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Research article

Food consumption patterns in employees of Ethiopian institute of agricultural research

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ABSTRACT

In developing countries, including Ethiopia, diet-related non-communicable diseases are prevalent among the working population. Understanding this active group's dietary diversity and food consumption patterns is essential to devise alternative solutions and recommend possible improvements. This study investigates the food consumption patterns of employees of the Ethiopian Institute of Agricultural Research. A cross-sectional survey was conducted from January 1 to March 31, 2022, involving 13 different research centers of the institute situated in different agro-ecological regions of the country. A validated food frequency questionnaire and a 24-h food recall were administered to a total sample size of 355 employees. A systematic random sampling was used for data collection. Stata survey commands version 16.0 and multiple logistic regression were used to analyze the data. The research confirmed that socio-demographic determinants, income, and educational level affect the food consumption patterns of employees. The majority of employees have low consumption of foods like fish, fruits, vegetables, and animal products. Consumption of all kinds of animal products was very low on Wednesday and Friday. This result will help employees to give more attention to low-cost healthier food items, as well as institutional management bodies in designing awareness-creation campaigns and government programs to encourage the production and access of nutritious food.

1. Introduction

Food and nutrition security remains an important concern in the global food system [1]. In low- and middle-income countries, achieving sustainable, equitable, and large-scale improvements in food and nutrition security is a great challenge [2]. Consequently, undernutrition, micronutrient deficiencies, and growing rates of overweight and obesity are even increasing in the population of sub-Saharan Africa [3,4].

Diet-related non-communicable diseases (NCDs) have recently been affecting working populations at an alarming rate [5,6]. The World Health Organization (WHO) predicts that the global burden of NCDs will rise from 49% to 56% by 2030 [7]. This is linked to nutrition transition and the shift in dietary consumption towards increased intake of foods high in sugars, sweets, fats and oils, and a decrease in calorie expenditure [8]. In Ethiopia, non-communicable diseases like cancer, diabetes, and cardiovascular diseases (CVDs) have been increasing in the last few decades [9-11]. Poor dietary consumption was responsible for 60,402 deaths of Ethiopians in

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2013, of which 23.0% of the deaths were due to NCDs. Consumptions of foods which are low in fruits (14.3%), and vegetables (6.1%), and high in sweets (6.3%) are the biggest dietary risk factors and contribute to NCD related deaths in the country [12].

Knowing and choosing what to consume is a basic human right that is essential for disease prevention and maintaining optimal health [13]. However, this has not been practicable in Ethiopia due to food and nutrition insecurity, poverty, and inequitable food distribution [14]. Moreover, poor consumer food behavior and eating practices are also the influencing factors [1]. To improve such problems, evidence-based data is important for convincing consumers, producers, and decision makers. In this regard, there has been an effort by a few studies [1,15–17] to get evidence of food consumption patterns in the country. Those published studies have been limited to investigating dietary patterns in children, women, and households. However, there is no data determining food consumption patterns among adults. To the best of our knowledge, this is the first institution-based study involving adults to examine food consumption patterns and their linkage with socio-demographic factors in Ethiopia. Therefore, the information from this study can serve as a base for designing an intervention program targeting the consumption patterns of research employees.

2. Methods

2.1. Design and study site

A cross-sectional study was conducted involving 12 research centers and one head quarter in the Ethiopian Institute of Agricultural Research (EIAR) in 2022. EIAR is a federal agricultural research institute that consists of a head office in the capital city of Addis Ababa and 20 research centers in different agro-ecological zones of the country. Based on the database from the Human Resources Management Office of EIAR, in 2022, there were a total of 4598 staff, of whom 3337 are males and 1261 are females. The study site was detailed in Fig. 1.

