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The impact of COVID-19 on food management in households of an emerging economy

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ABSTRACT

The COVID-19 pandemic has affected how households buy, prepare and consume food, with resultant impacts on food waste generated. These impacts have not yet been properly understood, especially in the context of developing countries. Better understanding of the impacts of COVID-19 on food management behavior of households can aid in the design of policy interventions to reduce the amounts of wasted food during disastrous events. This becomes particularly important in light of the likely pro-longed effect held by the pandemic on household lifestyles in the future. This study has segmented households in Turkey, a rapidly emerging economy, on the basis of the effects imposed by COVID-19 on their food management behavior. A two-step clustering analysis has been conducted on the factor scores of planned shopping and cooking skills. Three segments were identified: *careless planners and cooks, resourceful planners and cooks* and *careless planners and resourceful cooks.* The segments were further described using health orientation, price consciousness, environmental concern, food waste disposal routines and self-perception of the amount of food waste variables. The first and the smallest segment, *careless planners and cooks,* is characterized by low levels of planned shopping and cooking skills, with resultant significant wastage. The largest segment of *resourceful planners and cooks* demonstrates excellent planned shopping and cooking skills, with resultant small wastage. The segment of *careless planners and resourceful cooks* showcases excellent cooking skills, but poor skills of planned shopping. The study provides first known evidence to understand how Turkish households differ on the grounds of their food management behavior in the time of the pandemic, thus laying a foundation for future segmentation studies in Turkey and beyond.

1. Introduction

The Coronavirus disease (COVID-19) has imposed manifold, largely negative, impacts on the global economy and household lifestyles [1]. The sudden disruption of industrial and commercial systems has eroded business profitability and contributed to unemployment [2]. More than half of global households, an equivalent of at least 4.5 billion people, have experienced, often for a pro-longed time, various types of restrictions, such as national lockdown orders and travel bans [3].

The pandemic has affected all elements of the global food supply chains [4] causing problems related to food availability, accessibility and waste [5]. The issue of food waste (FW) has become particularly pronounced due to temporary or permanent closure of hospitality and foodservice businesses [6]. Food has also been wasted on farms due to the suddenly reduced demand from the downstream of the food supply chains [7]. Lastly, FW has been generated by households as many have been forced to work from home with changed routines of shopping, preparing and storing food [8].

Long before the pandemic, the issue of FW has been recognized as globally significant [9]. This particularly concerns FW generated by households with mounting evidence showcasing the largest share of household FW in the total amounts of food wasted in the food supply chains of many countries [10–12]. This wastage has been attributed to various factors, including but not limited to: food planning [13], shopping [14], storage [15], cooking [16], consumption [17], and disposal [18]. The socio-demographic factors, such as household structure [19], age [20] and gender [21] alongside income levels [22] and levels of education [23] have also played a role.

The pandemic has changed the dynamics of FW in households [24]. In particular, national lockdown orders imposed by many governments around the world have forced populations to stay at home and considerably affected the way how households manage food [25]. Travel

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restrictions and limited options to eat out have prompted households to pay more attention to food shopping, in terms of its frequency, cost and quantity [26–28]. For example, since the start of the national lockdown in the U.S., it is estimated that nearly 40% of households reduced the number of their shopping trips, bought more non-perishable foods, and spent more on each shopping trip [29]. National lockdown orders have encouraged households to better organize their cooking routines [30], but also prompted them to re-think their food storage [24] and food left-over re-use practices [31].

The changes in food management behavior of households have been attributed not only to the situation-specific (i.e., national lockdowns), but also various psychographic and socio-demographic factors. The pandemic has prompted households to pay attention to the 'healthiness' of their food choices [26,32]. Healthy eating has been considered in light of supporting the immune system to withstand the virus [33,34]. Concurrently, the pandemic has also forced households to cut on their expenditures as a result of lost or potentially endangered jobs, increased costs of living, uncertain future and unfavorable macro-economic forecasts [35]. Increased levels of frugality and thrift have been observed in households as a result [10,36].

Given the disruptive effect of COVID-19, an increasing number of studies have started exploring the effect of the pandemic on household food management behaviors and household FW. Although households have increased the amounts of food wasted in the first weeks of national lockdowns (March–April 2020) [25], there is mounting evidence pinpointing improvements in the FW dynamics in the following months. For instance, while the amount of food purchased [27,37] increased at the start of the pandemic, often driven by panic buying and stock-piling behavior [28], the quantities of food wasted by households decreased afterwards [27,31]. The changes in the household food management practices are attributed to various socio-economic (e.g. governmental restrictions, income loss, food availability) [38], psychological (e.g. developing stronger positive attitudes towards FW reduction) [31,38], behavioral (e.g. planning meals, more efficient stocking, developing cooking skills, buying more non-perishable food) [27], and situational (i.e., spending more time at home) [31,37] factors.

Household food management behavior during COVID-19 lockdowns was studied from the perspective of segmentation. For example, Pocol [39] differentiated between three household types in Romania based on their FW habits, general knowledge on FW, childhood food consumption habits, and socio-demographic factors: careless, precautious, and ignorant. The 'careless' and 'ignorant' households tend to waste more food due to poor food management skills (i.e. planning, storing, cooking, reusing leftovers). In contrast, the 'precautious' households tend to carefully observe the amounts of food they keep at home by checking the 'use by' dates and revising the food stock on a weekly basis. This category of households wastes less food as a result. Likewise, Principato et al. [40] segmented Italian households on the basis of their FW related behavior and identified seven types of households with significant variations recorded in the FW they generated during the pandemic.

