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# Predictors of Food Handling Practices of Massive Food Catering Establishment in Ethiopia: Systematic Review and Meta-Analysis

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**Abstract**

Food borne disease is one among a series of public health problems globally due to poor food handling practices from production to service. This study aimed to find out the predictors of food handling practice among massive food catering establishments in Ethiopia. Different search engines were used and extraction of the data was done. Random-effects meta-analysis model was used to analyze the pooled value. DerSimonian – Laird method was used to estimate the study variance. The Cochrane's Q test (chi-square) and I2(%) were used to identify the heterogeneity of the studies. The overall pooled prevalence of good food handling practice was 50 (95% CI:43%, 57%). Predictors such as good Knowledge (AOR: 2.6(95% CI: 1.90, 3.18), Training (AOR: 3.16(95% CI: 2.2, 4.44), Medical cheek up (AOR: 6.76(95%

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CI: 4.49, 10.18), Supervision (AOR: 3.76(95% CI:2.12, 6.66), Experience (AOR: 2.00(95% CI: 1.52, 2.79) and Water basin availability (AOR: 2.06(95% CI:1.94, 3.83) were significant factors of food handling practice in massive food catering establishment in Ethiopia. Food handling practice was low and predictors of food handling including, knowledge, Training, Medical checkup, Supervision, Experience, and water availability were statistically significant. Therefore, Policymakers and facilities owners, give better or higher prominence to improving the status of food handling practices with design intervention strategies. In conclusion, comparatively low levels of good food handling practice were found among Ethiopian food handlers working in public food establishments, and factors including food handler training, attitude towards good food handling practice, and the presence of regular medical check-ups were identified as contributing factors.

**Introduction**

The proper handling of food is one of the most crucial steps in ensuring that the quality of the food people eat is not compromised. Food handlers are those who work with food in any capacity, including but not limited to manufacturing, transportation, sale, preparation, and service.[1] Unhygienic food handler's habits such as fingering, licking hand, scratching body, uncovering hair and irregular hand washing, and these factors affecting the food quality resulting unsatisfied consumers health.[2] Any unnecessary activity that handlers' habits during food processing, cooking, and service result in undesired public health impacts for consumers. In the fact that there are different microorganisms sourced as causing and affecting food safety.[3] Moreover, polluted air and dust, water, pets, and vermin may all lower food quality. The most prevalent recognized cause of food born sickness is improper food handling practices.

Food borne disease is one among series public health problem globally, WHO study report indicated that in Africa more than 91 million people ill and 137,000 die every year due to food borne disease this estimated that 1/3$^{rd}$ of the global death due to food borne disease. Furthermore, most of the food destroyed due to climatic conditions and other biogenic and abiogenic effects. [4,5,6,7,8,9,10,11,12] This problem is highly common in food industries, and many of them compliance, restrict, discomfort, when they get disease. Basically, the condition is mostly happened in the developing countries, with low- and middle-income public groups.[13]

Good food handling practice among massive food catering service were 27.4% in Addis,[14] 72% in Dessie,[15] 67.8% in Assosa,[16] 49% in Gondor city,[17] 46.7% in university of Gondor,[18] 66.5% in butcher shops Gondar city,[19] 40.1% in Debark town,[20] 67.6% in Bahir Dar Town,[21] 32.6% in Arba Minch Town,[22] 47.7% in Addis Ababa university cafeteria,[21] 20.9% in Godey Town, 46.5% in Woldia town,[23] 52.5% in Dangila town,[24] 53.1% in Mekelle town,[25] 54% in DebreMarkos town,[16] and 53% in Batu town.[26] As studies revealed that factors of food handling practice were Knowledge, educational status, experience, and medical checkup, regular supervision, behavioral factors such as washing hand, personal hygiene and availability of sanitation service and training of food safety.

Despite many studies have been conducted and reported the prevalence and associated factors of food handling practice in Ethiopia, but there are limited studies address the pool prevalence and predictors of food handling practice in the massive food catering establishment in Ethiopia. Also, food losses, wastage and other factors affect the food safety significantly and need to overcome all these issues through various studies. If these issues will not be handled properly on time, more hurdles be in coming years. Therefore, this study tried to collected research systematically and analysis to get the pool food handling value and predictors of food handling in Ethiopia thus, address the gap seen for researchers and forward to reader, policy makers and researcher to design the possible intervention strategy to resolved the problems in the future carriers.