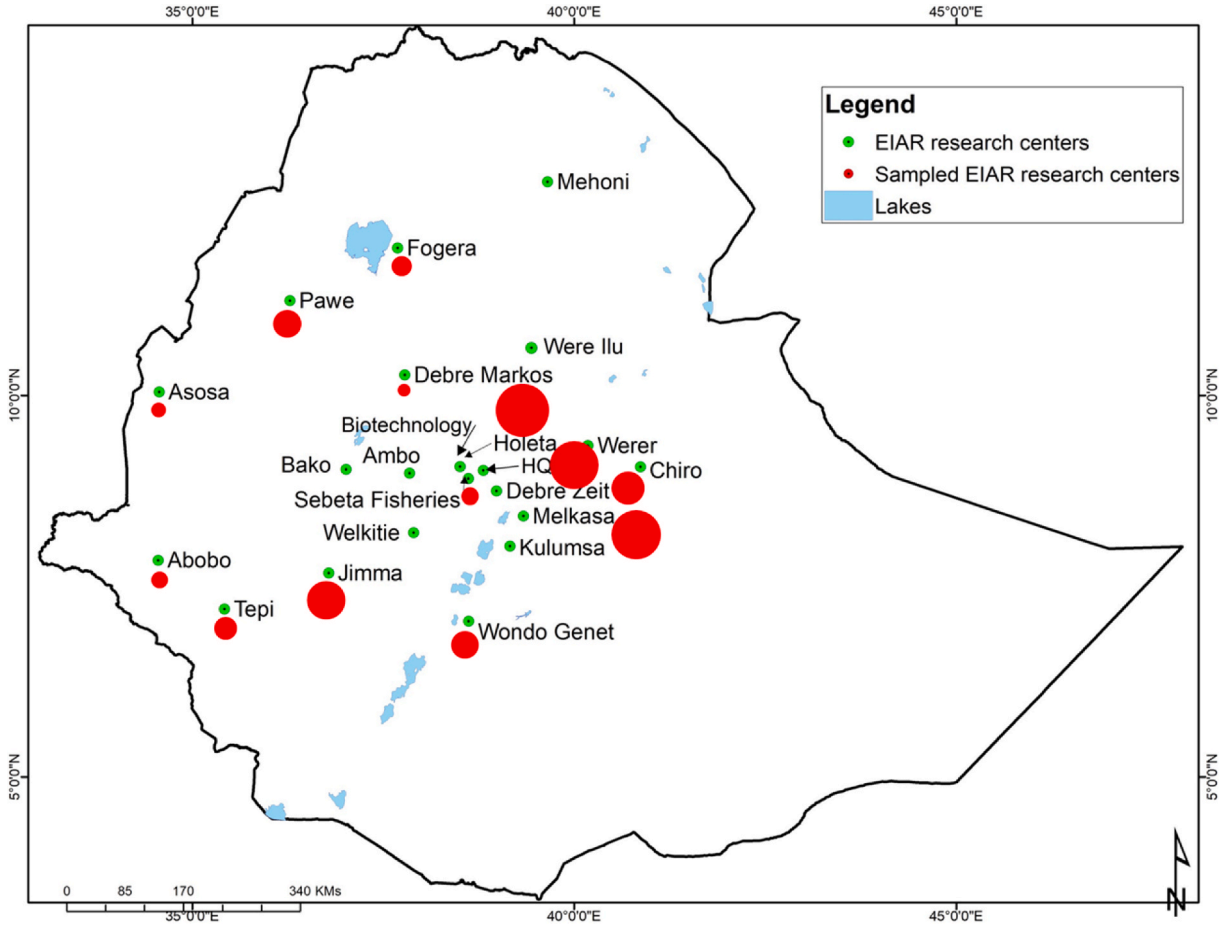

Fig. 1. Sample collection centers; the variation in size of red circles shows the relative proportion of sample size in the study

2.2. Sampling procedure and data collection

Sample size of 355 was estimated using the assumption of unknown variability in the proportion [18], considering 0.5 proportion (maximum variability), 95% confidence interval, and a 5% margin of error. Thus, $n = \frac{z^2pq}{d^2} = \frac{(1.96)^2 * 0.5(1-0.5).}{(0.05)^2} = 384$. Since the population size is known, the final sample size was adjusted by using the formula $n = \frac{n_o}{1+\frac{(n_o-1)}{N}}$, where n is the sample size and N is the population size. Therefore, 355 was used as the sample size for this study. A simple random sampling technique was used to select employees for data collection. Thirteen research centers were randomly selected from twenty-one in total. An equal proportion allocation was applied to each of the selected research centers to draw the required sample size. Then, respondents were selected from each center randomly. Sampling procedure is presented in Supplementary Figure 1.

A structured questionnaire was used to collect socio-demographic and food consumption data [19,20]. A pre-test of the developed questionnaire was done in other centers where the actual data were not collected. The questionnaire was translated into the local language, the interview was self-administered, and an interviewer-guided approach was employed. For part of the data collection, an email invitation was sent to employees having internet access, outlining the goals of the study and inviting them to complete the online survey via Google form. Employees with no access to internet or have skill limitations to use the system completed the questionnaires in hard copies with the guidance of Food Science and Nutrition Researchers. Participation was voluntary and anonymous, with no incentives provided, and data was confidential and protected. When the survey was completed, the research team entered collected data of hard copies into an excel sheet. After cross-checking the data for completeness, it was coded for downstream analysis and imported into Stata software for statistical analysis. Out of 355 participants, data of 11 (3%) were incomplete and was excluded from the analysis.

