SOCIAL SCIENCE REVIEW ARCHIVES
ISSN Online: 3006-4708
ISSN Print: 3006-4694
https://policyjournalofms.com

"Wasting Less, Saving More: The Social Impact of Food Storage Behaviors in Peshawar Households".

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DOI: https://doi.org/10.70670/sra.v3i2.665

Abstract
Food wastage is a critical issue with significant economic, environmental, and social implications. This study investigates the association between food storage practices and food wastage at the household level in district Peshawar, Khyber Pakhtunkhwa, Pakistan. A multistage stratified random sampling technique was applied to select 379 households for the study. Data were collected using structured interview schedule and analyzed using descriptive statistics, chi-square test, Fisher exact test, and Kendall Tau-b test. The results reveal that proper food storage practices significantly influence food wastage behaviors among households. Controlling food temperatures, knowledge of temperature limits affecting food spoilage, adherence to consumption dates and storage instructions, regular rotation of food items, and culinary skills are associated with reduced food wastage. Conversely, storing excess food beyond daily consumption needs is positively correlated with food wastage. These findings underscore the importance of consumer education and awareness programs aimed at promoting responsible food storage practices to minimize food wastage. Implementing strategies to enhance food storage knowledge and skills can contribute to more efficient use of food resources, improved food safety, economic savings, and environmental sustainability. Addressing household food wastage through targeted interventions can have far-reaching benefits for individuals, communities, and the environment.

Key words: Food storage, household, awareness, skill, consumption

Introduction

Food wastage refers to the loss or disposal of food that is still edible and could have been consumed. It occurs at various stages of the food supply chain, including production, processing, distribution, and consumption. Food wastage can happen for several reasons, such as overproduction, spoilage, improper storage, transportation issues, cosmetic imperfections leading

to rejection by retailers, and consumer behavior such as purchasing more than needed or not consuming leftovers (FAO,2019).Food wastage has significant economic, environmental, and social implications. Economically, it represents a loss of resources invested in food production and distribution. Environmentally, it contributes to greenhouse gas emissions, as decomposing food waste in landfills produces methane, a potent greenhouse gas. Socially, it exacerbates food insecurity and hunger, as resources that could have been used to feed people are wasted (UNEP,2021).Efforts to reduce food wastage involve interventions at different stages of the food supply chain, including improving agricultural practices, optimizing transportation and storage, redistributing surplus food to those in need, educating consumers about food management and portion control, and developing policies and regulations to discourage wasteful practices (Parfitt et al., 2010). Food wastage due to inadequate food storage is a significant issue globally, leading to economic losses and exacerbating food insecurity. Improper storage conditions can accelerate food spoilage and deterioration, resulting in the disposal of edible food that could have been consumed. According to the Food and Agriculture Organization of the United Nations (FAO), approximately one-third of the food produced for human consumption is lost or wasted annually, with a significant portion attributed to poor storage practices (FAO, 2019). Factors such as inadequate temperature control, humidity, and exposure to light and air can contribute to the degradation of food quality and increase the likelihood of spoilage. For example, fruits and vegetables are particularly vulnerable to deterioration when stored under suboptimal conditions, leading to discoloration, mold growth, and loss of nutritional value. Similarly, improper storage of grains and cereals can result in pest infestation and moisture damage, rendering them unfit for consumption. Food storage is an important aspect of reducing food waste and ensuring food safety. Proper food storage helps maintain the quality and freshness of food items, extends their shelf life, and prevents spoilage. Individuals and households can take proactive steps to control food storage effectively, prevent spoilage, and reduce food wastage. This not only saves money but also contributes to a more sustainable and environmentally responsible lifestyle. Mostly, the household purchase and keep a stock of different food items. Some of these food items stored for food security, special recipe or occasion are never used and become spoiled. Most such wastage is linked to unplanned household storage behavior. Such households, usually, don't update themselves from store stock and their date of expiry which ultimately leads to discarding food. For example, household members keep the refrigerator temperature very high due to which the quality of food becomes spoiled (Wansink, 2000). In addition, consumers often make unplanned purchases, driven by marketing strategies, product displays, or attractive promotions. These impulsive decisions can result in buying more food than needed, leading to food storage challenges (Verain et al., 2017).