## Methods

### Study Protocol Registration

The protocol was used to develop and write this systematic review and meta-analysis using the preferred procedure by PRISMA guideline 27 and registered (CRD42022321263) on International Prospective Register of Systematic Reviews (PROSPERO).

### Data Bases and Search Strategy

Different searching electronic data based was used including Google scholar, Web of Science, Scopus, PubMed, Science direct, thesis and other documents from different university to identify the presence of systematic review and meta-analysis on food handling practice and associated factors among food catering establishment in Ethiopia. Moreover, manual searching strategies were employed to identify and gather relevant topic studies with specified period using key terms like; "prevalence", "magnitude", "food handler", "food safety", "food waiter", "food cooker", "food seller", "factors associated", "risk factors", "massive food catering", "food and drinking establishment", and "Ethiopia". Advanced Google Search employing keywords and medical topic headings (''Food'', ''Handling'', ''Practice'', ''Handlers'' and 'Ethiopia''). The titles and abstracts of the individual research articles were initially reviewed. The protocol has been written and approved by each member and registered to PROSPERO. These searching items were used with separate or combine by "OR" and "AND". Furthermore, different studies also included to find out relevant information under the cited reference list from all research papers.

### Study Selection Criteria

This systematic review and meta-analysis paper were developed through gather relevant studies conducted in Ethiopia on food handlers. Those observational studies reported prevalence and associated factors among food catering establishment in Ethiopia from 2010-2021 were included for the review. The studies not stated the prevalence or magnitude of food handling practice, food hygiene practice, and food safety practice, other than massive food catering, food and drinking establishment, and conducted other than Ethiopia country, and year of publication were excluded from the review. In addition to this whenever there is no full text available, the corresponded authors were asked through email, and unanswered or paper only abstract were excluded from this study.

### Data Extraction

Systematically data was extracted from the paper pre-designed format in the table and imported all papers in the Medline reference data base. Data extraction format was adapted from the Joanna Briggs Institute (JBI) data extraction format.[28] The data was prepared on Microsoft excel sheets by author and year of publication. The extracted format was developed based on systematic and meta-analysis objective of this study, and all authors were participated to review independently the full text and whenever disagreement happen between us resolved through discussion. The extraction format contained the information like; author and year, sample size, study design, region, prevalence of food handling practice, associated factors for food handling practice in the study.

### Quality Assessment

The quality of research was screened using the Newcastle Ottawa Scale (NOS) for cross-sectional study quality assessment protocol.[29] This scale was required to assess methodological quality, comparability, and outcome of each study by all authors (SK, HD, CY and GT) independently. The cut off point for measured 7 out of 10, which was used by different studies. In this study all articles were included since all scored more than 7 according to NOS quality assessment criteria.

### Data Processing and Analysis

The extracted data were imported to STATA version 14 for further analysis (stata Corporation, College Station, Texas 77845 USA) for analysis. Different commands were deployed in Stata by referring previous studies source. Random-effects meta-analysis model was used for analysis. DerSimonian – Laird method was used to estimate the study variance. The Cochrane's Q test (chi-square) and $I^2$(%) with its corresponding p-values was used to identified heterogeneity of the included studies.[30,31] The subgroup analysis conducted to find out the possible source of heterogeneity. In addition to this sensitivity analysis also performed to find whether the step-by-step omission of single study from the analysis influenced the overall pooled prevalence of food handling practice. Publication bias was assessed using symmetry of funnel plot

and Egger's test statistics. The pooled prevalence of food handling practice was reported with a 95% CI and p-vales<0.05 were considered statistically significant.

