilizes the upper space of the kitchen, but the size of this type of cabinet is limited by the operations of the users inside the kitchen. The depth of the wall cabinets are generally ranged from 300 to 360 mm, and the height has no standardized limits. The most common height for wall cabinets in this study is found to be between 500 to 750mm (See figure 5). However, most of them have the problem of not being able to freely reach for items at higher shelves. Only the lower part of the cabinet can be accessed easily, and the higher part need the assistance of ladders and other similar items to access.

Wall Cabinet Size Analysis

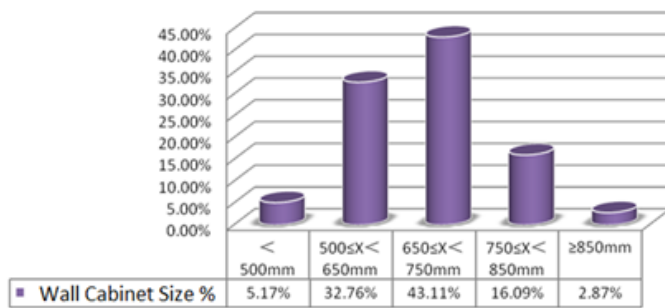


Figure 5. Wall Cabinet Size Statistics

Space between cabinets and countertops: From data obtained from users of this survey, there is plenty of free space between the kitchen cabinet and the countertop. Different kitchenware, small appliances, seasoning bottles etc. are placed on the countertop. Wall storage devices include hangers, hooks, and the like. Currently, even though there is no specific design standards, the reasonable height between bottom of the wall cabinet and the countertop is from 500 to 700 mm [6]. Among the surveys, users without wall cabinets account for 23.04%, users with wall cabinets that are at a height “700 -750 mm” from the countertop account for 17.39%, a height of “800 – 850mm” account for 16.96%, these two groups account for the two majority groups, and a height of lower than 700mm account for 11.31% (See Figure 6). The reduction of the height makes accessing the cabinets easier for shorter users, but the lowering of the cabinet could also result in problems such as hitting the user’s head when opening cabinet doors.

Height Between Wall Cabinet and Countertop

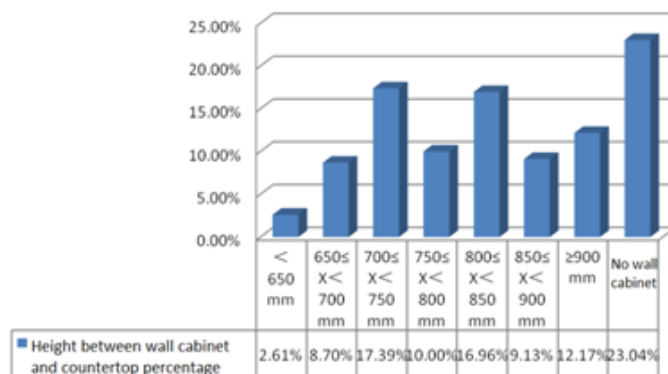


Figure 6. Height between wall cabinet and countertop statistics

Users who have shelves/racks on countertop account for 26.96%, 36.52% and 22.26% of the users have wall-mounted racks or wall-mounted hooks. 28.26% of users don’t have any storage accessories, and the reasons for that are: 1) New tenants, with less household items; 2) inadequate understanding for storage, less encounters with relevant storage products in the market; 3) no will to purchase, do not accept storage products.

Base Cabinet: In terms of cabinet height, according to the Chinese average height measurement, the preferable height for countertops with cut outs for stoves is from 800 mm to 850 mm, while the preferable height for countertop with no cut outs is from 650 mm to 700 mm. The survey found that the percentages of users with base cabinet with different heights are: “less than 700mm,” 1%; “700-750mm,” 5%; “750-800mm,” 53%; “801-850mm,” 36%; “851-900mm,” 3%; “greater than 900mm,” 2% (see Figure 7). Within these users, 90% uses countertops with cut outs for stoves, and 10% put stoves on top of the countertops. Users who have countertops with a height of “800 – 850mm” and with cut outs account for

47.8%. Base cabinets are more accessible compared to wall cabinets, and thus can store items that are used frequently. Therefore, with ergonomic standards in mind, the design of base cabinet is very important.