2.3. Measurements

Food consumption habits of employees were measured by a food frequency questionnaire [19,20] comprising 11 indicator variables. The food frequency questionnaire included consumption of 11 food items: fruits (banana, mango, papaya, avocado, orange, apple); vegetables (cabbages, spinach, lettuce, pumpkin, green pepper, tomato); cereals (pasta, macaroni, rice, injera, dabo, kolo, bula, porridge); roots and tubers (potato, carrot, beet); legumes and nuts (beans, peas, ground nut); meat (beef, lamb, chicken); eggs; fish; milk, and milk products (milk, cheese, yoghurt); sweets (sugar, honey, tea, biscuits, cakes, soft drinks); and fatty foods (oil, fat or butter). The question asks, "How often do you eat the following foods?" All frequency variables were coded as more than once a day, once a day, 2–6 times a week, once a week, 1–3 times a month, less than once a month, and never. Also, a 24-h dietary recall was administered to the respondents, asking them to recall the exact food intake of the previous day [19,20]. The question asks "did you eat the following foods in the preceding 24 h?", and the response variables were coded as "yes" and "no". In addition, weekly food consumption distribution was asked from employees. The question asks "Did you eat the following food in the last seven days (Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, and Sunday)?", and the response variables were coded as "yes" and "no".

2.4. Statistical analysis

Data was analyzed using Stata survey commands, "Stata version 16.0 (Stata Corp, College Station, Texas, USA)." A descriptive analysis by frequencies and percentages was performed to know the food consumption patterns of employees. A Chi-square statistic was used to test the association between socio-demographic variables and 24-h dietary intake. If cell counts were <5, Fisher's exact test was used. To examine factors influencing healthy and unhealthy foods, multiple logistic regression was used. First, bivariate logistic regression analyses were applied to measure the impact of each independent variable on the outcome. The dependent variables included healthy food and unhealthy food, whereas age, sex, education, and monthly income were included as independent variables. Next, only variables with a p value < 0.25 was entered into multiple logistic regression model to control possible confounders. In the final model, predictors of healthy food and unhealthy food were identified at the p value < 0.05 significance level. The multiple logistic regression equation was adopted from Agresti [21] as:

$$\pi j(X) = \frac{e^{\beta_{j0}+\beta_{j1x1}+\beta_{j2x2}+\ldots+\beta_{jpxp}}}{1+e^{\beta_{j0}+\beta_{j1x1}+\beta_{j2x2}+\ldots+\beta_{jpxp}}} = \frac{e^{X\beta j}}{1+e^{X\beta j}} \quad j = 1,2$$

Where $\pi_j(X) = P(Y_{ji} = 1|X)$, the probability of the employee consuming healthy food (Y_{1i}) and unhealthy food (Y_{2i}) given other covariates X. Furthermore, this equation can be expressed interims of Odds ratio as:

$$logit\left[\pi_{j(x)}\right] = logit\left[P\left(Y_{ji} = 1|X\right)\right]$$

$$= \beta_{j0} + \beta_{j1^{x1}} + \beta_{j1^{x1}} + \ldots + \beta_{j1^{x1}}$$

$$= X\,\beta_j$$

2.5. Ethical consideration

Ethical clearance was approved by the Research Ethics Committee of the Ethiopian Institute of Agricultural Research (Ref. No: 23.18/3167/2022). Verbal informed consent was obtained from all subjects before data collection and was witnessed and formally recorded.

3. Results

3.1. Sociodemographic characteristics

A total of 344 employees with a 96.90% response rate participated in the study. About 131 (38.08%) of the study participants fell into the age range of 30–39 years, while 5 (1.45%) were over 60 years old. Two-thirds of the respondents were male, whereas the remaining one-third were female. The majority (85.17%) of employees had attained a higher education, and 11 (3.20%) of the respondents paid more than 22,727 ETB (Ethiopian Birr) monthly (Table 1).

3.2. Food consumption habits of EIAR employees

Table 2 shows employees' consumption habits for 11 food items. Only sweets had a high percentage of consumption for once per day (37.21%), whereas fish had the highest percent (62.79%) of never being consumed among the food groups. Fruits and vegetables were distributed similarly, with the exception of less than once a month for fruits and two to six times a week for vegetable consumption patterns. Both the food groups (fruits and vegetables) had a very low percentage of consumption. Cereals and fats had similar distributions, with high percentages for more than once per day and very low percentages for never being consumed. Meat was consumed mostly less than once a month (28.20%), while legumes/nuts had a high (33.72%) daily consumption. More of milk/milk products were eaten two to six times a week, whereas egg had not consumed for several times a day.