Role of proper food storage in preventing food waste is important. Proper food storage techniques can significantly extend the shelf life of various food items, allowing consumers to use them before they spoil. This is particularly important for perishable items like fruits, vegetables, and dairy products. Effective food storage helps reduce spoilage by preventing exposure to factors that cause food to deteriorate, such as temperature fluctuations, humidity, and oxygen. Awareness of food storage practices can prevent cross-contamination between raw and cooked foods, as well as between different types of food. Separating and sealing foods appropriately reduce the risk of foodborne illnesses. By storing leftovers in suitable containers and labeling them with storage dates, individuals can make the most of cooked meals. This practice encourages consumption of leftovers rather than wasting and ensures that items are easily accessible and reduces the likelihood of forgetting about them (Mena et al., 2011). There are several critical aspects of household food safety practices in the context of food insecurity. Households facing food insecurity might have limited access to resources and education related to food safety. As a result, they may not be well-

equipped to handle, store, and manage food in a way that prevents wastage and ensures food safety (Adane, 2019). The leftover food items in the fridge are usually remaining too long or not checked by households at the end of the expiry date before discarding. Consumers' priority is to buy too much food stock at low prices and then become careless in checking stores to avoid wastage and also some lack of knowledge about the required storage atmosphere and temperature to prevent wastage (Troost & Herpen, 2012).

It is an important aspect of human behavior related to food storage and consumption that when food is plentiful and prices are low, people often stock up on food items. However, this practice can increase the likelihood of food wastage due to various factors such as food spoilage and not consuming the stored items before they expire. When there is lack of planning during food purchases, poor management of food throughout the entire process from storage to cooking and reuse and the tendency to buy more food than needed, often due to affluence or consumer behavior lead to food wastage. People can make an impact by carefully managing their food supply, being mindful of expiry dates, and using food items efficiently (Dang et al., 2019).

Human behavior adds the reflection of their socialization and training mostly undertaken with the primary agents like family, peers, neighborhood, and educational institutions in shaping an individual's behavior and attitudes, especially in terms of food utilization and storage. Correct knowledge of food storage, including factors like maintaining refrigerator temperature, placing vegetables appropriately, and managing leftovers, is indeed crucial for reducing food wastage. Maintaining appropriate temperatures for different types of food inside refrigerators is advised by experts. The temperature should be kept at or below 40°F (4°C), while freezers should be set to 0°F (-18°C) to keep perishable items fresh longer. Before storing food items, households need to pay attention to use-by or expiry dates on food packaging. These dates indicate the last day a product is at its peak quality. Consuming items before these dates can help reduce waste (FDA, 2021).

According to United States Department of Agriculture (USDA) "Food Storage and Preservation, households needs to be aware of storing food in airtight containers or use vacuum-sealed bags to prevent exposure to air, which can lead to spoilage and freezer burn. Proper food storage is essential to prevent spoilage and reduce food wastage in households. To effectively manage food storage, it's crucial to be aware of how long different foods can be safely stored. For instance, raw poultry should be used within 1-2 days, while cooked meats can last 3-4 days in the refrigerator. Labeling leftovers with dates can help track their freshness and avoid confusion. When storing vegetables, it's important to be mindful of their specific requirements. Some vegetables need to be kept in the refrigerator to maintain their freshness, while others, such as potatoes and onions, are best stored in a cool, dark place. Canned goods should be stored in a cool, dry place, and it's essential to inspect cans for any signs of damage, denting, or bulging, as these can indicate spoilage or contamination. For dry staples like rice, pasta, and cereal, it's advisable to use airtight containers to prevent moisture and pests from compromising their quality. In the freezer, adopting a "first in, first out" approach ensures that older items are used before newer ones, preventing items from developing freezer burn. This practice helps in efficiently managing food storage and reducing wastage (USDA, 2021). It's important to emphasize that knowledge about food storage, while essential, should be complemented by behavioral control and a positive personal attitude to effectively prevent food wastage. It's not just about knowing how to store food but also about implementing that knowledge and having a willingness to minimize waste. If individuals can combine their knowledge with the motivation to reduce food wastage, it can lead to more effective food preservation practices (Visschers et al., 2016).

Food storage practices within households have significant social, economic, and ethical impacts. These impacts extend to various aspects of daily life and can influence both individual households and society as a whole. Proper food storage contributes to better public health by reducing foodborne illnesses. This is particularly important in developing countries where food safety regulations might be less stringent. Safe food storage and handling practices protect families from the dangers of spoiled or contaminated food. It also promotes a sense of responsibility within the household regarding health and well-being (Roe & Larkin, 2010). Effective food storage can lead to substantial cost savings for households. When food is stored correctly, it remains fresh for longer periods, reducing the need for frequent grocery shopping. This can help in managing household budgets and reducing food expenses. Furthermore, it minimizes food waste, which, when reduced, leads to less economic strain on both households and society (Buzby & Hyman, 2012). However, limited storage space or poorly organized storage areas can also lead to food items being tucked away and forgotten, eventually resulting in spoilage (Thøgersen,2019).

Material and method

The current research study was conducted in district Peshawar of Khyber Pakhtunkhwa. The district Peshawar is administratively divided into four towns (Town-I, Town-II, Town-III, Town-IV) including 357 Neighborhood/village councils, out of which 227 councils are rural and 130 are urban. A multistage stratified random sampling technique was adopted for selecting the respondents (Walliman, 2011)). Under the multistage stratified random sampling technique all the four towns (Town-1, Tow-II, Town-III, Town-IV), of the district Peshawar were included in the sampling process. At the next stage one urban and rural council (town/village councils) were randomly selected from each town (table#1). In this way eight town/village councils namely, Gulbahar, Akhoon Abad (Town-1), Hassan Gari and Shahi Bala (Town-II), University town and Regi, (Town-III), Hazar Khwani and Badabera Maryumzai, (Town-IV) were randomly selected. The total household population of eight selected towns/ village council stands at 38080 household (table-1).

For calculation of sample size, the procedure recommended by Chudry and Kamal (2009) was adopted (Equation-1), thus the required sample size for the population of 38080 household was worked as 379. The required sample is proportionally allocated to each neighborhood/village council by using proportional allocation procedure recommended by (Bowley, 1926).

The formula for sample size determination is given below

$$n = \frac{N\hat{p}\hat{q}z^2}{\hat{p}\hat{q}z^2+Ne^2-e^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

N= Total number of households =38080

P=population proportion = 0.50

q=opposite proportion q=(1-p) = 0.50

z = confidence level = 1.96

e = margin of error = 0.045

Bowley (1926) presented formula for proportional allocation of sample size is as under

$$n_h = \frac{Nh}{N} \times n \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

Where,

n_h = sample size required for Neighborhood/Village council

N_h = total population of household of N or V council

N= total population of the household.

n = required sample size.

Distribution of required sample size to selected Towns and Neighborhood/village councils is given in table-1

Table # 1 Proportional allocation of required sample Size to selected Town

District Name	Tehsil/ Town Name	Neighbor Councils/Village Councils	Total Household	SAMPLE SIZE
Peshawar	Town-I	Gulbahar (NC)	3840	38
		Akhoonabad (VC)	3249	32
	Town-II	Hassan Gari II (NC)	6482	65
		Shahi Bala (VC)	3910	39
	Town-III	University Town (NC)	8202	81
		Regi (VC)	4985	50
	Town-IV	Khazar khwani-I (NC)	4391	44
		Badabera Maryam zai (VC)	3021	30
	Total		**38080**	**379**

Source: Bureau of Statistics Khyber Pakhtunkhwa.