Considering that household food management practices have various socio-demographic, psychographic and behavioral antecedents [11,22,41], previous research has identified several key variables that can be used for segmentation analysis of households on the basis of their FW. These variables are represented by: beliefs and attitudes towards FW [42], food related lifestyles [43], knowledge of FW and its magnitude alongside perceptions of the negative consequences of FW generation [21,44], food spending and consumption habits [21], food planning, shopping, storing, cooking, and reusing leftovers habits [14,40,44,45]. The number of segments identified in those studies (e.g. [40,42,43]) ranges from 2 to 7. Almost every study has discovered a household segment whose members do not plan their food shopping or cooking ahead. This household segment has been referred to as 'uncaring' [42], 'careless food wasters' [46] 'non-aware' and 'unaware but wasteful consumers' [21], 'the short-termist' and 'the consumerist' [44], 'the exaggerated cook' and 'the exaggerated shopper' [14]. The segment of households which does not monitor its food stocks and lacks cooking skills has been coined in the literature as 'the self-indulgent' and 'the consumerist' [44], 'the unskilled cooks' and 'the exaggerated cooks' [14]. Past research has conclusively shown that household behaviors related to food management are suitable for segmentation [14,45,47].

Research on household FW is rapidly growing but its geographical focus has primarily been on developed economies [14,21,41]. While this focus is justified by the fact that developed economies waste more food on a per capita basis, developing and emerging economies also significantly contribute to the amounts of global FW at the household level [48]. Studies on household FW in developing and emerging economies are gradually growing in number [37–39] but some specific geographies have remained uncovered, especially in light of the pandemic. Studies on household food management behaviors in developing and emerging economies can aid in the design of more effective policies to reduce the amounts of wasted food, generally but also in a time of disastrous events.

This paper has set to segment households in an emerging economy, Turkey, on how they manage food in light of the COVID-19 pandemic. The paper makes a dual contribution to knowledge. First, by segmenting households based on their food management behavior during COVID-19, the study outlines a potential set of variables to be used in future research on food management behavior in households, with a focus on FW. Second, the segmentation analysis enhances an understanding of the household characteristics predominantly related to food management behavior, thus allowing policymakers and industry professionals to design evidence-based market interventions. These interventions can reduce the amounts of FW generated by households, thus making their food management more sustainable. The next section explains this study's research design.

2. Methodology

2.1. The study context: Turkey

The first COVID-19 case was detected in Turkey on March 11th, 2020 [49]. In the following few days, numerous restrictions were imposed, such as a ban on intercity, interstate and international travel, closure of educational establishments, shopping malls, entertainment venues and other non-essential businesses, including hospitality and foodservice operators [50,51]. A stay-at-home order was issued and only essential trips were allowed, such as for shopping [52]. A flexible working system with minimum personnel was introduced on March 27th, 2020 [53]. During this period, the majority of population stayed at home, cooking their own meals instead of ordering food from outside [54]. Households became more health-conscious and more sensitive to food prices [55]. On May 4th, 2020, a normalization plan was announced and the restrictions were lifted gradually by allowing intercity and interstate travel and reopening shopping malls, hospitality and foodservice operators on June 1st, 2020 [56–58]. In November 2020, restrictions were reintroduced including a stay at home recommendation [59]. As of December 1st, 2020, the nationwide nightly and weekend curfews have been in place. People were only allowed to leave home to buy essential items, which included food. Hospitality and foodservice operators provided food for delivery only [60] (Fig. 1).

2.2. Instrument design

The survey questionnaire was designed to consist of a cover page and six sections. The cover page informed the study participants of the anonymity and confidentiality of their responses. Section 1 contained a screening question aiming to confirm whether the participants were responsible for food shopping and cooking in their households. Section 2 set to clarify the focus of the study. Here, the participants were asked to read and agree to the following statement "*Please consider your household's food consumption practices during the COVID-19 period*" and "*I have read and understood the explanation above*". Section 3 included questions

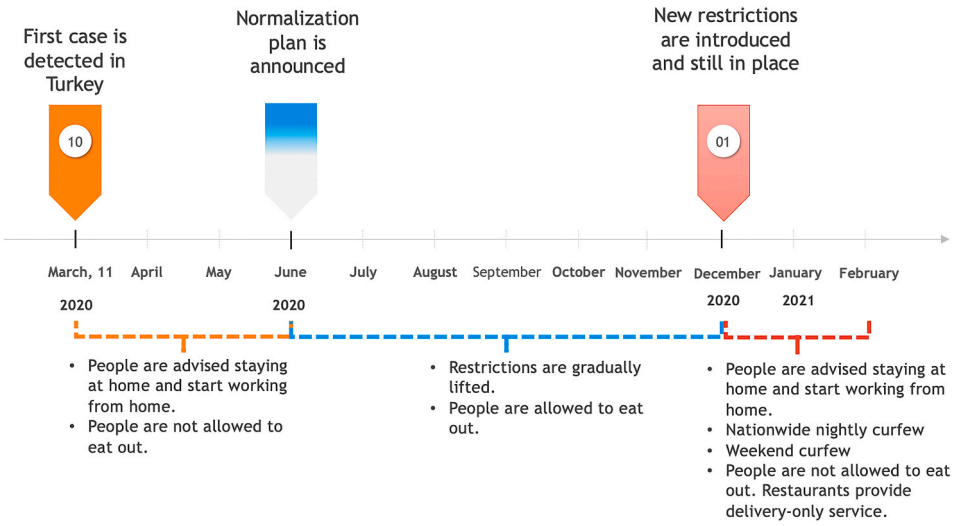

Fig. 1. The timeline of the pandemic in Turkey.

on food shopping habits (i.e. frequency of food shopping and the amount spent on groceries). Section 4 included 14 items represented by the segmenting variables aiming to measure household food management behavior. Five items for food planning were derived from Stancu et al. [61], five items for storage were adopted from Delley and Bruner [44], and four items for cooking were developed from Delley and Bruner [44] and Soorani and Ahmadvand [15]. Section 5 assessed the psychographic and FW-related variables whereby three items for health orientation were taken from Roininen et al. [62], three items for price consciousness were obtained from Katt and Meixner [63], one item for environmental concern was sourced out from Landry et al. [64], one item for FW disposal options, and one item for the self-perception of the FW amount generated in the household were taken from Gaiani et al. [14]. Section 6 included questions on socio-demographics. Appendix A contains a copy of the questionnaire.

A five-point Likert Type scale ranging from (1) strongly disagree to (5) strongly agree was used to measure items belonging to planning, cooking, storage, health orientation, and price consciousness. The scale of (1) not at all concerned to (5) very concerned was used to measure the level of environmental concern in line with the approach proposed by Berenguer et al. [65]. Multiple choices (thrown in the trash, used to feed animals, composting, and sharing with other people) were provided to measure the FW disposal options. Nominal scale was used to measure the self-perception of the FW amount (*To the best of my recall, the amount of food I throw away in my household now, during the pandemic, compared to the pre-pandemic times, has …)* using *"increased/decreased/did not change/not applicable-no food waste is generated in the household"* choices.

The items were translated and then back-translated from English to Turkish to ensure functional equivalency [66]. A pre-test was conducted on a sample of 30 participants to ensure that the items could be well-understood, and participants could follow the instructions as indicated. Minor changes to wording were made prior to survey administration.

2.3. Participants and procedure

The questionnaire was administered using a computerized self-administered questionnaire (CSAQ) in January 2021 during the nationwide curfew. CSAQs represent an effective method for primary data collection from households during the COVID-19 period [28, 38–40]. This is because travel restrictions and social distancing rules hampered administration of a survey face to face.

A link to the questionnaire was distributed via popular social media platforms such as Twitter and LinkedIn. Budget constraints prevented the use of a commercial survey company which could guarantee the representativeness of the sample. No incentive was provided to complete the questionnaire. Snowball sampling was adopted whereby initial participants were asked to share the link with other members of their networks to ensure sample diversity. Snowball sampling is often used when locating the large number of participants is difficult [67]. While data collection costs are greatly lowered, several shortcomings of the technique need to be acknowledged. Similar to other non-probability sampling techniques, the sample is not representative of the population and findings cannot be generalized to the population [68,69]. Despite these shortcomings, it has been applied in past research on household FW [42,70].

The sample frame consisted of individuals who held responsibility for household grocery shopping and cooking and 511 cases collected were suitable for analysis. The majority of the respondents (75.5%) were female which is in line with other FW studies [21,70,71]. Respondents consisted of all age groups, 34.4% aged from 30 to 40 years. 31.1% of aged from 41 to 51. The majority (68.9%) were married. Statistics show that 63.2% of the male population, 62.5% of the female population are married in Turkey [72]. The sample was well educated with 61.1% who had completed a 4-year degree. Based on the data from TÜİK [73], 13.9% of the Turkey's population have a 4-year degree. 59.3% of the sample was in full-time paid employment. Monthly household incomes were high, and 33.5% of the sample had a monthly household income lower than the monthly average household income in Turkey. Most respondents (59.5%) lived in a household with 3 people or more. Average household size in Turkey in 2019 was 3.35 [74]. 13.9% of the respondents indicated that they were leaving alone (1-person) which is close to the 2019 average of Turkey (16.9%) [74]. Most of the respondents indicated that they did not have children at home (40.5%) and 30.3% reported having two children or more. Table 1 provides the socio-demographic profile of participants that largely matches the characteristics of the Turkish population. The differences were attributed to the larger proportions of females, well-educated and wealthy households. The dominance of female respondents can be attributed to women being mainly responsible for grocery shopping and cooking in Turkey which is in line with other FW studies [21,70,71]. The dominance of well-educated and wealthy households can be assigned to the snowballing technique where subsequent selections are based on referrals whereby people tend to refer others with similar socio-demographic and psychographic characteristics [67].

Table 1
Socio-demographic profile of participants.

Characteristics	%	Characteristics	%
Gender		Number of children	
Male	22.9%	No children	40.5%
Female	75.5%	1 child	29.2%
Rather not to say	1.6%	2 or more children	30.3%
Age		Income	
29 or younger	14.7%	600 € or lower	33.5%
30–40	34.4%	601 € – 999 €	31.6%
41–51	31.1%	1000 € or higher	34.1%
52 or older	19.8%	Rather not to say	0.8%
Education		Employment	
2-years degree or lower	19.8%	Full time paid	59.3%
4-years degree	61.1%	Part time paid	1.4%
Master's and PhD	19.1%	Owner	4.3%
Marital status		Unemployed	4.3%
Single	28.8%	Student	3.3%
Married	68.9%	Retired	13.9%
Other	2.3%	Housewife	11.2%
Household size		Short-term working allowance	1.4%
1person	13.9%	Other	1.0%
2 people	26.6%		
3 or more	59.5%		

2.4. Data analysis

An exploratory factor analysis (EFA) using varimax rotation was conducted to determine the dimensions of the segmentation variables (14 items) and two descriptor variables, health orientation and price consciousness (6 items). After eliminating the items with low factor loadings (<0.50) and the cross-loaded items (two items from planning, one item from cooking, three items from storage) the remaining 14 items were obtained and these indicated a four-factor solution. The first factor 'planned shopping' was related to planning of food shopping and meals. The second factor 'cooking skills' was concerned with the ability of households to keep and reuse food leftovers, store food to ensure it does not spoil, and cook with as little waste as possible. The third factor 'health orientation' was related to household interest in healthy eating and consuming natural foods and foods with vitamins and minerals. The fourth factor 'price consciousness' explained household attitudes to the costs of food shopping.

Reliability of the factors was determined by using the Cronbach's alpha (α) and composite reliability (CR). All α's and CR values were greater than .70 showing a satisfactory level of reliability [75]. In order to check for validity, the values of average variance extracted (AVE) and convergent validity were used. All AVE values were higher than 0.50 as recommended by Fornell and Larcker [76], and all factor loadings were higher than 0.50 establishing convergent validity [77]. The descriptive statistics of the items, EFA loadings, reliability, and validity values are provided in Table 2.

A two-step clustering analysis was adopted to categorize participants based on the factor scores of segmentation variables (planned shopping and cooking skills) obtained from the EFA. Using this two-step approach in place of a single method is recommended because two approaches complement each other's advantages [68]. Such procedure has been applied in previous studies on FW segmentation [42,45,46]. First, a hierarchical cluster analysis using the Ward's method was conducted and an examination of the dendrograms and agglomeration coefficients was carried out to determine the number of clusters. Second, a non-hierarchical technique (i.e. the k-means) was utilized to create an improved solution [78]. Following the determination of clusters, descriptor variables were used to profile the clusters in detail. This is in line with past research which has used various descriptor variables such as socio-demographics [46], and psychographics (e.g. norms, concerns, attitudes) [45] to further describe and compare the clusters. Fig. 2 outlines the steps used in the cluster analysis. The next section presents this study's results.

3. Results

A two-step clustering analysis yielded a three-cluster solution. The three clusters were labeled regarding the mean scores of planned shopping and cooking skills as follows: *careless planners and cooks*,

Table 2
Descriptive statistics, EFA loadings, AVEs, CR and Cronbach's alpha values.

Factors	Items	M (SD)	Overall M (SD)	Factor loadings	AVE	CR	α
Planned shopping	I plan all my shopping trips in advance by e.g., checking what food is available in the fridge and making a list of the items I need to buy.	4.11 (0.901)	3.89 (0.789)	0.784	0.608	0.819	0.726
	I plan what to eat to ensure I use the most short-dated food first.	3.79 (1.125)		0.784			
	I plan in advance what meals will be cooked in my household.	3.76 (0.940)		0.759			
Cooking skills	I do my best to prepare food in such a way that no leftovers are generated.	4.16 (0.753)	4.19 (0.570)	0.778	0.510	0.838	0.794
	I try to cook meals that everyone in my household enjoys.	4.25 (0.730)		0.587			
	I do my best to ensure my cooking generates as little waste as possible.	4.21 (0.718)		0.740			
	I keep leftovers for future re-use.	4.00 (0.916)		0.683			
	I know the proper way to store the food to prevent spoilage.	4.31 (0.714)		0.766			
Health orientation	During the COVID-19 period, I try to eat as healthily as I can.	4.07 (0.827)	4.02 (0.789)	0.880	0.757	0.903	0.890
	During the COVID-19 period, I try to eat a wide variety of foods in the right proportions.	3.93 (0.827)		0.917			
	During the COVID-19 period, it is important to me that my daily diet contains a lot of vitamins and minerals.	4.05 (0.789)		0.809			
Price consciousness	During the COVID-19 period, I try to buy food items that are on sale.	3.49 (0.879)	3.68 (0.724)	0.825	0.622	0.830	0.707
	During the COVID-19 period, I pay attention to supermarket deals.	3.74 (0.918)		0.849			
	During the COVID-19 period, I compare food prices from different brands.	3.81 (0.942)		0.681			

Notes: M = Mean, SD=Standard deviation, AVE = Average variance extracted, CR=Composite reliability, α = Cronbach's alpha.

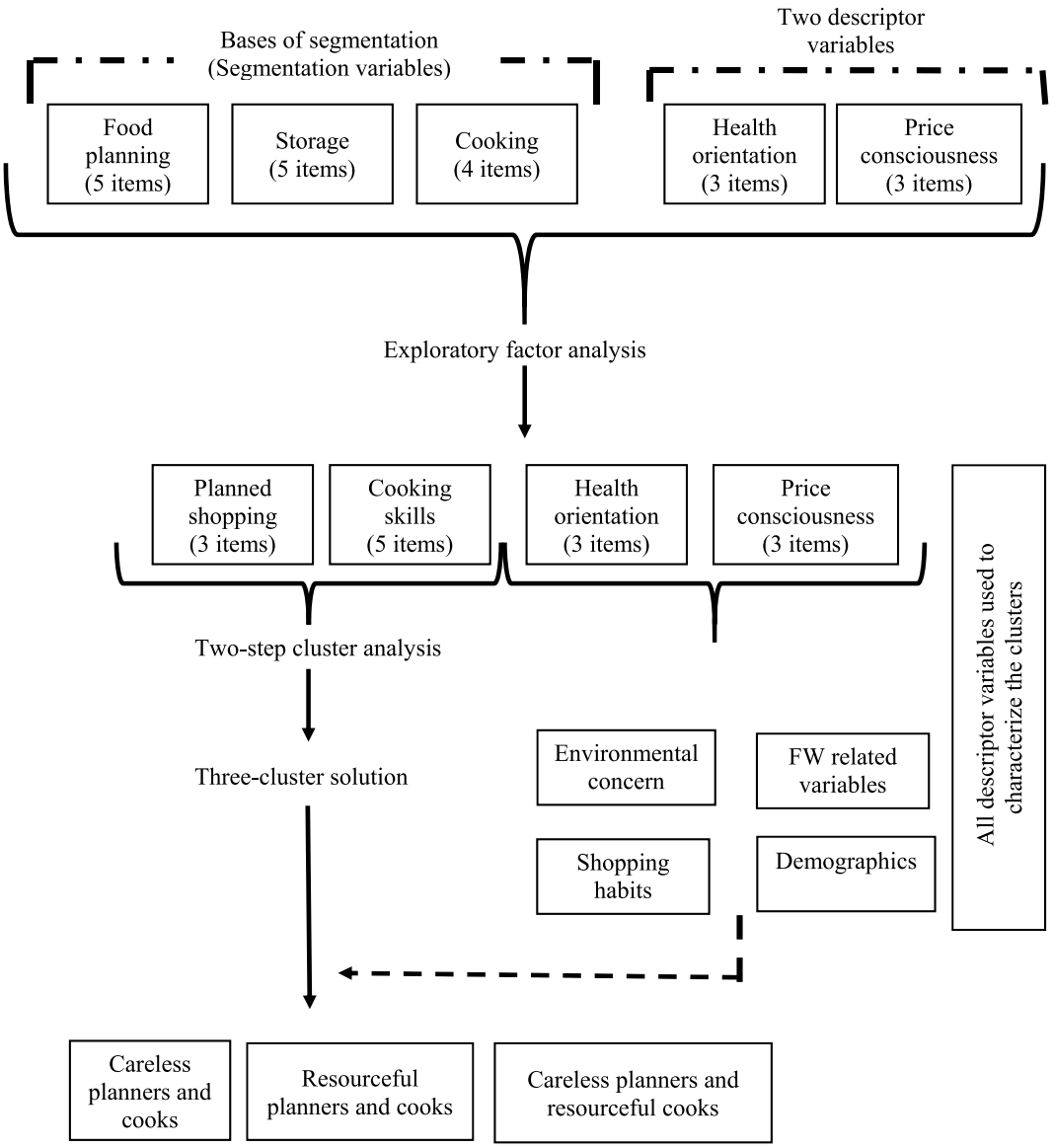

Fig. 2. Cluster analysis steps.

resourceful planners and cooks, and *careless planners and resourceful cooks*. *Careless planners and cooks* had low scores of planned shopping and cooking skills. *Resourceful planners and cooks* showcased the highest scores on planned shopping and cooking skills. *Careless planners and resourceful cooks* had high scores of cooking skills but the lowest scores on planned shopping. One-way ANOVA confirmed significant differences between the three clusters based on planned shopping ($F = 306.806$, $p < .001$) and cooking skills ($F = 225.867$, $p < .001$). Results of the Tukey's post hoc analysis evidenced significant differences in planned shopping scores among the three clusters (all $ps < .001$) (Table 3).

The clusters were then characterized based on the levels of health orientation, price consciousness, and environmental concern. One-way ANOVA revealed significant differences between the three clusters in terms of health orientation ($F = 22.033$, $p < .001$), price consciousness ($F = 8.097$, $p < .001$), and environmental concern ($F = 11.115$, $p < .001$). The Tukey's post hoc tests revealed that all clusters differed from each other significantly for health orientation levels (all $ps < .05$) (Table 4).

Table 3
One-way ANOVA and Tukey's post hoc analyses for segmentation variables.

Segmentation Variables	F-value	Careless planners and cooks (n = 90)	Resourceful planners and cooks (n = 285)	Careless planners and resourceful cooks (n = 136)
		M (SD)	M (SD)	M (SD)
Planned shopping a***, b***, c***	306.806***	3.50 (.64)	4.40 (.44)	3.07 (.65)
Cooking skills a***, b***	225.867***	3.34 (.54)	4.39 (.38)	4.33 (.41)

Notes: M = Mean, SD=Standard deviation, [a] *Careless planners and cooks* differ from *resourceful planners and cooks;* [b] *Careless planners and cooks* differ from *careless planners and resourceful cooks;* [c] *Resourceful planners and cooks* differ from *careless planners and resourceful cooks;* *$p < .10$; **$p < .05$; ***$p < .001$.

Table 4
One-way ANOVA and Tukey's post hoc analyses for psychological variables.

Psychological Variables	F value	Careless planners and cooks (n = 90)	Resourceful planners and cooks (n = 285)	Careless planners and resourceful cooks (n = 136)
		M (SD)	M (SD)	M (SD)
Health orientation a***, b**, c**	22.033***	3.61 (.83)	4.17 (.70)	3.96 (.63)
Price consciousness a**, b**	8.097***	3.40 (.71)	3.73 (.73)	3.75 (.68)
Environmental concern a***, b**, c*	11.115***	4.11 (.78)	4.52 (.69)	4.35 (.76)

Notes: M = Mean, SD=Standard deviation, [a] *Careless planners and cooks* differ from *resourceful planners and cooks;* [b] *Careless planners and cooks* differ from *careless planners and resourceful cooks;* [c] *Resourceful planners and cooks* differ from *careless planners and resourceful cooks;* *p < .10, **p < .05, ***p < .001.

3.1. Cluster profiles

In order to profile the three household segments identified, each cluster was described on the basis of planned shopping, cooking skills, psychological and FW disposal-related variables, shopping habits, and demographics.

3.1.1. Careless planners and cooks

Careless planners and cooks, characterized by low levels of planned shopping and cooking skills, had a share of 17.61% of the sample. They had the lowest levels of health orientation, price consciousness, and environmental concern among the three clusters. The percentage of *careless planners and cooks* perceiving that FW increased during COVID-19, compared to the pre-pandemic period, was higher than in other segments. *Careless planners and cooks* generally preferred direct FW disposal option. They went shopping less frequently than other segments, and their weekly spent on food was higher than others. *Careless planners and cooks* were relatively young because the study participants aged 30–40 hold the highest proportion in this segment compared to other age groups. The education level of *careless planners and cooks* was high as the percentage of Master and/or PhD holders in this segment was higher than in other segments. Compared to other segments, the share of single member households among *careless planners and cooks* was the highest. This segment was predominantly characterized by small-sized households with no children. *Careless planners and cooks* earned more than the other segments. The percentage of full-time paid employees among *careless planners and cooks* was slightly higher than in the other segments.

3.1.2. Resourceful planners and cooks

Resourceful planners and cooks, showcasing better planned shopping and cooking skills, represented 55.77% of the sample. They had the highest scores of health orientation and environmental concern with moderate levels of price consciousness. The share of households engaging in FW prevention (by using FW to feed animals, sharing surplus food with others, and composting wasted food) as a FW disposal option in this segment was higher than in the other segments. *Resourceful planners and cooks* were older than other segments because the study participants aged 41–51 had the highest share. *Resourceful planners and cooks* had lower education levels and the share of married participants was the highest in this segment. The majority of the participants' household size was three or more people, and *resourceful planners and cooks* had at least one child. *Resourceful planners and cooks* earned less than other segments. The share of housewives was slightly higher among *resourceful planners and cooks* compared to the other segments.

3.1.3. Careless planners and resourceful cooks

Careless planners and resourceful cooks, accounting for 26.62% of the sample, had high levels of cooking skills, but demonstrated the lowest scores on planned shopping. They had the highest level of price consciousness among the three clusters with high levels of health orientation and environmental concern. The share of *careless planners and resourceful cooks* generating no FW regardless of the pandemic was higher than in the other segments. *Careless planners and resourceful cooks* went shopping twice a week or more often which was more frequent than in the other segments. Above 80% of *careless planners and resourceful cooks* spent less than 60 € on food shopping in a week which is less than Turkey's average weekly food expenditure for a family of four [79]. The share of *careless planners and resourceful cooks* spending less than 60 € on shopping in a week was slightly higher than in the other segments. In terms of age distribution, the study participants aged 30–40 hold the highest share in this segment. Household size was generally three or more people among *careless planners and resourceful cooks* and they had two or more children (See Fig. 3 and Table 5).

4. Discussion and conclusion

The current study segmented Turkish households on the basis of their food management behavior during COVID-19. This study contributed to knowledge in three ways. First, planned shopping and cooking skills represented useful variables to segment household food management behavior during the COVID-19 period and beyond. Thus, this study provided further empirical evidence as to how these variables could be used to segment households, with a particular focus on an emerging economy [14,39,40,44,45]. Second, previous studies have mostly used socio-demographic factors [39], consumption habits [21], perception, awareness and information about FW [21,44,46] to describe the household segments. Limited research has used psychographic variables, such as norms, concerns, and attitudes to profile households [45]. Thus, the current study extended the literature on household segmentation by using health orientation, price consciousness, and environmental concern to identify and describe detailed profiles of the household segments. Again, the empirical evidence from an emerging economy is useful in setting the benchmarks, thus facilitating future, comparative and cross-country, research on the topic in question conducted in the context of the COVID-19 pandemic, but also in general conditions. Third, this study revealed that only a small portion of Turkish households increased FW during the COVID-19 period. This contributed to the emerging trajectory of research on the effect of the pandemic on household food consumption habits and related food wastage [25,27,37,40]. The empirical evidence collected in an emerging economy of Turkey offered scope for comparisons and critical evaluations of the drivers of more as well as less wasteful household food consumption behaviors.

Three household segments were identified based on their planned shopping and cooking skills: *careless planners and cooks, resourceful planners and cooks,* and *careless planners and resourceful cooks.* These segments exhibited several similarities in comparison to the segments disclosed in other studies on household FW. In terms of their poor food management behavior with resultant wastage, but also younger age, small-sized households and engagement in direct FW disposal, *careless planners and cooks* shared commonalities with the 'uncaring' segment of households established by Flanagan and Priyadarshini [42], 'careless food wasters' segment of Richter [46], 'consumerist' segment of Delley and Bruner [44], and 'non-aware' segment of Di Talia et al. [21]. The monthly household income level of *careless planners and cooks* was high. Taken together, these findings are consistent with those of Gaiani et al. [14] concluding that the small-sized households with high income levels are prone to generate more FW than the large-sized households with low income levels. This can be attributed to the busy/hectic lifestyles that

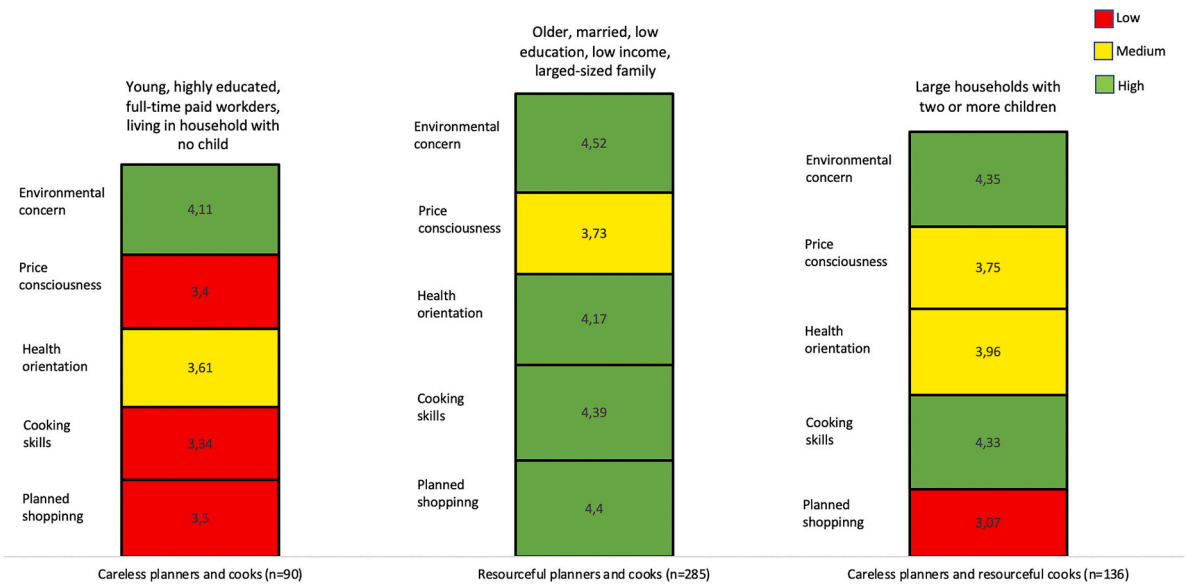

Fig. 3. Segments' profiles based on mean scores.

imply no time for food planning and/or cooking.

Resourceful planners and cooks constituted the largest segment of Turkish households. Regarding good planning capabilities, excellent cooking abilities, moderate price consciousness, and high engagement in FW prevention, this segment was similar to 'the conservative' segment of Delley and Brunner [44]. The members of this household segment were older, married, had low education and income levels with large-sized families. In terms of their socio-demographics and FW avoidance attitudes, this segment had commonalities with the 'caring' segment of Flanagan and Priyadarshini [42], the 'guilty food wasters' segment of Richter [46], 'conscious consumer' segment of Di Talia et al. [21], and 'virtuous' segment of Romani et al. [45]. Food management behavior can be attributed to better time availability whereby such households can invest time in food planning and cooking. It can also be associated with low disposable income whereby such households have to use food stocks wisely to ensure effective use of (often limited) budgets.

Careless planners and resourceful cooks were characterized by low planned shopping and high cooking skills. They were relatively young. Their households were comprised of three or more people with two or more children. They shared a number of features with the 'moderate' segment of Romani et al. [45] in terms of their low planned shopping and intermediate engagement level in FW prevention. Low planned behavior can be attributed to high shopping frequency and household composition whereby such households have young children. On the other hand, FW avoidance in such households can be related to their low grocery budget.

The study provided empirical evidence to support the idea that the pandemic had triggered positive changes to food management in households as previously highlighted by Jribi et al. [38] in Tunisia, and Principato et al. [40] in Italy. One of such changes was attributed to building better cooking skills, which aided in the reduction of household FW [11,80–82]. The stay-at-home order [52] and flexible working systems [53] prompted Turkish households to cook at home [37] and improve their cooking skills [83]. The current study indicated that such household segments as *resourceful planners and cooks* and *careless planners and resourceful cooks* showcased excellent cooking skills which brought about less wastage during COVID-19. Although *careless planners and resourceful cooks* were also characterized by low planned shopping, they went shopping for food more frequently than the other segments, had the highest price consciousness and generated low FW. This finding supported the evidence that frequent buyers were more price conscious, thus wasting less food in households [84]. This finding also demonstrated that improved cooking capability skills may have played a more significant role in reducing household FW in the pandemic compared to planned shopping. Additionally, high levels of health orientation showcased by most Turkish households except *careless planners and cooks* supported the idea that health was a significant concern when shopping for food during the COVID-19 period [85].

The results of the current study have important implications for developing different strategies on better food management practices for each household segment. The segment of *careless planners and cooks* should be educated about the benefits of resourceful cooking but, especially, food shopping. While such benefits as reduced FW with the resultant environmental conservation can be communicated to this segment of households, the power of the economic benefits may exert a larger effect and should not, therefore, be under-estimated. Given that this household segment is represented by relatively young and highly educated people, technology can be harnessed to educate them on resourceful planning and cooking. For instance, QR codes can be displayed on food packaging providing links to wasteless food recipes, food storage tips, and/or shopping plans. Although this household segment may be sensitive to environmental issues [86], they may find it difficult to build the cause-effect relationship between their behavior, FW and negative environmental impacts [87]. Thus, awareness-raising campaigns can be designed to inform this household segment about the environmental consequences of FW and how it links to their food choices [46]. Persuasive communication on potential health risks of ready-made meals and take-aways can increase the health orientation of this household segment, thus prompting more resourceful food shopping and cooking. This pervasive communication can be combined with nudging to facilitate positive changes in FW related behaviors [88].

The *resourceful planners and cooks* segment should be motivated to maintain the skills for better food management practices. Awareness campaigns to reinforce FW avoidance can be launched for this segment. However, campaigns should be accompanied by interventions for behavioral changes against FW as recommended by Hebrok and Boks [89] and Stöckli et al. [90]. To this end, interventions providing advanced household food management tips (for example, on adequate storing, measuring quantities of food ingredients before cooking, and transforming leftovers into new meals) [91,92] can be used. Additionally, cooking shows or celebrity chefs can be effective in giving the food management tips to prevent FW as this segment showcased excellent cooking skills.

Table 5
Segments' profile based on FW related variables, shopping habits and demographics.

Variables	*Careless planners and cooks* (n = 90)	*Resourceful planners and cooks* (n = 285)	*Careless planners and resourceful cooks* (n = 136)
FW related variables			
FW disposal options			
Actions trashing involved	70.0%	56.1%	61.0%
FW preventing actions (animal feeding, sharing with others, composting)	30.0%	43.9%	39.0%
FW perception			
Increased	13.3%	3.9%	2.9%
Decreased	32.3%	30.9%	29.4%
Did not change	33.3%	26.3%	24.3%
Not applicable – No	21.1%	38.9%	43.4%
FW is wasted			
Shopping habits			
Shopping frequency			
Every day	7.8%	9.4%	11.8%
Every other day	21.1%	20.7%	23.6%
Twice a week	37.8%	39.3%	41.9%
Once a week	26.7%	21.4%	19.1%
Twice a month or less	6.6%	9.2%	3.6%
Weekly amount spent on shopping			
less than 30 €	28.9%	26.0%	30.9%
31 € - 60 €	51.1%	50.5%	51.5%
61 € - 90 €	11.1%	17.2%	9.6%
91 € - 120 €	3.3%	3.9%	4.4%
more than 121 €	5.6%	2.4%	3.6%
Demographics			
Gender			
Male	26.7%	15.4%	36.1%
Female	71.1%	83.9%	61.0%
Rather not to say	2.2%	0.7%	2.9%
Age			
29 or younger	22.3%	11.9%	15.4%
30-40	42.2%	30.9%	36.8%
41-51	24.4%	34.7%	27.9%
52 or older	11.1%	22.5%	19.9%
Education			
2-years degree or lower	12.2%	22.2%	19.9%
4-years degree	62.2%	60.4%	61.7%
Master's and PhD	25.6%	17.4%	18.4%
Marital status			
Single	36.7%	25.2%	30.9%
Married	62.2%	72.3%	66.2%
Other	1.1%	2.5%	2.9%
Household size			
1person	20.0%	12.6%	12.5%
2 people	34.4%	23.5%	27.9%
3 or more	45.6%	63.9%	59.6%
Number of children			
No children	56.7%	34.4%	42.6%
1 child	21.1%	35.1%	22.1%
2 or more children	22.2%	30.5%	35.3%
Income			
600 € or lower	24.4%	35.5%	35.3%
601 € – 999 €	36.7%	31.9%	27.9%
1000 € or higher	38.9%	31.2%	36.8%
Rather not to say	0	1.4%	0%
Employment			
Full time paid	68.9%	55.4%	61.0%
Part time paid	1.1%	2.1%	0
Owner	3.3%	3.9%	5.9%
Unemployed	2.2%	4.2%	5.9%
Student	3.3%	3.2%	3.7%
Retired	12.2%	15.1%	12.5%
Housewife	5.6%	14.0%	8.8%
Short-term working allowance	1.1%	1.4%	1.5%
Other	2.3%	0.7%	0.7%

The segment of *careless planners and resourceful cooks* should be instructed on how to better plan their meals. This task can be attributed to meal planning apps. In-store prompts and displays can be utilized to remind this segment about the benefits of food planning. These displays can be run in collaboration with major food producers in Turkey who should be encouraged to tell their consumers about the most rational use and, in the case of food leftovers, re-use of the meals they produce. Additionally, high price consciousness of this segment should be capitalized upon to showcase that better food planning is closely related to monetary savings, thus benefiting household budgets.

This study had limitations. First, the data were collected online by using a non-probabilistic sampling strategy, which limited the representativeness of the studied sample and restricted the generalizability of the findings. A larger sample size should have aided in partially overcoming this problem. Second, the limitations regarding the survey method should be considered. Despite such advantages as the simplicity of implementation and low cost [93], the survey findings may have been biased by the study participants' recall ability [94], which is a known drawback of surveys compared to the methods of direct measurement of FW or in-situ FW observations. However, past research has established correlation between the amounts of household FW reported using FW dairies (i.e. the method of direct measurement) and consumer questionnaires [95] which justifies the use of the latter in the current study. Third, social desirability biases represent a known drawback of the survey method and these may have affected this study's results [96]. To overcome this bias, the anonymity of the study participants was ensured straight from the survey's outset [70,88]. Fourth, at the time of writing this manuscript, there was a lack of segmentation studies on household food management behavior during the COVID-19 period in Turkey. This has made it difficult to compare and validate the findings of the current study as applied to the Turkish market of food consumption. The final limitation is related to conducting a cluster analysis. The selection of alternative clustering algorithms, such as hierarchical, non-hierarchical, or combination of both, could have yielded different results. Concurrently, the results of the clustering approach adopted in this study could have been influenced by subjective decisions of the research team (e.g. the number of clusters to be determined) [68]. The role of subjective choice in clustering research is recognized and its influences can be minimized by combining several judgments from all members of the research team, the approach adopted in this study [97].

This study provided a cross-sectional analysis of food management behavior of households in Turkey. It will be valuable to replicate this study after the COVID-19 restrictions are lifted in order to capture the lasting impact of the pandemic on food management behavior of Turkish households. Future research could also extend the typology of the current study by conducting more research on food management behavior in households in other emerging economies. As mentioned by Wang et al. [98], further work is required to analyze FW by various research methods, such as by direct measurements and/or observations, in developing and emerging economies. More research comparing household FW in developed versus developing, but also transition economies should also be conducted. Finally, future research should consider additional stakeholders such as grocery retailers and restaurant managers to comprehend the extent of changes in household food consumption during COVID-19 in Turkey and beyond.

Authorship contribution statement

Raife Meltem Yetkin Özbük: Conceptualization, Data collection, Formal analysis, Writing- Original draft preparation.

Ayşen Coşkun: Conceptualization, Data collection, Formal analysis, Writing- Original draft preparation.

Viachaslau Filimonau: Conceptualization, Data curation, Writing-Final draft

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Declaration of competing interest

The authors declare no competing interests.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.seps.2021.101094.

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