3.3. Weekly food consumption distribution for EIAR staff

Fig. 2 indicates the distribution of food consumption in the last seven days (Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, and Sunday). Grains, pulses, fatty or oily foods, and sweets were regularly consumed by the majority (75%) of the participants, whereas rare consumption (21%) was observed for fruits, meat, and eggs. Low consumption of meat, eggs, and milk or milk products was seen on Wednesday (14%) and Friday (12%). Fish was not consumed for most of the days, except for very low consumption (<2%) on Tuesday, Wednesday, and Friday.

3.4. Dietary intake of EIAR staff within 24 h by age, gender, education, and income variables

Dietary intake within 24 h was described by age, sex, educational status, and monthly income of the study participant (Table 3). Most of the age groups had consumed cereal food in the past 24 h. High percentages of fat and sweets consumption were observed for all age groups, while low percentages intakes were seen for fruits and vegetables. Fruits were consumed by two-thirds (60%) of participants who are over the age of 60, while vegetables were consumed by 80% of them. The consumption of milk or milk products was the only age-related significance difference found. Those older than 60 years had a significantly higher frequency of consumption of milk/milk products ($p = 0.03$).

Table 1
Sociodemographic characteristics of the study participants (N = 344).

Variable	Frequency (n)	Percent (%)
Age		
20-29	82	23.84
30-39	131	38.08
40-49	68	19.77
50-59	58	16.86
>60	5	1.45
Sex		
Male	224	65.12
Female	120	34.88
Educational status		
Primary education	10	2.91
Secondary education	41	11.92
Higher education	293	85.17
Monthly income		
<1864 ETB	38	11.05
1865–7368 ETB	137	39.83
7369–22,727 ETB	158	45.93
>22,727 ETB	11	3.20

Table 2
Consumption pattern of 11 food group among EIAR staff in Ethiopia (N = 344).

Food group	More than once per a day	Once per a day	2-6 times per a week	Once a week	1-3 times per a month	Less than once a month	Never
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Fruits	1 (0.29)	13 (3.78)	55 (15.99)	75 (21.80)	70 (20.35)	105 (30.52)	25 (7.27)
Vegetables	24 (6.98)	34 (9.88)	98 (28.49)	94 (27.33)	58 (16.86)	34 (9.88)	2 (0.58)
Cereals	114 (33.14)	79 (22.97)	83 (24.13)	44 (12.79)	17 (4.94)	4 (1.16)	3 (0.87)
Roots/tubers	6 (1.74)	27 (7.85)	100 (29.07)	108 (31.40)	54 (15.70)	38 (11.05)	11 (3.20)
Legumes/nuts	48 (13.95)	116 (33.72)	85 (24.71)	41 (11.92)	25 (7.27)	26 (7.56)	3 (0.87)
Meat	4 (1.16)	9 (2.62)	79 (22.97)	69 (20.06)	58 (16.86)	97 (28.20)	28 (8.14)
Egg	0 (0.00)	1 (0.29)	48 (13.95)	73 (21.22)	80 (23.26)	96 (27.91)	46 (13.37)
Fish	0 (0.00)	0 (0.00)	3 (0.87)	10 (2.91)	26 (7.56)	89 (25.87)	216 (62.79)
Milk/milk products	4 (1.16)	31 (9.01)	95 (27.62)	54 (15.70)	59 (17.15)	70 (20.35)	31 (9.01)
Sweets	70 (20.35)	128 (37.21)	63 (18.31)	11 (3.20)	21 (6.10)	21 (6.10)	30 (8.72)
Fats	168 (48.84)	96 (27.91)	50 (14.53)	8 (2.33)	9 (2.62)	8 (2.33)	5 (1.45)