Conceptual frame work of the study

The conceptual frame work of the study consists on one independent variable (Food storage) and one dependent variable (Food wastage) as given in table-2

Table -2 Conceptual framework

Independent variable	Dependent variable
Food storage	Food wastage

Measurement of variables

Food storage consist of (8 items) and it was measured on Schanes et al. (2018), Flasconi et al.(2017), and Muresan et al. (2022) scales with some slide modified as suggested by departmental supervisory committee. Positive response on five or more items on food storage scale was considered as well aware of food storage (coded as 1) while positive response on less than five items on the scale was considered low awareness of food storage (coded as 0).

Data Analysis

The data analysis included Univariate, Bivariate, independent and dependent variable the percentage were calculated using equation -4 (Chaudhry and Kamal, 1996) given below

Percentage of data class = f/N × 100 Equation…….. (3)

Where f = frequency of data class, N = number of observations in the data set

At bivariate level the food wastage variable (Dependent variable) was categorized into two groups while taking the average amount of food wastage as cut point. Respondents with food wastage amount below cut point were categorized as below average food wastage while the rest of the respondents were grouped in above average food wastage category. All the dependent variables, at bivariate analysis level were cross tabulated with the indexed dependent variable (Food wastage) to determine the strength and direction of their association. Chi-Square test, Fisher exact test and Kendall Tau-b test were applied to measure the strength and direction of association among variables.

The chi square values are calculated using Equation (5) (Marry, 2009).

$$\chi^2 = \sum_{i=1}^{r}\sum_{j=1}^{c}\frac{(O_{ij}-e_{ij})^2}{e_{ij}}$$ Equation …….4

χ^2 = Chi Square

O_{ij} = Observed frequencies in i^{th} row and j^{th} column

e_{ij} = Expected frequencies regarding i^{th} row and j^{th} column

r = Number of rows

c = Number of columns

Df = (r-1) (c-1)

Conditions of chi-square test are as under:

1. Random and independent selection of subjects from each group

2. Every observation should qualify only one category

3. Sufficiently large sample size that no expected frequency is less than five.

In case of violation of 3rd condition, Fisher exact test was introduced as substitute Chi-Square test (Bowely, 1982)

Fisher Exact Test= $\frac{(a+b)!(c+d)!(a+c)!(b+d)!}{N!\ a!b!c!d!}$ Equation……..(5)

Where, ‘a,’ ‘b,’ ‘c’ and ‘d’ are the individual frequencies of the 2x2 contingency table, and ‘N’ is the total frequency.

Kendal Tau-b is calculated by using the following equation-6, (Nachmias, 1992).

$$T^b = \frac{Ns-Nd}{\sqrt{(Ns+Nd+Tx)(Ns+Nd+Tx)}} \qquad \text{Equation-6}$$

Where;

Tb = Kendall’s Tau-b

Ns = same order pairs

Nd = different order pairs

Tx = pairs tied on X

Results and discussion

Frequency distribution and proportion of the respondents on the basis of food storage

Proper household food storage is crucial to minimize food wastage and ensure that food remains safe and nutritious. Lack of information and failure to meet storage requirements can lead to unnecessary food spoilage and waste. Many households lack proper information about the best practices for food storage, including understanding expiry dates, proper storage conditions, and the signs of spoilage. Without this knowledge, people may unknowingly store food improperly, leading to quicker spoilage and increased wastage. The perceptions of respondents regarding food storage, is given in table-3 and explain below

The results indicate that majority of respondents (86.5 percent) agreed that controlling food temperatures helped prevent foodborne illnesses or food wastage, 78.9 percent stated that food storage had an impact on food hygiene, 68.3 percent stored excess food than their daily consumption. Controlling food temperatures is essential for both preventing foodborne illnesses and reducing food wastage. Moreover, food storage practices significantly impact food hygiene by preventing contamination, maintaining food quality, and controlling pests. These insights underscore the importance of proper food handling, storage, and preparation to ensure the safety and longevity of the food. Many households take advantage of bulk purchasing and discounts offered by stores and supermarkets. Buying in bulk can lead to having more food at home than what is immediately needed for daily consumption. While this can save money in the long run, it may also result in excess food storage. Some respondents may not be fully aware of the quantity of food they genuinely require daily, leading to unintentional excess food storage. Without proper meal planning, people may buy items they think they might use but never get around to incorporating them into their meals. This can lead to food sitting unused and eventually going to waste. According to FDA (2021) refrigeration is one of the most effective way to control raw and cooked food temperatures below 40°F (4°C) to prevent the growth of bacteria that can cause foodborne illnesses. Improper storage practices can lead to contamination, spoilage, and the growth of harmful microorganisms. For example, storing raw meat or poultry above ready-to-eat foods in the refrigerator can lead to the dripping of potentially dangerous bacteria onto the safe-to-eat items. By separating raw and cooked foods and using appropriate storage containers, the risk of cross-contamination can be significantly reduced, enhancing food hygiene. In addition, proper food storage includes paying attention to expiration dates and "best before" dates on food packaging. Consuming foods beyond their expiration dates may lead to foodborne illnesses or reduced quality. By regularly checking and rotating food items to use older products first,