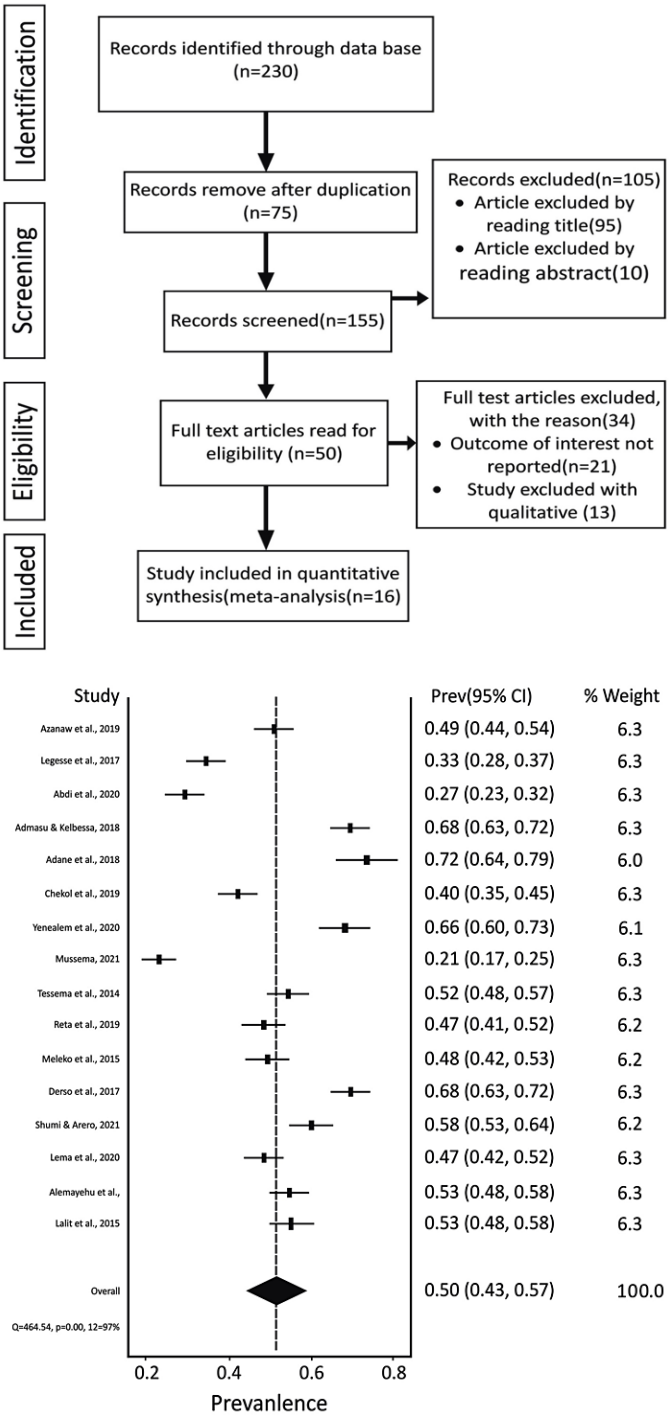


**Fig.1 (A): PRISMA Flow chart of the study selection process on the predictors of food handling practices among massive food catering in Ethiopia, 2022. (B) Forest plot showing the pooled prevalence of food handling practice among massive food catering establishment in Ethiopia**

