A Quantitative Study on the Ethnobotanical Knowledge about Wild Edible Plants among the Population of Messiwa

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ABSTRACT

BACKGROUND: The preservation of traditional knowledge of wild edible plants (WEPs) is one of the challenges to the sustainability of natural resources. Therefore, it is crucial to assess the traditional knowledge of WEPs in relation to some socio-demographic and economic factors.

METHODS: The survey was conducted among the Messiwa population through a semi-structured questionnaire. The first part of the questionnaire concerns socio-demographic and economic information, while the second part concerns the plants recognized and used by the informant. The recognition frequency (RF), the use frequency (UF), the general consumption frequency (CF), the recent consumption frequency (RCF), and the correlation between these frequencies were evaluated. A comparison of means was also used to compare informant’s knowledge according to their socio-demographic and economic status.

RESULTS: The three species; Foeniculum vulgare, Ziziphus lotus, and Malva sylvestris were the most recognized (FR = 1) and the most used (FU = 1). The consumption frequency (CF) and the recent consumption frequency (RCF) for Foeniculum vulgare were 1 and 0.9, respectively. Taraxacum getulum, Calendula arvensis and Cyperus rotundus were the least recognized (FR = 0.16; 0.16; 0.48) and least used (FU = 0.3; 0.3; 0.4) species, respectively. The informants who showed a high level of traditional knowledge on WEPs were housewives, with a low level of schooling and at least 45 years old.

CONCLUSION: Despite the decline in traditional knowledge about wild edible plants, some populations preserve this knowledge, especially among the elderly. Therefore, documentation of this knowledge is necessary through ethnobotanical and ethnomedicinal studies.

KEYWORDS: Ethnobotany; wild edible plants; Traditional knowledge; Erosion; Quantitative study

INTRODUCTION

Wild edible plants (WEPs) are natural resources that include nutrition, therapy, aesthetics, and spiritual purposes (1,2,3). The use of these wild edible plants has been very important in Morocco as in many places around the world (2,4). In particular during the periods of dearth where the people turned to these plants, despite the toxicity of some of these species (2,5).
The consumption of WEPs has shown a worrying decline in the last few years (6,7). Modernization, climate change, and excessive consumption of a limited number of domesticated species have been among the causes of this regression (8). Ignorance of these wild species by the descendant and their progressive lack in the local markets are two other factors that may further accelerate this regression (9,10).

The region of Al-Haouz in Morocco is known for its plant biodiversity and the presence of some Moroccan endemic plants like Lavandula mairei Humbert (11,12). Moreover, the population of the Al-Haouz region mainly the Messiwa, which is an original population, still uses some wild edible plants in traditional dishes (11).

The present study aimed to assess the knowledge of the Messiwa population regarding some wild edible plants that were used in the Al-Haouz region. The difference in knowledge among the respondents was also assessed according to their socio-demographic and economic status.

METHODS

Study area: This study was conducted in the province of Al-Haouz in Morocco (Figure 1) among the Messiwa population. The topography of the Al-Haouz region shows a plain part and a mountainous part (belonging to the High Atlas Mountains) (13). The rural communities represent 88% of the total population of Al-Haouz, with farming and pastoral activities for a large part of this population (14). Moreover, as this region includes a plain part and another mountainous part, the climate ranges from arid to humid. Furthermore, this diversity of climate is accompanied by a diversity of vegetation (15).

The studied population: The Messiwa population is a native population of the Al-Haouz region (16). Regarding the activities of the local population, a part of them is involved in agricultural activities such as subsistence farming, nurseries, and herbal plants. The other part has non-agricultural occupations such as private security, local trade, and construction work. However, the majority of women are housewives (14). All informants were adults able to answer our questions. Informed consent was obtained from all informants after explaining the purpose of the study.

Questionnaire design: The questionnaire included two parts; the first part contained the respondent's personal information (age, gender, family types, income, educational level, occupation...) and the second part represented a list of 64 wild edible plants cited by the Messiwa population in a previous study by Ghanimi et al. 2022 (11). The herbarium containing the 64 WEPs was represented to the informants to determine which species they would recognize, then specify whether the recognized plant is edible, determine if they have ever consumed this plant, and the last time of use (within 2 years or more).

Recognition frequency (RF): The recognition frequency of the plant represents the number of
informants recognizing the plant from the herbarium. The RF was calculated by the following formula:

$$RF = \frac{\text{Number of informants who recognized the plant}}{\text{total number of informants}}$$

**Use frequency (UF):** The use frequency of the plant represents the frequency of people considering the plant edible and it was calculated by the following formula:

$$UF = \frac{\text{Number of informants considering the plant as edible}}{\text{total number of informants}}$$

**General consumption frequency (CF):** General consumption frequency represents the frequency of people who have previously consumed the plant. The CF was calculated as:

$$CF = \frac{\text{Number of informants who consumed the plant}}{\text{total number of informants}}$$

**Recent Consumption Frequency (RCF):** The recent consumption frequency represents the frequency of people who have consumed the plant during the last two years. The RCF was calculated by the following formula:

$$RCF = \frac{\text{Number of informants who have used the plant in the last 2 years}}{\text{total number of informants}}$$

**Statistical analysis:** The collected data were analyzed using IBM SPSS 20 software and Excel 2010. Analysis of variance (ANOVA) was used followed by the Duncan test. The Student test was also used and the difference was considered significant at $P < 0.05$.