individuals can avoid consuming expired or degraded food (WHO, 2015). While it might seem intuitive that having a surplus of food would reduce the risk of running out, it can actually contribute to wasteful practices. When people buy more food than they can consume within a reasonable time frame, some of the perishable items are likely to reach their expiry date before they can be used (Visschers et al., 2016).

Furthermore, 55.4 percent of respondents knew the maximum temperature limit above which food poisoning bacteria start to grow, 56.5 percent knew the maximum temperature limits below which food can freeze and get damaged, and 62.3 percent were aware of the importance of storing food and checking its consumption date. Proper food storage at appropriate temperature and adhering to the recommended dates provided by the manufacturer are essential for preventing food spoilage and ensuring it remains safe to eat. These results suggest that a significant portion of the respondents have some understanding of food safety and storage practices. However, there is still room for improvement. Food safety standards requires to store food at below 40°F (4°C) as a small number of bacteria on food can quickly become a large and dangerous population if left at temperatures between 40°F to 140°F. thus cold foods should be stored below 40°F (4°C), ideally in the refrigerator, while hot foods should be kept above 140°F (60°C), such as in a heated chafing dish or slow cooker (USDA, 2020). This prevents edible food from being discarded due to uncertainty about its safety or quality. If households are unaware of the optimal storage conditions for various fruits and vegetables, these items may spoil more quickly and end up being thrown away (FAO, 2013).

In addition, 76.8 percent of respondents regularly rotate food items in their food storage, 81.0 percent know how to prepare all of the food in their storage. Food management skills and culinary knowledge are important in reducing food wastage. Households with better awareness of how to use and rotate through their food items are more likely to minimize waste and make efficient use of their food. To address the challenges faced by respondents who are not regularly consuming or rotating their food items and those who don't know how to prepare all the food they have, educational programs on meal planning, culinary skills, and food storage organization could be beneficial. This reduces the chances of food going to waste due to prolonged storage (Gustavsson et al., 2011; & FAO, 2013). Having culinary skills and knowledge of various recipes allows households to adapt and use different ingredients creatively. This reduces the chances of certain food items going to waste due to lack of know-how (Stancu, 2016).

Table # 3 Frequency distribution and proportion of the respondents on the basis of food storage

Statements	Yes	No	Total
Controlling food temperatures help to prevent food borne illnesses or food wastage	328(86.5)	51(13.5)	379(100)
Food storage affect the food hygiene	299(78.9)	80(21.1)	379(100)
Have you stored excess food than your daily consumption	259(68.3)	120(31.7)	379(100)
You know the maximum temperature limit above which the food poisoning bugs start to grow	210(55.4)	169(44.6)	379(100)
You know the maximum temperature limits below which food can freeze and is damaged	214(56.5)	165(43.5)	379(100)

When storing food, you know its consumption date and the storage instructions given by the manufacturer	236(62.3)	143(37.7)	379(100)
Do you regularly consume or rotate through all items in your food storage	291(76.8)	88 (23.2)	379(100)
Do you know how to prepare all of the food in your storage	307(81.0)	72(19.0)	379(100)

Frequencies are given in parenthesis (Source: Survey 2023)

Association between food storage and food wastage

Food storage is essential for securing a reliable food supply, ensuring safety, preserving quality, reducing wastage, saving money, and contributing to environmental sustainability. Proper practices enable individuals to make efficient use of most of their food resources while promoting health and well-being. Food storage practices have a significant impact on food wastage. Proper food storage can help extend the shelf life of perishable items, reduce spoilage, and prevent the need to discard food prematurely. The association of food storage with food wastage is given table-4 and explained below.