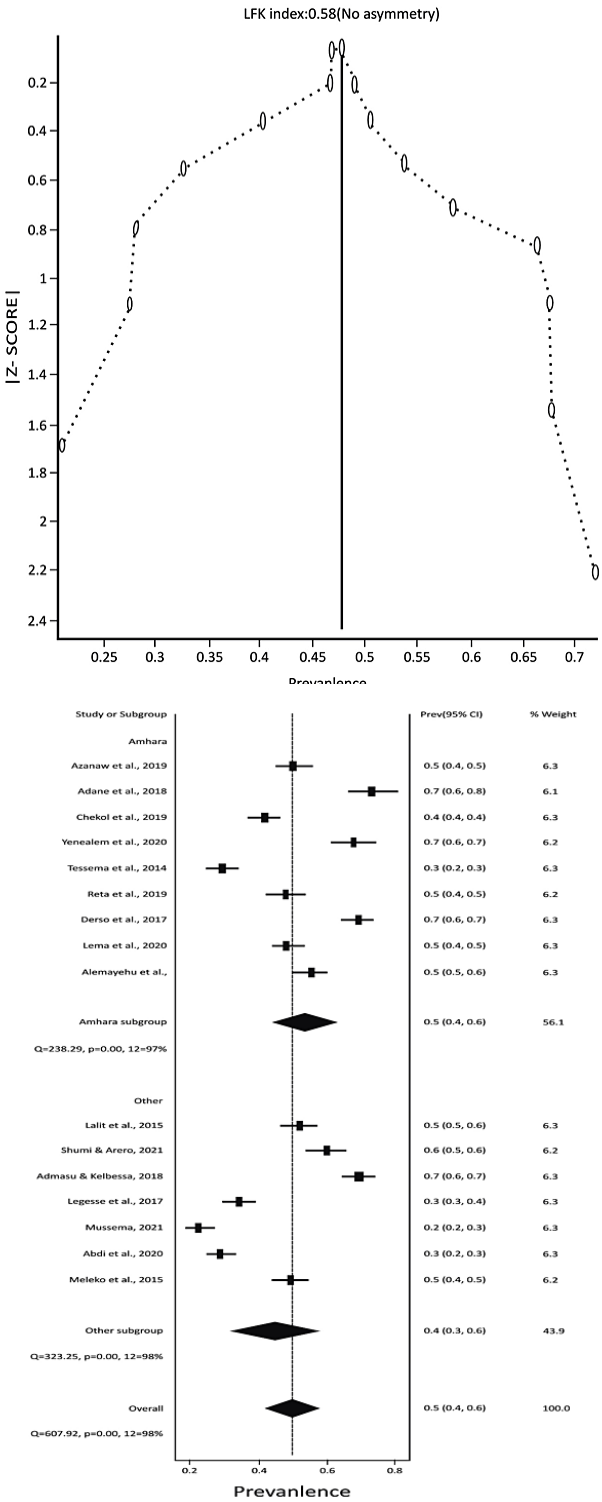


**Fig. 2 (A): The double arcs showed that the pooled prevalence of food handling practice among food caters in Ethiopia, 2022. (B) Sub-group analysis forest plot revealed pooled prevalence of food handling practice among massive food catering establishment in Ethiopia**

## Results

### Study Selection

Systematically studies were searched on topic with predictor of food handling practice among massive food catering establishment in Ethiopia and 230 studies recorded. Then after studies were screen for duplication and eligibility. Finally, 16 studies were satisfied the criteria and included in this systematic review and meta-analysis (Fig 1A).

**Table 1: Characteristics of included studies in the systematic review and meta-analysis of food handling practice among food handlers in massive food catering, Ethiopia, 2022**

| Author year | Publication year | Region | Sample size | Prevalence % |
|---|---|---|---|---|
| 32 | | Amhara | 384 | 49 |
| 33 | | SNNPR | 383 | 32.6 |
| 34 | | Addis Ababa | 394 | 27.4 |
| 35 | | Oromia | 384 | 67.8 |
| 36 | | Amhara | 135 | 72 |
| 37 | | Amhara | 416 | 40.1 |
| 38 | | Amhara | 214 | 66.4 |
| 39 | | Somalia | 390 | 20.9 |
| 40 | | Amhara | 406 | 52.5 |
| 41 | | Amhara | 288 | 46.5 |
| 42 | | Addis Ababa | 302 | 47.7 |
| 43 | | Amhara | 422 | 67.6 |
| 44 | | Oromia | 302 | 58.3 |
| 45 | | Amhara | 394 | 46.7 |
| 46 | | Amhara | 408 | 53.7 |
| 47 | | Tigray | 369 | 53.1 |

**Table 2: Sensitivity analysis of food handling practice among food catering in Ethiopia, 2022**

| Excluded study | Pooled Prevalence (%) 95% CI | p | $I^2$(%) 95%CI |
|---|---|---|---|
| 48 | 49.9(42.10,57,82) | 0.00 | 96.9(96.04,97.70) |
| 49 | 51.0(43.58,58.55) | 0.00 | 96.67(95.60,97.49) |
| 50 | 51.4(44.29,58.58) | 0.00 | 96.35(95.13,97.26) |
| 51 | 48.6(41.37,55.97) | 0.00 | 96.5(95.36,97.37) |
| 52 | 48.4(41.08,55.86) | 0.00 | 96.76(95.72,97.54) |
| 53 | 50.5(42.77,58.33) | 0.00 | 96.9(95.92,97.64) |
| 54 | 48.7(41.32,56.28) | 0.00 | 96.78(95.75,97.56) |
| 55 | 51.9(45.38,58.44) | 0.00 | 95.63(94.07,96.78) |
| 56 | 49.7(41.87,57.58) | 0.00 | 96.96(96.02,97.69) |
| 57 | 50.1(42.33,57.90) | 0.00 | 96.98(96.04,97.70) |
| 58 | 50.0(42.24,57.84) | 0.00 | 96.98(96.04,97.70) |
| 59 | 48.6(41.40,55.96) | 0.00 | 96.4(95.29,97.34) |
| 60 | 49.3(41.64,57.03) | 0.00 | 96.9(95.92,97.64) |
| 61 | 50.1(42.25,57.97) | 0.00 | 96.9(96.04,97.70) |
| 62 | 49.6(41.85,57.54) | 0.00 | 96.96(96.01,97.68) |
| 63 | 49.6(41.86, 57.50) | 0.00 | 96.96(96.01,97.68) |
| **Over all pooled value** | 50.0(0.43, 0.57) | 0.00 | 97.00(95,96.68) |