Base Cabinet Height Analysis

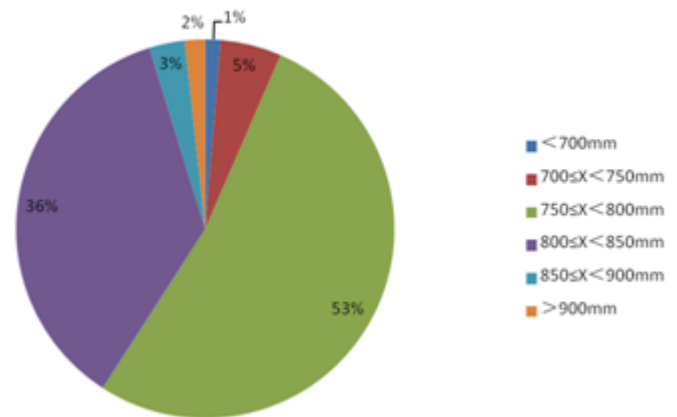


Figure 7. Base Cabinet Height Statistics Chart

B. Plane Analysis

Kitchen Size: In the survey, users who have “home ownership” account for 90%, home size of “>75 m²” account for 86.09%, home size of “76 – 150m²” account for most of the users, at 75.22% (see Figure 8); home size of “76 – 150m²” and with “home ownership” account for 69%. Kitchen size of “4-6m²” account for 50.44% (see Figure 9), kitchen size of “4-6m²” with “home ownership” account for 49.1%. Home size of “76-150 m²” with kitchen size of “4-6m²” and “home ownership” account for 36%. It can be observed that Chinese kitchen occupies a relatively smaller area, and the overall space is limited. Thus, how to reasonably use this space becomes a crucial problem.

Home Size Statics

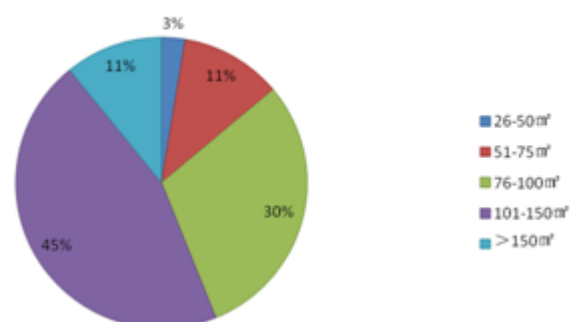


Figure 8. Home Size Statics Chart

Kitchen Size Statics

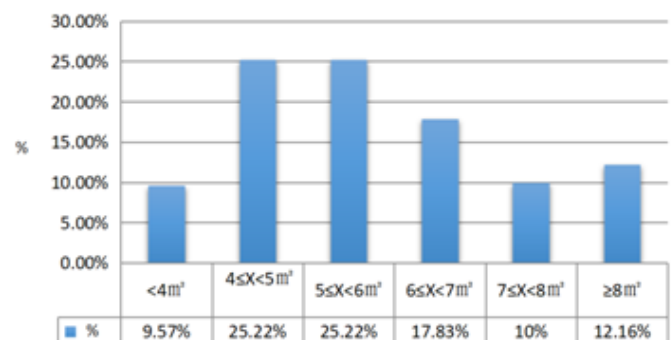


Figure 9. Kitchen Size Statics Chart

Countertop Size: Kitchen countertops are the main work space for the kitchen. The statistical results for countertop size