The results show, a highly significant (P=0.000) and negative (tau-b=-300) association between controlling food temperatures and food wastage. Similarly, a highly significant (0.000) and negative (tau-b= -0.544) association was found between knowing the knowledge of maximum temperature limit, above which foodborne pathogens begin to increase, and food wastage. Likewise, a highly significant (P=0.000) and negative (tau=-0.546) association between the awareness regarding knowing the maximum temperature limits below which food can freeze and food wastage was found. Moreover, a highly significant (P=0.000) and positive (tau-b=0.374) association was found between food storage practices and food hygiene with food wastage. In addition, a highly significant (0.000) and positive (tau-b=0.395) association was found between the practice of storing more food than one's daily consumption and food wastage. In practical terms, as the practice of controlling food temperatures increases, food wastage tends to decrease. Individuals who prioritize food temperature control tend to engage in safer food handling practices, make more efficient use of food resources, and reduce the likelihood of premature food disposal. However, storing more food than their daily consumption increases the chances of food wastage. This can be attributed to various factors, including overestimation of needs, bulk buying, lack of meal planning, cooking excess food and psychological factors. It is scientifically proven that proper food temperature control, including refrigeration and cooking to recommended temperatures, helps prevent the growth of harmful bacteria and pathogens. This reduces the risk of foodborne illnesses. Safe food handling practices include separating raw and cooked foods, avoiding cross-contamination, and storing perishables at the correct temperature (Charles, 2020). Proper food temperature control extends the shelf life of perishable items. This aligns with global efforts to reduce food waste and its associated environmental consequences (Gunders, 2017). Following WHO recommendations for food storage and hygiene practices reduces foodborne illnesses. These practices enhance food safety and reduce the need to discard food due to safety concerns, ultimately leading to less wastage (WHO, 2015 & Zhang et al, 2018). When food is subjected to temperatures below its freezing point, it can sustain damage to its texture, flavor, and nutritional content. As consumers become aware of these potential quality issues, they may use frozen food more appropriately, reducing wastage (Alsailawi et al., 2020; USDA, 2020; & WHO, 2015). People may misinterpret food labels or misunderstand safe food storage practices, causing them to discard food prematurely (Schanes et al.,2018). In addition, a highly significant (P=0.000)

and negative (tau-b=-0.406) association was found between knowing the consumption date and following the manufacturer's storage instructions and food wastage. Moreover, a highly significant (P=0.000) and negative (tau-b= -0.361) association was found between regularly consuming or rotating through all items in food storage and food wastage. Furthermore, the results show a highly significant (P=0.000) and negative (tau-b=-0.362) association between knowing how to prepare all of the food stored in home and food wastage. The findings suggest that checking storage instruction from the food manufacturers and regularly rotating the food items in storage is associated with reduced food wastage. These practices help individuals make informed decisions, optimize food storage conditions, reduce food safety concerns, and contribute to sustainability and economic benefits. Promoting consumer education about responsible food management practices is essential in achieving these positive outcomes. Education and awareness of consumers about the significance of consumption dates and storage instructions empowers them to make informed decisions about when to use food and how to store it properly, contributing to waste reduction economic savings and healthy diets. Visibility and accessibility of food in storage by rotating stored food items is also important in reducing food waste (Murray, 2017; & FAO, 2013). Individuals knowing how to prepare storage and frozen food are more likely to use it in meals, reducing the chances of food items going to waste due to lack of culinary skills or familiarity. Knowing how to prepare stored food items can lead to a decreased reliance on convenience foods, which often come in single-use packaging and contribute to higher food wastage (Redmond & Griffith, 2009).

It is concluded that knowledge and skills of food storage separately under required temperature grades and effective use of such stored food reduce spoiling of food items, maintains its nutritional value and physical properties that ensure effective utilization of stored food and reduces food wastage.

Table # 4 Association between food storage and food wastage

Independent variable (Food storage)	**Dependent variable**	**Statistics-$\chi 2$, (P-value &tau-b**
Controlling food temperatures help to prevent food borne illnesses or food wastage	Food storage	$\chi 2$=34.224 (0.000) Tau-b= -0.300
Food storage affect the food hygiene	Food storage	$\chi 2$=52.914 (0.000) Tau-b= 0.374
Have you stored excess food than your daily consumption	Food storage	$\chi 2$=59.213 (0.000) Tau-b= 0.395
You know the maximum temperature limit above which the food poisoning bugs start to grow	Food storage	$\chi 2$=112.316 (0.000) Tau-b= - 0.544
You know the maximum temperature limits below which food can freeze and is damaged	Food storage	$\chi 2$=112.912 (0.000) tau-b= 0.546

When storing food, you know its consumption date and the storage instructions given by the manufacturer	Food storage	$\chi 2$=62.537 (0.000) tau-b= 0.406
Do you regularly consume or rotate through all items in your food storage	Food storage	$\chi 2$=49.390 (0.000) tau-b=-0.361
Do you know how to prepare all of the food in your storage	Food storage	$\chi 2$= 49.648 (0.000) tau-b= 0.362

Source survey 2023

Association between food storage and food wastage (controlling socio-economic status of the respondents)

The result in Table #5 show that the association of food storage on food wastage was highly significant (P=0.000) and negative (tau-b=-0.707) for respondents from low socioeconomic status group. Similarly, among respondents with a middle socioeconomic status, food storage was highly significant (P=0.000) and negatively associated (tau-b=-0.728) with food wastage. Among respondents with a high socioeconomic status, food storage was found highly significant (P=0.000) and negatively associated (tau-b=-0.718) with food wastage. The value of the level of significance and Tau-b between food storage and food wastage for the entire table was highly significant (P=0.000) and negative (tau-b=-0.721). These findings emphasize the universal importance of efficient food storage practices in mitigating food wastage across all socioeconomic backgrounds. Proper food storage not only helps conserve resources but also plays important role in reducing food wastage among diverse groups of individuals. Individuals with low socioeconomic status often have limited financial resources, which can lead to challenges in purchasing and storing food items efficiently. As a result, they are struggling to maintain proper food storage practices, which contribute to increased food wastage (Buzby & Hyman, 2012). Low-income households have limited access to suitable storage facilities, such as refrigerators and freezers, which are essential for preserving food. Without these resources, food may spoil more quickly, leading to higher wastage. Consequently, the poor avoid bulk purchasing to avoid extra storage requirement and can result in food items being stored for extended periods within the available resources, reducing the risk of spoilage and waste (Visschers et al., 2016). Food insecurity, a common issue among low-income populations, can lead to erratic food consumption patterns. This uncertainty can result in over-purchasing or improper storage, ultimately contributing to higher food wastage (Pinto et al., 2016). Better training of low socioeconomic status groups n proper food storage is often associated with better food conservation (Kaplan & Schuldt, 2017). Cultural norms and social pressures influence food storage behaviors. In some cases, individuals from low-income backgrounds feel obligated to store food and leftovers effectively, leading to reduced wastage (Bertoni et al., 2014). Middle-income individuals have greater access to a variety of foods and are more inclined to purchase larger quantities of perishable items. This increased variety and volume of food can lead to improper storage and, subsequently, higher wastage. However, awareness and training of proper storage recites reduces chances of food wastage in them (Visschers et al., 2016). Most middle socioeconomic status people perceive food as highly valuable commodity. This perception can lead to cautious storage and a higher likelihood of preventing premature discarding food items (Aschemann-Witzel et al., 2015). Middle-income households may experience social pressures to conform to certain food consumption norms, which can lead to controlled purchasing of food. Beside that cultural practices and traditions related to food preparation and consumption influence storage behaviors. (Bertoni et al., 2014). Individuals with higher socioeconomic status have greater access to resources and purchase larger quantities of food items. They also have better storage facilities. This abundance and facility encourages proper stocking of food items and reduces the

likelihood of food items going to waste (Visschers et al., 2016). Individuals with a high socioeconomic status are better equipped with required knowledge and skills to store food, leading to proper storage practices and a reduced likelihood of discarding food items prematurely (Aschemann-Witzel et al., 2015).

Table # Association between food storage and food wastage (controlling socio-economic status of the respondents)

Socio-economic status of the respondents	Independent variable	Dependent variable	Statistics $\chi 2$,(P-value & tau-b	Statistics $\chi 2$, (P-value) & tau-b for entire table
Low socioeconomic status	Food storage	Food wastage	$\chi 2$=30.450 (0.000) tau-b=-0.707	$\chi 2$=196.830 (0.000) tau-b=-0.721
Middle socioeconomic status	Food storage	Food wastage	$\chi 2$=79.592 (0.000) tau-b=-0.728	
High socioeconomic status	Food storage	Food wastage	$\chi 2$=86.706 (0.000) tau-b=-0.718	

(Source: Survey 2023)

Conclusion

The study highlights the critical role of proper food storage practices in mitigating food wastage across various socioeconomic backgrounds. Effective food storage not only helps conserve resources but also contributes to reducing food wastage, promoting food safety, and fostering sustainability. The findings reveal a strong association between controlling food temperatures, knowing maximum temperature limits, and adherence to consumption dates and storage instructions with reduced food wastage. Individuals who prioritize proper food storage tend to engage in safer food handling practices, make efficient use of food resources, and minimize premature disposal of food items. Moreover, the study underscores the significance of consumer education and awareness programs on food management practices, meal planning, culinary skills, and food storage organization. Empowering individuals with the knowledge and skills necessary for effective food storage can lead to reduced food wastage and improved utilization of food resources.

Recommendation

1. Implement educational programs aimed at raising awareness about proper food storage practices, including temperature control, labeling, rotation, and utilization of food items. These programs should target diverse socioeconomic groups to ensure broad access and effectiveness.
2. Develop and enforce policies and regulations to promote responsible food management practices, including food labeling standards, storage guidelines, and hygiene requirements. Collaborate with relevant stakeholders, including government agencies, NGOs, and community organizations, to implement and monitor these policies effectively.
3. Invest in improving access to appropriate storage facilities, such as refrigerators and freezers, particularly in low-income communities. Provide incentives or subsidies for the

adoption of energy-efficient appliances to reduce operating costs and environmental impact.

4. Foster community engagement and participation in food waste reduction initiatives through outreach programs, workshops, and local partnerships. Encourage community members to share knowledge, resources, and best practices for effective food storage and utilization.
5. Support research and innovation in food preservation technologies, packaging materials, and storage solutions to enhance food shelf life, reduce spoilage, and minimize waste generation. Foster collaboration between academia, industry, and government agencies to develop sustainable and cost-effective solutions.
6. Launch targeted campaigns to promote behavioral change among consumers, encouraging them to adopt responsible food storage habits, plan meals effectively, and minimize over-purchasing. Utilize social media, advertising, and community events to reach diverse audiences and reinforce positive behaviors.
7. Establish mechanisms for ongoing monitoring and evaluation of food storage practices, food wastage trends, and the effectiveness of intervention programs. Use feedback and data-driven insights to refine strategies, address emerging challenges, and optimize resource allocation.

Acknowledgements The authors are grateful to the households for providing the data. The authors are also thankful to the University of Agriculture, Peshawar, Pakistan, for providing a good platform for this research study.

Novelty Statement This research study was conducted to determine the household behavior and awareness regarding food wastage at household level in district Peshawar, Khyber Pakhtunkhwa-Pakistan. No such research was conducted before in the study area.

Author's Contribution Abid Jan: Conceived idea, designed research, collected data, analyzed data and prepared draft.

Asad Ullah: Supervised research, designed research, analyzed data and edited draft.

Conflict of interest: The authors have declared no conflict of interest

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