**Characteristics of Included Studies**

Systematic review and meta-analysis included 16 eligible cross-sectional studies consist of 5,591 study participants. The sample study rage from 135 to 422. With regards of the prevalence of good food handling practice, the lowest 20.9% was reported from a study conducted in Somalia and the highest 72% was seen from the study conducted in Amhara region (Table1).

**Food Handling Practices in Massive Food Catering Establishment**

The Cochrane $I^2$ values in this meta-analysis were $I^2$=97%, p<0.00, indicating that there was significantly high heterogeneity (fig 1B). Furthermore, sub-group analysis using region was done to verify the heterogeneity of studies, and result showed that the pooled prevalence of food handling practice in the studies conducted Amhara region was 50% (95% CI 50, 60). There was high heterogeneity between study finding $I^2$=97%, P<0.00 and it's contributed 56.1% on the overall pooled value of this study. Other studies also analyzed separately and pooled prevalence of good food handling practice was 40% (95% CI 30, 60). The heterogeneity was high $I^2$=98%, P<0.00 and weighted 43.9% on the overall finding of this study depicted on fig 2A.

The pool prevalence of food handling practice in massive food catering in Ethiopia was 50% (95% CI 43,57). DerSimonian-Laired random effect model was used for further analysis due to the considerably high heterogeneity between the included studies ($I^2$= 97%, P<0.00) (Fig 1B).

**Publication Bias**

The funnel plot revealed the distribution of the included studies was asymmetrical (Fig 2B).

**Sensitivity Analysis**

Sensitivity analysis was performed to showed whether the overall pooled food handling prevalence significantly changed when each included study removed step by step from the analysis. The result revealed that none of the included studies significantly affected the combined estimates of food handling practice (Table2).

**Factors Associated with Good Food Handling Practice among Massive Food Catering Establishment**

Knowledge, education, medical checkup, supervision, experience, and access to water were all included in this meta-analysis. For example, Yenealem.[19] Analyzed the correlation between food safety knowledge and its prevalence across eight research. Better food handling practices were seen 2.48 times more often among food handlers who had knowledge of food borne illness and food hygiene and safety compared to those who did not (AOR: 2.48, (95%CI: 1.90,3.18). Among the studies, heterogeneity was minimal (I2=44%, p=0.09) (fig 3A).

The association between training and good food handling practice was analyzed in ten studies.[11,12,13,14] The finding revealed that those food handlers, who had been taken training on food hygiene and safety were 3.16 times more likely to have good food handling practice compare to non-trained (AOR: 3.16 (95%CI: 2.24,4.44). Random effects meta-analysis was used due to considerable heterogeneity (I2=57%; p=0.01) within the studies (fig 3B). The meta-analysis result showed that medical cheek up and food handling practice in three studies.[1] There was significant association between those food handlers had been taken medical cheek up with counterpart (AOR: 6.76(4.49, 10.18) and $I^2$=0%, p=0.39 within analysis studies (fig 4).

The association between supervised and food handling practice was analyzed in four studies.[16, 23] There was significant association between who had been supervised in work place as compare with non-supervised food handlers (AOR: 3.76(2.12, 6.66) and there was evidenced that heterogeneity across the included studies ($I^2$=62%, P=0.05) within the studies (fig 5). The association between experience with food handling practice was analyzed in five studies. Individual had experience more than 2 years were 2.06 time more likely good food handling practice compare with less year (AOR=2.26(1.52,2.79). there was low heterogeneity within studies (I2=55%, p= 0.06) (fig 6). Finally, the association between water availability and good

food handling practice was analyzed in five studies. the finding notified that those accessed water for personal hygiene 2.65 time more likely practice good food handling than limited water available facility workers (AOR=2.65(1.84,3.83). there was low heterogeneity across the included studies (I2=36%, P=0.18) within the studies (fig 7).

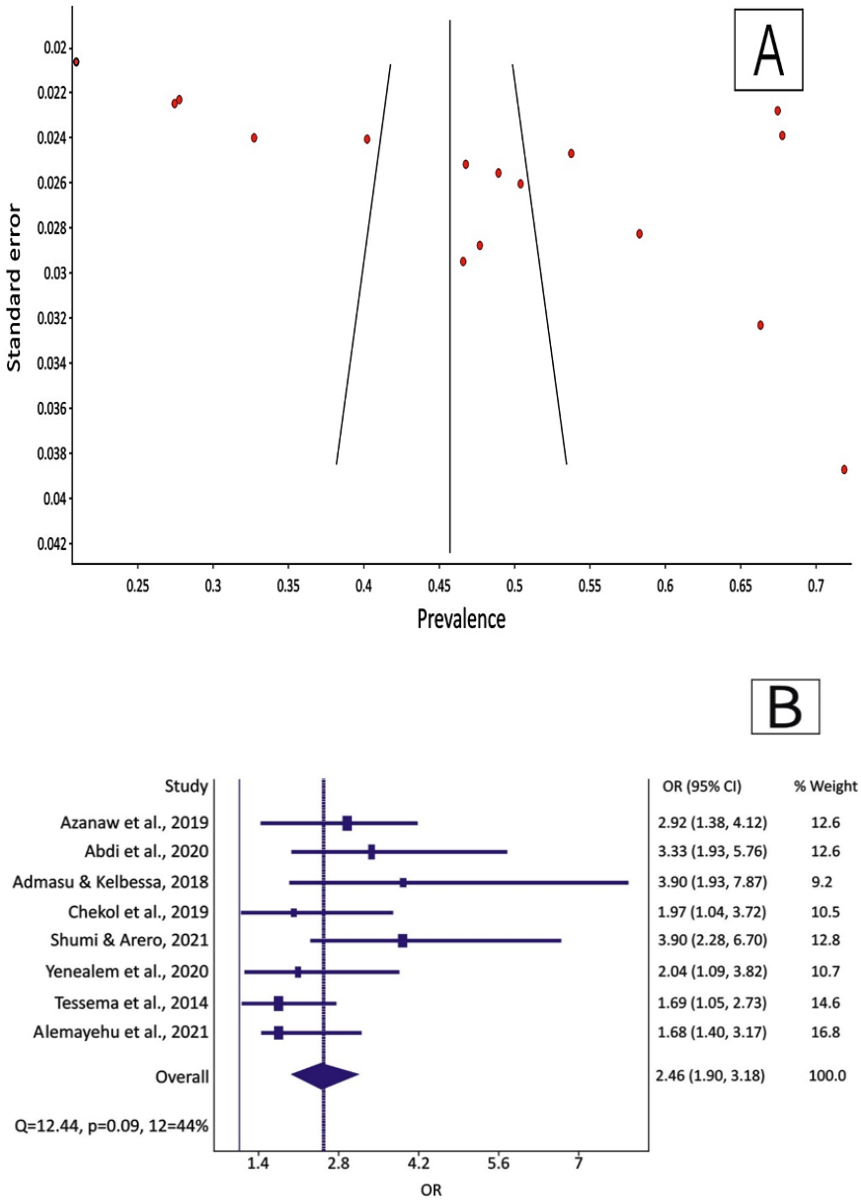


**Fig. 3 (A): Funnel plots show publication bias test of included studies in the meta-analysis. (B) The pooled odds ratio of the association between knowledge and good food handling practice among massive food handlers**

## Discussion

Hospitalization rates due to food poisoning continue to rise worldwide and represent a significant public health concern (Arias-granada, n.d.). In underdeveloped nations, inadequate sanitation and hygiene contribute to a high rate of hospital admissions and an increased reliance on medicine to treat the symptoms of illness. As every person

uses their hands as a tool while preparing or serving food, whether raw or cooked, proper food handling practices are the single most crucial component of the solution. The purpose of this meta-analysis was to examine the overall prevalence of safe food handling practices and the variables that contribute to them among Ethiopia's largest food service providers. The Amhara area is where the included studies were reported. In Addis Abeba and Oromia, four further research were reported to the municipal government. The remaining three studies came from the SNNPR, Tigray, and Somalia. This analysis found that, across all large-scale food catering companies, the overall prevalence of excellent food handling practice was 50% (95%CI: 40, 60). This finding is comparable with the study conducted in Kuwait among students 47.2%,[33] and lower than the study conducted on street food vendor in Ghana 62.9%. This difference might be due to workers experience, trained, and available of necessary facility to maintain hygienic condition in their work place had a significant impact on good food hygienic practice.[34,35] Subgroup analysis pooled prevalence of food handling practice results revealed among seven studies in Amhara region was 50% (30%, 60%).[36,37,38,20] While other studies composed of 40% (30%, 60%). This difference might be due to the fact that facility infrastructure and administrative culture emphasis given to improve hygienic and safety concerned by owner and employee trained workers to had good level of food handling practice in the massive food catering establishments.

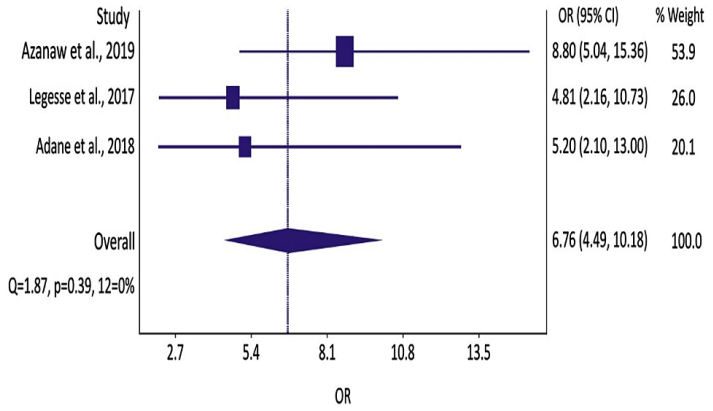


**Fig. 4: The pooled odds ratio of the association between medical checkup and good food handling practice among massive food handlers**

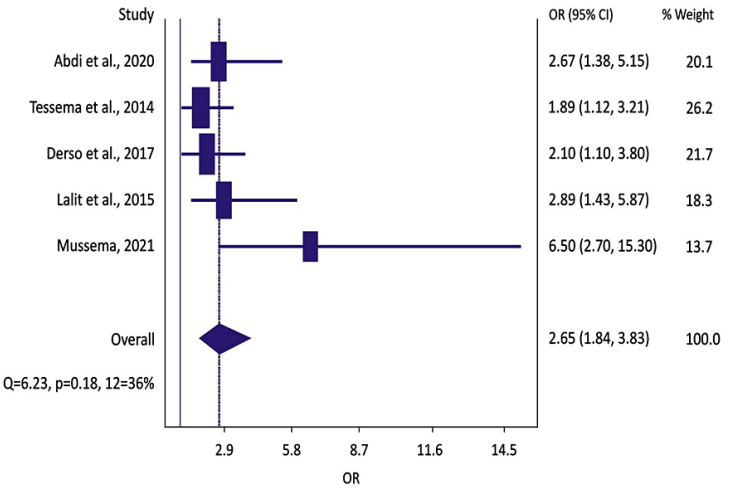


**Fig. 5: The pooled odds ratio of the association between supervisor and good food handling practice among massive food handlers**

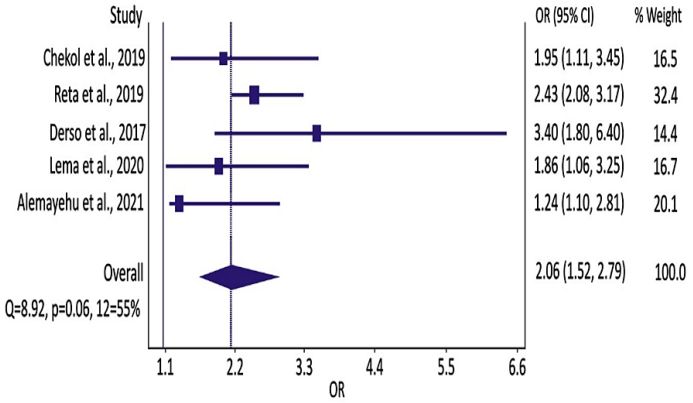


**Fig. 6: The pooled odds ratio of the association between experience and good food handling practice among massive food handlers**

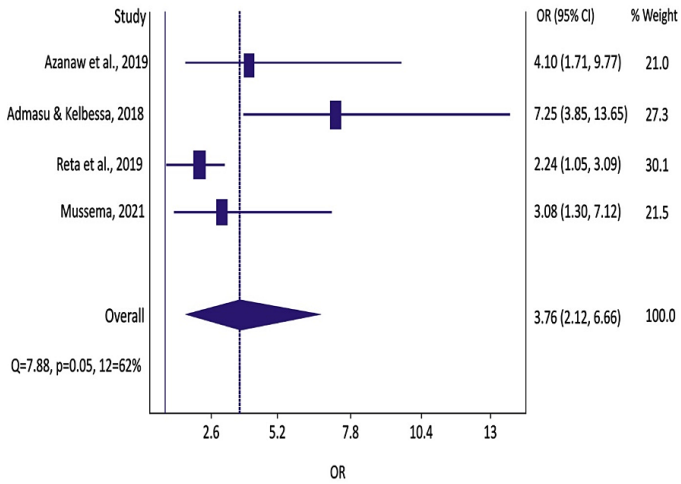


**Fig. 7: The pooled odds ratio of the association between availability water and good food handling practice among massive food handlers**

Knowledge of food handlers regarding on safety and hygiene were 2.6 time more likely had good food handling practice.[39,40] Similar finding were observed by Afolaranmi 37 certified that knowledge of food borne disease significant contribution for workers to kept its safety. On the same ways training regarding to food hygiene and safety for food handlers had remarkable value on their good practice. The study suggested that an intervention conducted to improve the knowledge of food handlers paramount important to satisfied good food handling practice. Other significant factor distorted food handling practice was training was 3.16 time more likely had good food handling practice than counterpart.[42] Good food handling practices were shown to be significantly improved when employees received training on food hygiene and safety. Good food handling practices were 6.76 times more common among those who had had regular medical cheek up 1,2 compared to those who had not. In a similar vein, those who had been closely watched while handling food were 3.76 times more likely to have appropriate food handling practices than those who had not. Workers with more than two years of experience in the food industry were 2.05 times more likely to have appropriate food handling practices than those with less than a year of experience. Researchers also noted that individuals who stayed in one profession for an extended period of time had a higher concentration of "intangible skills." Furthermore, a facility with adequate water and sanitation for its employees was 2.05 times more likely to have effective food handling

practices than one without. Water availability for food handlers was shown to encourage workers to follow safe food handling procedures by maintaining regular personal hygiene as suggested by the World Health Organization.

**Areas for Further Research**

This reviewed study was done only on articles accessed and published in different webpage. Therefore, the pooled prevalence of food handling practice might be changed, if it could be included unpublished article. Almost all involved papers for this review were conducted correctional and shared the drawback of the design itself.

**Conclusion**

Knowledge, medical back up, training, experience, supportive supervision, and the availability of a water basin for personal hygiene were significantly associated with good food handling practice among food workers, and the pooled prevalence of food handling practice among food handlers in large food catering establishments was 50%. Consequently, the results of this assessment can help Ethiopian authorities enhance the cleanliness and safety practices of large-scale food catering establishments. Food hygiene and safety should also be prioritized by the relevant government agency and facility owners, who should adopt an interventional approach to lessen the prevalence of food-borne diseases and safeguard the health of consumers. Several factors, including food handler training, attitude towards good food handling practice, and the availability of regular medical check-ups, contributed to the low level of good food handling practice among food handlers working in public eating businesses in Ethiopia. To enhance excellent food handling practice among food handlers working in public eating outlets in Ethiopia, training that may shift the attitude towards good food handling practice and frequent medical check-ups for food handlers must be in place. Workers who come into contact with food should have access to regular medical checkups and training that aims to alter their mindset.

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**Conflict of Interest**

The authors do not have any conflict of interest.

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