**RESULTS**

**Structure of the studied population:** The number of respondents was 200 (Table 1). Among them were 50 women aged 45 or more, 50 women under 45, 50 men aged 45 or more, and 50 men under 45. More than half of the men work in agriculture (52%), while the majority of the women are housewives (89%). Families consisting of parents and children (single family) represent 79% and extended families (containing children, parents, and grandparents) represent only 21%. Regarding monthly income, 65% of men and 75% of women have incomes below 3000 MDh (equivalent to 300 €). In addition, women have a high illiteracy rate (75%) compared to men who showed 48%. The percentage of people who have a university level was very low for women (1%) and also for men (7%).

| Variables          | Man (%) | Women (%) |
|--------------------|---------|-----------|
| **Age**            |         |           |
| Less than 45 years old | 50     | 50        |
| 45 years and older  | 50      | 50        |
| **Occupation**     |         |           |
| Agricultural       | 52      | 6         |
| Non-agricultural   | 48      | 5         |
| Housewife          | 0       | 89        |
| **Family type**    |         |           |
| Simple             | 79      | 79        |
| Extended           | 21      | 21        |
| **Income**         |         |           |
| Less than 3000 MDh  | 65      | 75        |
| 3000 to 5000 MDh   | 25      | 20        |
| More than 5000     | 10      | 5         |
| **Education level**|         |           |
| Illiterate         | 48      | 75        |
| Primary            | 20      | 14        |
| Middle school      | 18      | 9         |
| High School        | 7       | 1         |
| University         | 7       | 1         |

**Quantitative indices:** Table 2 represents the list of edible wild plants and the different quantitative indices (RF, UF, CF, and RCF). The three species; *Foeniculum vulgare*, *Ziziphus lotus*, and *Malva sylvestris* were the most recognized plants by the informants. The recognition frequency (RF) and use frequency (UF) for the three plants were 1; which means that all the informants were able to recognize these three species and they knew that they are edible. Regarding the general consumption frequency; *Foeniculum vulgare* showed an
### Table 2: List of wild edible plants, their medicinal uses, and their recognition, use, and consumption indices.

| Scientific name              | Family               | Local name       | Medicinal uses                                      | FR  | FU   | FC  | FCR |
|------------------------------|----------------------|------------------|-----------------------------------------------------|-----|------|-----|-----|
| *Ajuga iva* (L.) Schreb       | Lamiaceae            | Chadgoura        | cold and abdominal pain                              | 0.36| 0.1  | 0.08| 0.06|
| *Allium roseum* L.           | Amaryllidaceae       | lbsal barri      | only edible in times of famine                       | 0.48| 0.31 | 0.23| 0.13|
| *Arbutus unedo* L.           | Ericaceae            | Sasnou           | only edible                                          | 0.43| 0.41 | 0.38| 0.22|
| *Ardisarum vulgar* O.Targ.Tozz| Araceae              | Irni             | only edible                                          | 0.26| 0.14 | 0.07| 0.04|
| *Aristolochia paucinervis* Pomel| Aristolochiaceae     | Brztim           | only edible                                          | 0.38| 0.21 | 0.12| 0.05|
| *Artemisia herba-alba* Asso   | Compositae           | Chih             | Aromatizer, abdominal pain, and wounds              | 0.89| 0.54 | 0.47| 0.35|
| *Asparagus albus* L.          | Asparagaceae         | Hmissou          | Cold                                                 | 0.63| 0.61 | 0.48| 0.27|
| *Asparagus altissimus* Munby  | Asparagaceae         | Hmissou          | Cold                                                 | 0.63| 0.61 | 0.48| 0.27|
| *Asparagus hortorum* L.       | Asparagaceae         | Hmissou          | Cold                                                 | 0.63| 0.61 | 0.48| 0.27|
| *Calendula arvensis* M.Bieb   | Compositae           | Jamra            | Only edible                                          | 0.16| 0.03 | 0.01| 0   |
| *Capparis spinosa* L.         | Capparaceae          | Kabbar           | Rheumatism and cold                                  | 0.4 | 0.33 | 0.22| 0.11|
| *Caralluma europaea* (Guss.) N.E.Br | Apocynaceae        | Ddaghmous        | Diabetes and cough                                   | 0.45| 0.36 | 0.17| 0.08|
| *Carlina gummifera* (L.) Less | Compositae           | Addad            | only edible                                          | 0.56| 0.09 | 0.05| 0   |
| *Ceratonia siliqua* L.        | