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Prevalence of household food insecurity and its predictive role on the health of mothers with children aged under 60 months

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SUMMARY

Background: Food insecurity can have poor physical and mental health consequences for all family members. The present study investigated the prevalence of household food insecurity and its predictive role on the health of mothers of children aged under 60 months in Qazvin (Iran).

Methods: A cross-sectional study was carried out between January 2019 and December 2020. Participants included all mothers with children aged under 60 months who referred themselves to comprehensive health centers in Qazvin (N = 1750; mean age 30.61 years). Convenience sampling was performed. Data were collected using a demographic information checklist, the General Health Questionnaire (GHQ) and the Household Food Insecurity Access Scale (HFIAS). Data analysis was performed using independent *t*-tests, one-way analyses of variance, uni-variable and multivariable linear regression with a significance level of $p < 0.05$.

Results: Two-thirds of the participants had a secure food status (68.4%). Household food security status showed a significant, and inverse relationship with general health subscales. General health subscales of depression (standardized mean difference or SMD: −1.24 [95% CI: −1.36; −1.13]), somatic symptoms (SMD: −0.92 [95% CI: −1.03; −0.81]) and anxiety and insomnia (SMD: −0.72 [95% CI: −0.83; −0.61]) were significantly lower among food secure participants vs. food insecure participants. Social dysfunction was not significantly associated with household food security. The regression models demonstrated that household food security was a significant predictor for the health of mothers with children aged under 60 months: uni-variable (β = −0.38) and multivariable (β = −0.41).

Conclusion: Household food security is associated with various aspects of mothers' health. Since the growth and development of a healthy child depends on having a healthy mother, the food security situation of the family and the general health of mother can be assessed as part of providing health service regarding monitoring growth and development of children. This will help in targeting appropriate interventions if needed.

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1. Introduction

Food security comprises the physical, social, and economic access of all individuals at all times to adequate, safe and nutritious food (i.e., foods that meet the needs of the diet for a healthy and active life) [1]. Worldwide, more than 850 million individuals face food insecurity [2] with high prevalence in both developed and developing countries [3]. Data from Global Food Insecurity in 2017, showed that 20% of individuals in middle east countries

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List of abbreviations

ANOVA	analysis of variance
GHQ	General Health Questionnaire
HFIAS	Household Food Insecurity Access Scale
SD	standard deviation
SMD	standardized mean difference
VIF	Variance Inflation Factor

experienced food insecurity and that 7% experienced severe food insecurity (including Iran where the present study was carried out) [4]. In Iran, significant progress has been made in reducing food insecurity over the past three decades, and the country has seen the largest decline in the Global Hunger Index (GHI) in the Middle East. However, there have been few up-to-date studies in Iran dealing with food security. The prevalence of food insecurity in Iran has varied from 16% to 73.4% in different regions and different times from 2007 to 2018 [5–11] but prevalence of household food insecurity among Iranian families with children under 5 years old has not been investigated.

Food insecurity can cause poor physical and mental health among individuals in such households [12], delayed child development, obesity [13], and mental health disorders [14]. These health-related consequences of food insecurity can increase annual healthcare costs by more than 100% among individuals with severe food insecurity compared to those with food security [15]. Food insecurity is a special form of nutrition deprivation that can put pressure on mothers and their young children. Moreover, mothers that are exposed to the stressors of food-seeking have difficulty interacting with their children [16,17]. This can lead to insecure attachment among children, as well as emotional changes marked by anxiety and depression, difficulty interacting with peers (that persist even after improvement of food intake status), and maternal stress [17–19].

Food insecurity might lead to the emotional distress of mothers, including symptoms of anxiety and depression [18]. A study by Vozoris et al. [19] reported that Canadian individuals in malnourished families suffered from severe depression and distress, and poor social support, compared with families that were not malnourished. Some studies have investigated the relationship between food security and various aspects of health among family members but not mothers with children under 5 years old. The association of food insecurity with general health of Canadian women [19], physical and mental health of American low-income women [20] and mental health of American female of welfare recipients [21] regardless of having children have been investigated. Casey et al. investigated the association of food insecurity with maternal depression among American mothers with children under three years old [22]. To best of the authors' knowledge, few studies have investigated different aspects of health. Those that have been carried out, mostly examine mental health with respect of food security status, especially among mothers. Moreover, most of these were conducted in developed countries. As aforementioned, a considerable proportion of individuals experience food insecurity in developing countries in the middle east including Iran. Moreover, having a perspective concerning the prevalence of food insecurity among mothers who have children aged under five years old and their health status in relation to different aspects of physical and mental provides useful information for health policymakers. Therefore, the present study was designed and conducted to investigate the prevalence of food insecurity and its' predictive role in health of mothers with children aged four to 60 months in Qazvin, Iran.

2. Methods

2.1. Study design and participants

A cross-sectional study was conducted between January 2019 and December 2020. Participants included all mothers with children aged under 60 months who referred themselves to comprehensive health centers in Qazvin, Iran. The inclusion criteria included being an Iranian family (either with both parents or one of parents due to divorce or death) and having a child under 60 months (with full-term birth and no history of chronic or congenital diseases). The only exclusion criterion was unwillingness to participate in the study.

2.2. Sampling procedure

A convenience sampling method was used in the present study. Due to the differences in the socio-economic status of households in different parts of the city, sampling was carried out at all health centers in Qazvin. The research team liaised with comprehensive health centers in Qazvin, and mothers with children aged under 60 months were invited to participate in the study.

2.3. Variables and measures

2.3.1. Demographic characteristics

The survey included demographic questions concerning parental information (parents' age, parents' education level, parents' employment status, family economic status, place of residence [town vs. village]), and child-related information (children's age and gender, number of children in the family).

2.3.2. General Health Questionnaire (GHQ)

The 28-item GHQ [23] – comprising four subscales and seven items in each subscale – was used to assess maternal general health. The four subscales include physical symptoms, anxiety and sleep disorders, social functioning and depressive symptoms. Items are scored on a four-point scale from 0 (*better than usual*) to 3 (*much worse than usual*). In each scale, a score of 6 and above and a total of a score of 22 and above indicates pathological symptoms [23]. The scale has good validity and reliability. Reliability coefficients of the GHQ between 0.78 and 0.95 have been reported in various studies [24]. The psychometric version of the Persian version has been validated [25].

2.3.3. Household Food Insecurity Access Scale (HFIAS)

The HFIAS [26] was used to assess household food security. This scale reflects the householder's feelings regarding food insecurity for themselves and their family in conversational terms. In the HFIAS, the questions do not directly refer to nutritional quality, but assess the household perception of changes in food quality, irrespective of actual food composition. The HFIAS assesses the household food security situation with nine questions on a four-point Likert scale from 0 (*rarely*) to 3 (*often*). Higher scores reflect greater food insecurity. Moreover, a score of 0–1 is considered food safe and a score higher than 2 is considered food unsafe. The validity of the HFIAS was confirmed in a study by Salarkia et al. with a Cronbach's alpha coefficient of 0.95 [27].

2.4. Ethics

The present study was approved by the Institutional Review Board and Ethics Committee of Qazvin University of Medical Sciences, Qazvin, Iran (confirmation code: IR.QUMS.1397.272). During the research, the necessary permits were obtained to attend comprehensive health centers. The design, goals and methods of the research were fully explained to all participants and informed consent was obtained from individuals to participate in the study. Individuals were assured that their information would remain confidential. Voluntary participation in the study and the rights of the participants to continue or withdraw from the study was observed.

2.5. Statistical analysis

Data were analyzed using SPSS version 24 (IBM Corp, New York, USA). Data are presented as means with standard deviations (SDs) for continuous data, and frequencies and percentages for categorical variables. The relationship between demographic variables and HFIAS was assessed by independent *t*-tests and one-way analyses of variance (ANOVAs). The relationship between HFIAS and GHQ subscales was examined in two main categories (food secure vs. food insecure) based on independent *t*-tests. Measures of effect in association of HFIAS on GHQ subscales were assessed based on standardized difference and 95% confidence intervals (CIs). The standardized mean difference (SMD) was calculated based on Cohen's *d*. A Cohen's effect size of 0.2–0.5 is considered small; 0.5–0.8 is considered moderate; and more than 0.8 is considered large [28].

To determine the predictive role of HFIAS on global maternal health, multivariable linear regression models considering HFIAS as well as all socio-demographic characteristics were included. The initial model was a univariable linear regression model assessing the predictive role of HFIAS on maternal health. However, to be more rigorous, a multivariable linear regression adjusted for all scio-demographic characteristics was conducted. Consequently, all investigated socio-demographic variables were entered into the multivariable model [29,30]. To implement the linear regression model, the mean GHQ score was set as a dependent variable and HFIAS and demographic variables were entered into the model by Stepwise method as independent variables. The assumptions of linear regression test including the normal distribution of dependent variables and the absence of outliers were tested and confirmed before the implementation of the model. After testing, the variance inflation factor (VIF) was <2, the tolerance was <1 for all variables, and Durbin–Watson = 1.79 for the models. Therefore, the test assumptions were met. The significance level of all tests was $p < 0.05$.

3. Results

A total of 1800 surveys were distributed and 1750 were returned with complete information to assess the household food security and maternal general health. Data missing (n = 50) was equal to 2.78% and the comparison of demographic characteristics of the two groups with and without missing data did not show a significant difference. The mean age of mothers was 30.61 years (SD=6.88), the mean age of their spouses was 36.03 years (SD=7.05), and the mean age of their children was 23.81 months (SD=18.40). The majority of participants and their spouses had higher diploma and academic education. The majority of housewives (86%) and the majority of their spouses (98%) were employed. The majority of participants had a secure food status (68.4%). All demographic variables showed a significant relationship with household food security status. Table 1 presents the demographic characteristics of the participants and their relationship to the food security situation of the household.

General health among the secure and insecure food groups was compared on the four GHQ subscales (i.e., physical symptoms, anxiety and insomnia, social dysfunction, and major depression). The results of the study showed that there was a significant relationship between general health subscales and household food security status except social dysfunction. The strongest relationship was between household food security status and depression: the standardized mean difference in this subscale was −1.24 (95% CI: −1.36; −1.13). The differences between the standardized mean of physical symptoms and anxiety and insomnia were −0.92 and −0.72, respectively. More specifically, the inverse relationships between household food security status and these subscales indicate that as food security deteriorated, maternal health conditions deteriorated in terms of depression, physical health, and anxiety and insomnia. Table 2 shows the average household food security scores on the general health subscales by secure and insecure food status.

The results of multivariable regression models in Table 3 show the predictive role of household food security on maternal general health. For each unit increase in the household food security score, the mother's general health decreased by −1.28 points in the univariable model and decreased by −1.24 points in the multivariable model. The regression model results also showed that household food security was a moderate predictor for the health of mothers with children aged under 60 months ($\beta = -0.38$ in the univariable model and $\beta = -0.37$ multivariable model). Household food security accounted for 14% variance of maternal general health in the univariable model. In the multivariable model, household food security along with where they lived (town vs. village: $\beta = 0.15$), family structure (living with both parents vs. one parent: $\beta = 0.07$), maternal and paternal educational status (high level education vs. low level education for maternal and paternal: $\beta = 0.11$ and 0.08 respectively), children's age ($\beta = 0.07$) and family economic status (fair vs. poor: $\beta = 0.12$) accounted for 22% of the variance of maternal general health with a child under 60 months. HFIAS was a moderate predictor and other variables were weak predictors of maternal general health. Figure 1 is a conceptual map regarding the predictors and consequence of HFIAS.

4. Discussion

The aim of the present study was to investigate the prevalence of household food insecurity and its predictive role on the health of mothers with children aged under 60 months. Although two-thirds of participants had secure food status (68.4%), a considerable proportion did not (31.6%). Reesor-Oyer et al. (2021) reported 15%–17% food insecurity among mothers with 3-year-old and 5-year-old children in 20 cities across the USA [31]. Ling et al. (2019) reported 46.9% of household food insecurity among low-income mother-child dyads from USA [32]. In Iran, Kazemi et al. reported 44% food insecurity among pregnant women in Qazvin [33]. More generally, the prevalence of food insecurity in Iran has ranged from 16% to 73.4% in different regions and at different times between 2007 and 2018 [5–11]. Therefore, the prevalence of food insecurity is varied depending upon the study and region. Although two-thirds of participants had secure food status in current study, but 31.6% of them were food insecure which is a considerable prevalence.

Similar to previous studies, the present study found that household food security status showed a significant and inverse relationship with general health subscales including depression, physical symptoms, and anxiety and insomnia. However, social

Table 1
Distribution of demographic variables and their association with HFIAS.

	Range	Mean		Results of Pearson correlation coefficient (*p*-value)
Mother's age (years)	16–49	30.61 (6.88)		0.12 (<0.001)
Father's age (years)	21–63	36.03 (7.05)		0.07 (0.002)
Child's age (months)	3–60	23.81 (18.40)		0.15 (<0.001)
	N (missing)	1800 (0)		
		No (%)	HFIAS Mean (SD)	Results of one-way ANOVA or t-test (*p*-value)
Father's education	Under diploma	291 (16.1)	2.91 (3.64)	21.76 (<0.001)
	Diploma	716 (39.94)	1.61 (2.96)	
	Academic	793 (44.1)	1.48 (3.34)	
	N (missing)	1798 (2)		
Mother's education	Under diploma	323 (17.94)	2.43 (3.41)	9.73 (<0.001)
	Diploma	657 (36.5)	1.80 (3.20)	
	Academic	818 (45.44)	1.48 (3.27)	
	N (missing)	1799 (1)		
Father's job	Unemployed	30 (1.7)	7.36 (4.48)	34.17 (<0.001)
	Employed	1736 (96.44)	1.69 (3.21)	
	Retired	5 (0.3)	0.33 (0.82)	
	N (missing)	1791 (9)		
Mother's job	Housewife	1550 (86)	1.92 (3.38)	25.19 (<0.001)
	Employed	250 (14)	0.80 (2.39)	
	N (missing)	1800 (0)		
Perceived family income statue	Poor	297 (16.52)	5.70 (4.95)	357.29 (<0.001)
	Fair	1257 (69.83)	1.07 (2.18)	
	Good	240 (13.3)	0.55 (1.59)	
	N (missing)	1794 (6)		
Place of residency	Town	1378 (76.56)	2.00 (3.57)	7.35 (<0.001)
	Village	422 (23.44)	1.01 (1.94)	
	N (missing)	1800 (0)		
Insurance status	No insurance	43 (2.4)	2.83 (3.68)	2.10 (0.04)
	Have insurance	1757 (97.6)	1.74 (3.28)	
	N (missing)	1800 (0)		
Child gender	Boy	800 (44.5)	2.18 (3.76)	4.71 (<0.001)
	Girl	1000 (55.5)	1.43 (2.81)	
	N (missing)	1800 (0)		
Family structure	Living with both parents	1783 (98.8)	1.77 (3.29)	0.591 (0.55)
	Living with one parent (mother)	17 (0.9)	1.29 (2.93)	
	N (missing)	1800 (0)		
Child number	1	1080 (60)	1.54 (3.02)	5.22 (0.005)
	2	581 (32.28)	1.96 (3.50)	
	3 ≤	105 (5.8)	2.27 (3.76)	
	N (missing)	1766 (34)		

dysfunction had no significant relationship with household food security. The results of the univariable and multivariable linear regression model showed that household food security was a moderate predictive variable for the health of mothers with children aged under 60 months. Vozoris et al. [19], Casey et al. [22], Heflin et al. [21] and Siefert et al. [20] all found that individuals in malnourished families suffer from severe depression and distress, and poor social support, compared with families with no malnutrition. Weinreb et al. surveyed homeless and low-income mothers and reported more stressful life events and anxiety compared to those without hunger [34]. Food insecurity has also been found to be a strong predictor of depression and anxiety among middle-aged adults with children compared to those without [35,36].

From the results of various studies, it can be seen that the vicious cycle of depression and food insecurity persists. Moreover, maternal depression can cause food insecurity because depressive symptoms such as fatigue in the mother may affect the mother's ability to manage her family resources and essential tasks such as buying food and preparing food. Also, the needed costs of medication for depression may affect the family economy and may result in a food insecurity crisis for the family. On the other hand, constant exposure to adversity such as food insecurity and inadequacy can lead to depression [22,35,37–40].

Table 2
Comparison of mean (SD) of GHQ total and subscale scores based on food security status.

GHQ Subscales Mean (SD)	Food security status*		*t* (*p*-value)	Mean difference (95% CI)	Standardized mean difference (95% CI)
	Food insecure (N = 559)	Food secure (N = 1237)			
Somatic symptoms	9.17 (3.70)	5.82 (3.46)	18.59 (<0.001)	−3.35 (−3.70; −3.00)	−0.92 (−1.03; −0.81)
Anxiety and insomnia	7.00 (3.68)	4.29 (3.94)	13.77 (<0.001)	−2.71 (−3.10; −2.33)	−0.72 (−0.83; −0.61)
Social dysfunction	12.65 (3.54)	13.03 (4.92)	−1.62 (0.11)	0.38 (−0.08; 0.83)	0.10 (−0.01; 0.20)
Severe depression	6.02 (4.61)	0.87 (2.50)	30.50 (<0.001)	−5.14 (−5.47; −4.81)	−1.24 (−1.36; −1.13)
GHQ Total	34.98 (10.05)	23.89 (8.88)	23.24 (<0.001)	−11.09 (−12.02; −10.15)	−1.14 (−1.25; −1.02)

All comparison is based on food insecure-food secure group.
*N total for HFIAS = 1796, missing = 4.

Table 3
Results of univariable and multivariable linear regression model to assess the predictive role of HFIAS in the general health of participants.

Model		Unstandardized Coefficients		Standardized Coefficients	Sig.	Model summary	
		B (95% CI)	Std. Error	Beta		R	Adjusted R^2
Unadjusted	HFIAS	−1.27 (−1.41; −1.12)	0.07	−0.38	<0.001	0.38	0.14
ïAdjusted*	HFIAS	−1.24 (−1.39; −1.09)	0.08	−0.37	<0.001	0.47	0.22
	Place of residency (urban vs. rural)	3.88 (2.65; 5.11)	0.63	0.15	<0.001		
	Family Structure (Both parents vs. one parent)	7.95 (2.87; 13.02)	2.59	0.07	0.002		
	Maternal Education (Academic vs. under diploma)	2.45 (0.96; 3.94)	0.76	0.11	0.001		
	Father education (Academic vs. under diploma)	1.756 (0.25; 3.26)	0.767	0.080	0.022		
	Economic status (fair vs. poor)	2.87 (1.71; 4.03)	0.59	0.12	<0.001		
	Child's age (month)	0.04 (0.01; 0.07)	0.02	0.07	0.013		

Dependent variable: GHQ Total.
*Adjusted for all socio-demographic variables.
N Total (missing): 1760 (40) for general health of participants.

One of the findings of the present study was the association between food insecurity and insomnia. Studies have shown that a higher percentage of individuals with food insecurity than individuals with food insecurity suffer from problems such as longer or shorter average sleep duration, poorer mental sleep quality and difficulty falling asleep [41,42]. Polynomial logistic regression models have shown that addressing or reducing food insecurity may be a new opportunity to improve sleep health among low-income populations [35,36]. Also the results of a recent systematic review and meta-analysis among US adults demonstrated a strong association between food insecurity and depression, anxiety, and sleep disorders [43].

4.1. Strengths and limitations

To best of the authors' knowledge, the present study is the first to examine the prevalence of household food insecurity and its predictive role on the health among mothers of children aged under 60 months in Iran. The previous Iranian studies have either considered only one dimension of health alone (e.g., depression, anxiety, insomnia, etc.) whereas the present study investigated the association of household food insecurity with different physical, psychological and social aspects of health using the GHQ. Another strength of the present study was the different participant cohort from previous studies. Prior studies in Iran have surveyed patients, pregnant and lactating mothers, children, and adolescents. The cohort surveyed in the present study (i.e., mothers with children aged under 60 months) are also an important group in the context if food insecurity. Their health directly affects the growth and development of their children, so mothers' health and well-being directly determine the health of future generations. Other strengths of the present study include the relatively large sample size compared to previous studies and the utilizing of multivariable analysis and adjusting for socio-demographic characteristics.

Some limitations should be also be considered when interpreting the results of the present study. First, the cross-sectional

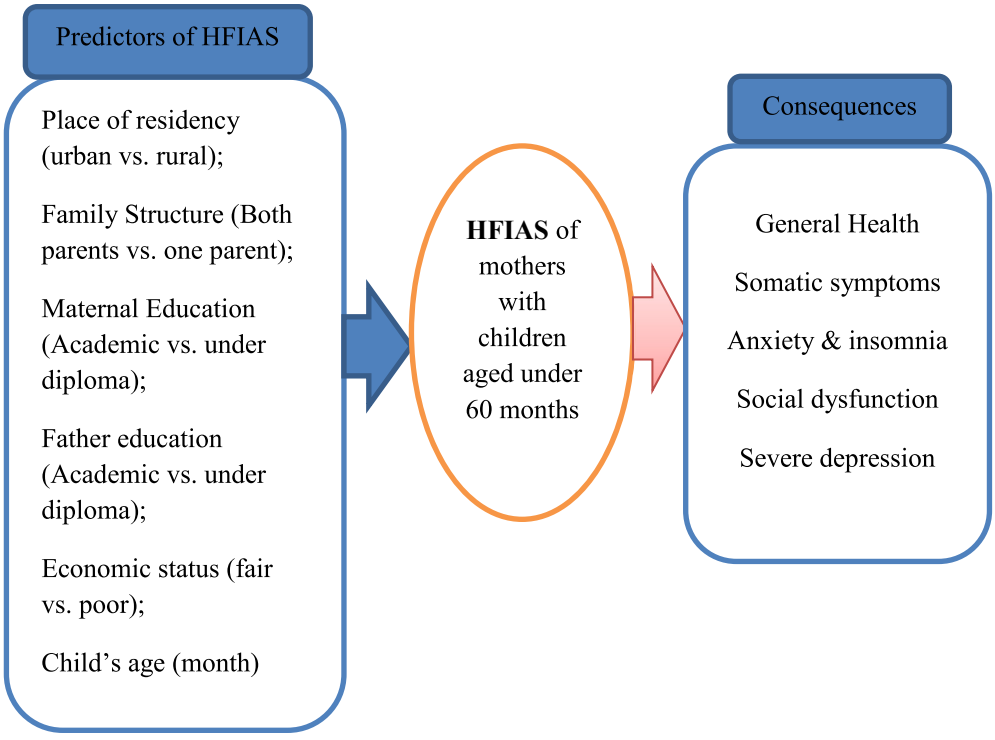

Fig. 1. Conceptual map regarding the predictors and consequence of HFIAS among mothers with children aged under 60 months

nature of the study means that it was not possible to identify any causal relationship between household food security and maternal health status. Another potential limitation was the long period it took for data collection which was due to the COVID-19 pandemic. In addition, to examine the variables in the present study, self-report data were collected which are not an objective assessment of variables under investigation. The convenience sampling method is another limitation of study and means the sample was not nationally representative of Iranian women. Some of these limitations could be overcome in future research by recruiting more representative samples, and by employing longitudinal study designs.

5. Conclusion and clinical implications

The results of the present study showed that household food security can play an important role in various aspects of the health of mothers with children aged under 60 months. Since the growth and development of a healthy child depends on having a healthy mother, the food security situation of the family and the general health of mother can be assessed as part of providing health service regarding monitoring growth and development of children. This will help in targeting appropriate interventions if needed.

Authors' Contributions

Z.A. and A.H.P. equally contributed to the conception and design of this research; N.R.M., M.R.N. and Z.B. contributed to the acquisition and analysis of the data; Z.A. and A.H.P. contributed to the interpretation of the data; Z.A. and N.R.M. drafted the manuscript. A.H.P. and M.D.G. provided contributions to the literature review and discussion and prepared the final version of the manuscript. M.D.G. revised the final version of manuscript and copy-edited the manuscript. All authors critically revised the manuscript, agreed to be fully accountable for ensuring the integrity and accuracy of the work, and read and approved the final manuscript to be published. All authors met the criteria for authorship and that all entitled to authorship were listed as authors in the title page.

Patient consent to publish

Not required.

Ethics approval

The present study was approved by the Institutional Review Board and Ethics Committee of Qazvin University of Medical Sciences, Qazvin, Iran (confirmation code: IR.QUMS.1397.272). Informed consent was obtained from participants at enrollment.

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