are: “ $<2\text{ m}^2$ ” account for 33%, “ $2\text{ m}^2 \leq X < 3\text{ m}^2$ ” account for 53%, “ $3\text{ m}^2 \leq X < 4\text{ m}^2$ ” account for 13%, “ $\geq 4\text{ m}^2$ ” account for 1%. The majority of the countertops in Chinese kitchens are between $2\text{--}3\text{ m}^2$, if excluding the sink and stove area, the practical countertop space will be reduced by approximately $0.5\text{ to }0.75\text{ m}^2$. The users whose countertop area occupies “ $<30\%$ ” of total kitchen area accounts for 12.17%, “occupies greater than 30%, but less than 45%” accounts for 54.78%, “greater than 45%, but less than 60%” accounts for 27.4%, “ $\geq 60\%$ ” accounts for 5.65% (see Figure 10). The countertop working space is relatively small, but occupies almost half of the whole kitchen area. In addition to the basic kitchen operations, the countertops often have small household appliances, spice jars, fruits and vegetables on the surface, which attributes to the crowdedness of the already small area. Thus, how to properly store items and be able to find them more easily becomes an important issue to improve the workflow and to reduce the users’ work intensities in the kitchen.

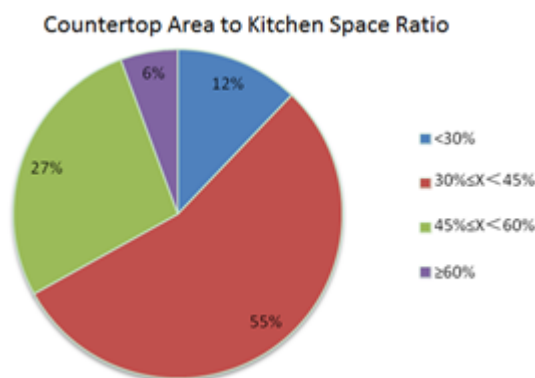


Figure 10. Countertop Area to Total Kitchen Area Percentage Statistics

Floor Plan: Cabinets, refrigerators, floor rack, trash cans, and other items are usually put into the kitchen. 50.87% of the users have refrigerators inside the kitchen, while 46.1% of the users have refrigerators in another room close to the kitchen. Large amount of ingredients are stored inside refrigerators, thus having them near the kitchen work area can shorten the walking distance and improve efficiency. Trash cans are an integral part of the kitchen, for garbage collection and later processing. There is no garbage disposal device (an electronic device installed underneath the sink for shredding of food waste in order to prevent clog up and avoid odor) found with any user, and the reasons being: 1) due to traditional mindset limitations, cannot adapt quickly to new treatment methods; 2) imported products are not sufficiently applicable and safe enough for Chinese food waste; 3) higher prices and greater water usage^[7].

From the analysis above, it can be observed that the actual space to move about the kitchen is relatively small, but most users prefer to store fruits, vegetables, etc. on the ground, which crowds up the already small kitchen area. The reasons for this behavior include: 1) habits that have been already established throughout daily life; 2) there is no dedicated space for storing fresh vegetable in the kitchen cabinets. Amongst the surveyed users, those with kitchen floor shelves for assisted storage account for only 29.57%. This storage method can store items which are placed on the ground in a vertical method, which can not only improve the space utilization, but also make it easier to access and make the kitchen easily cleaned and maintained.

IV. ANALYSIS OF PROBLEMS AND CAUSES

According to the research data, problems which arises from users actual everyday life situations in the kitchens are summarized.

Focus 1: kitchen stored items are messy

- Large piles of items on the floor (See Figure 11)
- Large number of kitchen appliances and kitchenware on countertop (See Figure 12)
- Cleaning cloth and detergent wipe randomly placed around the sink (See Figure 13)
- Large amount of seasoning bottles and bags around stoves, occupying countertop area

Focus 2: cabinet space (See Figure 14)

- Sink base cabinet susceptible to water leakage, high inside humidity, and unreasonable space planning resulting in wasting space.
- Items of different types and sizes stored in one cabinet, lack of classification, resulting in wasting space and appearing cluttered.
- Large distance between dividers, stored item size is often not considered, and the space cannot be fully utilized.
- Large amount of useless items (such as plastic bags, fast food boxes) inside cabinets, appear messy.

Focus 3: illogical item storage location (based on the 2 previous focuses)

- The interior of the cabinets are messy, divider distance unreasonable resulting in wasting space. Items inside plastic bags are piled together, making it difficult to find items.
- Countertop is messy, items on the ground are chaotic, no dedicated spot to place trash cans.
- Food, utensils, kitchenware etc. are placed randomly, without taking into consideration the normal kitchen workflow and utilization order and habits, resulting in users unable to find corresponding items in a panic.



Figure 11. Pictures of floor area



Figure 12. Pictures of countertop area



Figure 13. Pictures of the sink area



Figure 14. Pictures of the inside of cabinets

CONCLUSIONS AND DISCUSSION

The results of this study showed that the Chinese urban kitchen interior is overall rather messy, kitchen storage situation is not optimized. Firstly, due to the lifestyle habits of the users, there is no sorting habit for storage, thus items are randomly stored; secondly, cabinet interior design is not optimized, resulting in wasted space; thirdly, the dedicated storage product is lacking. Therefore, based on the existing problems regarding kitchen storage mentioned above, this paper proposes the following suggestions:

A. Storing items based on functionality

Storage of items in accordance with the kitchen cooking process to the end of the meal: accessing ingredients (refrigerator - frozen food, storage rack - fresh vegetables, cabinets - dry goods), cleaning (sink - washing supplies, containers, draining tools), food processing (cutting - cutting tools, chopping boards, cutlery), cooking (cooking stoves - spices, cooking utensils, pots and cookware), plating (dishware, supporting thermal insulation tools), eating (tables - cutlery, wine accessories, drinks), finishing (sink - cleaning tableware and utensils, refrigerator - leftovers).

- Accessing ingredients: first of all, in order to improve the consistency and efficiency of the entire workflow, one has to make sure to be able to easily access ingredients from their corresponding storage location such as refrigerators and vegetable rack, and to ensure that the distance to the next step is not too far. Since frozen and refrigerated meat and food ingredients are generally stored in refrigerators, daily purchased fresh vegetables can be placed on storage racks, and items such as rice, flour, and oil are bulky and heavy, thus base cabinets need to have easily accessible space for storage, and lighter weight dry goods can be stored in wall cabinets^[8].
- Cleaning: containers are used when cleaning the ingredients, and these containers need to be placed near the sink. The containers to hold the food are usually large, thus need corresponding sized space. While cleaning, water will splash onto the surrounding countertop and need to be readily wiped away. Chinese like to use rags, and if the rags are randomly stacked near the sink, bacteria will grow, rags will also be water saturated and cause them to no longer be able to effectively absorb more water splashes. Rags after being used for cleaning, should be placed on a hanging bar for drying, or paper towels should be placed near the sink. Detergent should also be placed around the sink for convenience^[9].
- Ingredient processing: peeling should be done near the trash can, and the trash can should be placed between the sink and cutting board. To help keeping the floor clean and minimize the need for bending, countertop trash cans should be used^[10]. Cutting board and knives are needed to process ingredient, thus a ventilated storage rack can be used.
- Cooking: to take out cookware and place them onto the stove, cookware should be placed inside the base cabinets underneath the stoves, and use metal stand or dividers inside the drawer. Multiple seasonings are used in the cooking process, and Chinese cuisine uses too many seasonings inside bottles and cans, which take a lot of countertop space. Thus, tabletop shelves can be used to store seasonings vertically.
- Plating: plates and dishes should be placed near the stove, in base pullout cabinet or sterilizer cabinet.

B. Use professional storage accessories

Kitchen floor storage stand, tabletop storage rack, wall rack/hook, metal drawers inside the cabinet, drawer divider, storage box (can be used to place different types of ingredients, to prevent difficulties in finding items in plastic bags that are stacked together).

C. Reasonable design of the shelf heights inside cabinet

Similar sized items of the same type should be placed on the same level for classification and storage, and certain amount of space should be left free for easy access.

The research on the human lifestyle at home is an ongoing process, and is not something to be done once and for all. The corresponding questions at different times will have different findings, and thus provide different results and conclusions. Variations in sampling will also cause differences in statistical data analysis. In order to design kitchen cabinets suitable for Chinese users' habits and behaviors, it is necessary to step into the users' lives, and understand the difficulties in

users' workflow process, and then develop new products based on these actual needs.

Acknowledgement

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