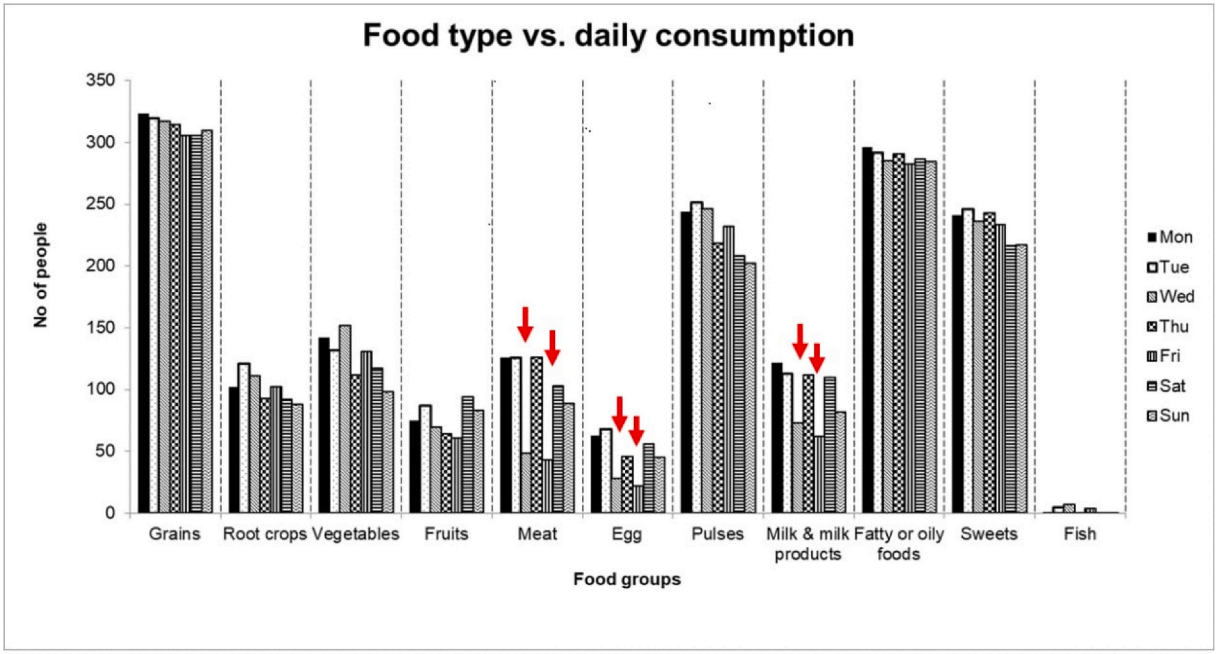

Fig. 2. Food consumption distribution in the last seven days among EIAR staff (**arrows indicate the low consumption of food items on Wednesday and Friday**).

No significant differences were seen between the genders in the consumption of many food groups (cereals, roots/tubers, fruits, vegetables, legumes/nuts, meat, milk/milk products, and sweets), except for fat consumption. There was significantly higher consumption of fat foods for females than for male participants. In both genders, high percentages of dietary intake were observed for cereals, legumes/nuts, fats, and sweets. However, for fruits, meat, and milk/milk products, low consumption percentages were observed for both gender groups.

Educational level of participants had an influence on some of the food groups (cereals, roots/tubers, fruits, and vegetables). Cereal foods were largely consumed by employees who had attained primary, secondary, and higher educations, respectively. Two thirds of employees with primary and secondary school certificates did not consume roots/tubers. Also, low frequency consumption of fruits and vegetables was observed at primary and secondary educational levels. There were no educationally significant differences in the consumption of legumes/nuts, meat, milk/milk products, fats, and sweets.

Regarding the income of the participants for consumption of foods, low frequency consumption for fruits, vegetables and meat was seen among the categorized monthly income. Significant differences were observed between the staff's income for the consumption of fruits, vegetables, and meat. Participants who earned less than 1864 ETB per month had significantly less consumption of fruits ($p = 0.004$), vegetables ($p = 0.004$), and meat ($p = 0.000$) compared to those who earned more than 22,727 ETB per month.

Table 3
Dietary intake within 24 h by age, sex, education, and income of staff in EIAR.

Variable	Total (N)	Cereals	P	Roots/ tubers	p	Fruits	P	Vegetables	P	Legumes/ nuts	P	Meat	P	Milk/ milk products	P	Fats	p	Sweets	P
		%		%		%		%		%		%		%		%		%	
Age																			
20-29	82	93.90	0.275	60.98	0.053	25.61	0.494	59.76	0.846	80.49	0.274	31.71	0.110	30.49	0.030	92.68	0.956	92.68	0.136
30-39	131	96.18		46.56		32.06		57.25		70.99		38.17		38.17		91.60		87.02	
40-49	68	98.53		48.53		27.94		54.41		77.94		51.47		32.35		89.71		83.82	
50-59	58	100.00		55.17		27.59		60.34		84.48		44.83		37.93		91.38		77.59	
>60	5	100.00		100.00		60.00		80.00		80.00		60.00		100.00		100.00		80.00	
Sex																			
Male	224	97.32	0.525	53.57	0.652	28.13	0.535	52.68	0.005	76.79	1.000	44.20	0.084	35.71	0.906	88.84	0.013	85.71	0.871
Female	120	95.83		50.83		31.67		68.33		77.50		34.17		36.67		96.67		86.67	
Educational status																			
Primary education	10	100.00	0.002	30.00	0.004	10.00	0.011	40.00	0.002	90.00	0.287	40.00	0.076	50.00	0.310	100.00	1.000	100.00	0.317
Secondary education	41	87.80		31.71		12.20		34.15		85.37		24.39		26.83		92.68		80.49	
Higher education	293	97.95		56.31		32.42		62.12		75.43		43.00		36.86		91.13		86.35	
Monthly income																			
<1864 ETB	38	92.11	0.240	44.74	0.711	10.53	0.004	31.58	0.004	86.84	0.066	18.42	0.000	36.84	0.778	92.11	0.108	92.11	0.449
1865–7368 ETB	135	96.35		54.01		24.82		58.39		80.29		38.69		32.85		95.62		83.21	
7369–22,727 ETB	158	98.10		53.80		36.71		63.92		73.42		44.30		38.61		88.61		87.34	
>22,727 ETB	11	100.00		45.45		45.45		63.64		54.55		90.91		36.36		81.82		81.82	

P values less than 0.05 indicate statistically significant differences; p = p value; % = percent; ETB = Ethiopian Birr.

3.5. Socio-demographic factors influencing health and unhealthy food

Table 4 shows the association between socio-demographic factors and healthy versus unhealthy food. Both education and income were independently associated with healthy food in an adjusted regression analysis. Participants who attained higher education [AOR: 2.44; 95% CI: 1.98, 10.79] were more likely to consume healthy food than those who attained primary education. The adjusted regression analysis also revealed that employees who earned monthly income of 1864–7368 ETB [AOR: 3.74; 95% CI: 1.47, 9.49], those who earned 7369–22,727 ETB [AOR: 6.19; 95% CI: 2.15, 17.87], and those who earned >22,727 ETB were more likely to consume healthy food than employees who earned <1864 ETB per month.

4. Discussion

Adequate consumption of healthy foods is considered as an important option for protecting against the risks of non-communicable diseases and maintaining optimal health. The present study describes food consumption patterns and their linkages with socioeconomic determinants among EIAR employees. The majority of the employees had low consumption of foods like fish, fruits, vegetables, and animal products. The diet of many of the employees was composed of cereals, sweets, and oils and fats. The study also showed that socioeconomic determinants like educational level and income influenced the consumption patterns of employees.

The non-consumption of fish by the majority might be associated with the general assumptions of the community as the food item is luxury; and might be because of the unavailability in the common market places. Similarly, Malawi women identified fish as "rare food", consumed infrequently due to their high price [22]. Even though fish is a nutritious food, there is no experience of consuming large quantities of fish in Ethiopia due to its scarce production [23]. Fish provide a rich source of bioavailable micronutrients, long-chain polyunsaturated fatty acids (PUFAs) and high-quality protein [22,24,25]. Fish consumption is linked to reduction of hunger and malnutrition [25,26]. As a result, regular fish consumption could reduce the burden of non-communicable diseases associated with overweight or obesity, as well as micronutrient deficiencies, mortality from cardiovascular diseases, heart failure, and stroke [27]. Our result is in line with the study done in the Amhara region of Ethiopia, in which only 3% of households consumed fish or other seafood [1]. A household survey in Ethiopia also showed that fish was the least consumed among food groups [28]. The low consumption of fruits and vegetables once a day or more than once a day might be due to their perishability and high price. Furthermore, these foods are not available everywhere or accessed at any time. In most cities in Ethiopia, fruits are commonly consumed during social occasions or holidays and while visiting patients at home or health facilities [29]. The low consumption of fruits and vegetables might influence the micronutrient intake of vitamins and minerals [4]. Insufficient intake of fruits and vegetables results in about 14% of gastrointestinal cancer deaths, 11% of ischemic heart disease deaths and 9% of stroke deaths [30]. The WHO reports indicate that more consumption of fruits and vegetables can reduce the risk of non-communicable diseases (NCDs) and maintain optimal health [30]. Increased consumption of fruits and vegetables could also play a role in enhancing mental well-being [31]. Despite these recommendations, only a few percent of our respondents' practices this. Similar findings were seen from studies in Sudan [32] and Ethiopia [33], where fruits and vegetables were consumed in very low quantities by households and children. In Kenya [7], about eight of ten university students consumed lower amounts of fruits and vegetables. The increased consumption of sweets and fats is mainly due to the participants might have more opportunities for the intake of tea, coffee, sweet baked goods, and locally "wet" foods made with salt and butter or oils once or frequently in a day. According to the WHO, sweets and fatty foods are categorized as unhealthy foods [34].

Table 4
Multiple logistic regression analysis between socio-demographic factors and healthy versus unhealthy food among the employees of EIAR.

Variable	Food					
	Healthy			Unhealthy		
	AOR	95% (CI)	p-value	AOR	95% (CI)	p-value
Age						
20-29	1 (referent)			1 (referent)		
30-39	0.73	(0.37, 1.42)	0.355	2.07	(0.470, 9.11)	0.336
40-49	0.58	(0.28, 1.23)	0.155	5.61	(0.56, 56.49)	0.143
50-59	0.77	(0.35, 1.70)	0.525	1.39	(0.27, 7.21)	0.696
>60	0.79	(0.19, 3.21)	0.74	0.94	(0.20, 4.37)	0.937
Sex						
Male	1 (referent)			1 (referent)		
Female	1.46	(0.90, 2.35)	0.122	3.70	(0.69, 19.85)	0.127
Educational status						
Primary education	1 (referent)			1 (referent)		
Secondary education	0.68	(0.15, 3.04)	0.612	1.07	(0.09, 12.25)	0.957
Higher education	2.44	(1.98, 10.79)	0.045*	0.76	(0.16, 3.56)	0.728
Monthly income						
<1864 ETB	1 (referent)			1 (referent)		
1865–7368 ETB	3.74	(1.47, 9.49)	0.005*	3.31	(0.29, 36.93)	0.331
7369–22,727 ETB	6.19	(2.15, 17.87)	0.001*	1.68	(0.12, 23.73)	0.702
>22,727 ETB	7.07	(1.29, 38.73)	0.024*	0.76	(0.03, 22.58)	0.876

AOR: adjusted odds ratio; CI: confidence interval; ETB: Ethiopian Birr; *: $p < 0.05$.

More consumption of unhealthy foods like sweets and fatty foods can lead to malnutrition and an increased risk of developing non-communicable diseases (NCDs) during adulthood [34]. Parallel findings were observed in Gondar, Ethiopia [29], Ghana [35], Malaysia [36], and Latin America [37]. Due to its wider availability and easy access, food consumption in Ethiopia is predominantly basis cereals and legumes, where these diets are insufficient in nutrient density, such as micronutrients [38]. Similar reports found that cereals were more frequently consumed in a day by most households in Borena, Ethiopia [39] and eastern and southern Africa [40]. The Ethiopian welfare monitoring survey also revealed that cereals were the most commonly consumed among food groups in the households [28]. In line with our result, these findings indicate that feeding diversified diets is required to meet the daily nutrient requirements. Moreover, the lower frequency of consumption of meat and eggs is due to the increased cost of these foods, and consumption by employees may be limited to festivals or ceremonies. This implies that the consumption of meat and eggs depends mostly on the purchasing power of the consumers. The other reason might be that the participants did not consume meat due to taboos where frequent consumption of meat is considered as it accelerates the body's aging [38]. Low animal source food consumption has been reported to increase the risk of being undernourished [41]. Similar findings from Sudan reported that unusual consumption of livestock products during festivals and happy occasions is a source of pride [32]. In Nigeria, nutrient-dense animal source foods were consumed the least [42].

In Ethiopia, religious norms and values can influence the dietary intake of consumers [43]. According to the Orthodox Church, 220 days a year are occupied by fasting where animal products are not consumed on Wednesday and Friday [44]. This implies that the consumption of meat, eggs, and milk or milk products is not regular and restricted to non-fasting days (Monday, Tuesday, Thursday, Saturday, and Sunday). The study in Ethiopia [43] supports our finding of low consumption of meat, eggs, and milk or milk products on Wednesday and Friday. Fish is the only animal source food consumed by some Orthodox followers during fasting days in Ethiopia [45]. Therefore, the very low fish consumption on Wednesday and Friday might be considered by participants to substitute consumption of other animal source foods. Our result agree with the finding that a little consumption of fish is experienced during fasting days in Ethiopia [23]. Despite high water bodies' potential for fish production in Ethiopia, fish production and consumption are very low [23].

The more consumption of milk or milk products in participants over the age of 60 might be traditionally, in Ethiopia, aged people become selective about their dietary intake after facing health problems. For example, they focus more on consumption of less healthy-risk foods like milk or milk products. Although the health effects of dairy products are debating; the consumption of dairy products rich in calcium and protein can reduce the risk of bone fracture, type-2 diabetes, and mortality during aging [46,47]. Our findings agree with studies in the United Arab Emirates that showed elderly people were more likely to consume milk products than younger people [48]. A significant difference was observed for the consumption of fatty foods among the genders. Female employees consumed more fatty foods than males. Similar results in India found that females had higher consumption of fats and oil products as compared to male respondents [49]. In contradiction, the study in Malaysia reported that male participants consumed significantly more fats and oils than females [36]. Concerning education, higher educated individuals may consume more healthy foods because they have a better understanding of healthy eating habits than those who have only completed primary and secondary school [5,50]. In Sudan, the more educated households spend more on cereal consumption than illiterate households [51]. Consumption of fruits and vegetables was significantly increased for those who had attained higher education compared to those with primary education in Portuguese adults [52]. Also in Poland, people with higher education had a higher intake of fruits and vegetables compared to those with primary and secondary education [53]. In terms of income, low incomes constrain how much food will be bought or which foods will be purchased by households [54]. For instance, meat, fruits, and vegetables are expensive relative to cereal foods in Ethiopia [38]. On the other hand, when income rises, higher energy-value and more nutritious foods can be consumed [55]. A comparable difference to this finding was observed in a previous study that revealed the consumption of fruits, vegetables, and animal products was increased in people with higher incomes than in those with lower incomes [5,55]. An earlier study in Ethiopia found that low-income households consumed significantly fewer fruits, vegetables, and animal-sourced foods [56].

Higher education attained groups more likely consume healthy foods because higher education may increase their knowledge and awareness about healthy food habits, which may lead to dietary inequalities between lower and higher level educational groups. In line with this finding, a study in the United States found that more highly educated adults consumed more healthy foods than adults with only a primary education [57]. Similarly, a study in the United States found that high school graduates ate less healthy than adults with some college education or more [58]. In South Korea, higher education was positively associated with adults' healthy eating habits [59]. Furthermore, higher income participants' consumption of healthy foods may explain income differences in which lower income participants are unable to cover the cost of a healthy food. Our results agree with findings from Japan, where higher household income was significantly associated with higher rates of healthy diet consumption [60]. In Finland, higher income has been found to be associated with the consumption of healthy food among employees [61]. The association of income with healthy food eating was also consistent with previous studies in South Korea [62].

The strength of this study is that it has provided new insight on food consumption patterns among research employees for decision-makers and the scientific community in general. The result of the study can give a clue about food consumption patterns of the productive working groups. However, it has certain limitations in that the consumption patterns of the participants were self-reported and collected through an interviewer-administered questionnaire, which might result in a little over or underestimation of the actual data. The study is not free of recall bias. In addition, due to the nature of this study, which was cross-sectional in design, it did not consider seasonal variation in food consumption patterns.

5. Conclusion and recommendations

This study provided an overview of the food consumption patterns of employees in the Ethiopian Institute of Agricultural Research,

Ethiopia. The consumption of fish, fruits, vegetables, meat, and eggs was very low. However, the regular consumption of cereals, sweets, and fatty foods increased among the employees. With the very low exception of fish consumption, animal source foods were not consumed during fasting days. Milk or milk products were consumed more in over the age of 60. Gender differences regarding the consumption of fatty foods were observed. Higher educational attainment increased the consumption of cereals, fruits, and vegetables. Having a higher income was associated with more consumption of fruits, vegetables, and meat.

This paper provided the following recommendations that are important to improve food consumption patterns for the employees.

1. The government should encourage the production and adequate access for consumption of fish and other animal-source foods, as well as fruits and vegetables.
2. Institutional managers should design nutritional education programs based on gender and educational level for the employees to tackle the excessive consumption of sweets and fatty foods.
3. Subsidizing those with lower incomes by providing healthy foods at a low cost and stabilizing the market are also important for better consumption patterns.

Author contribution statement

Dassalegn Daraje Jalata: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Solomon Abate Mekonnen: Conceived and designed the experiments; Analyzed and interpreted the data; Wrote the paper.

Hana Yeshitila Taddese: Conceived and designed the experiments; Performed the experiments.

Mulate Zerihun Workeneh: Conceived and designed the experiments.

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Data availability statement

Data will be made available on request.

Declaration of interest's statement

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.heliyon.2023.e12915.

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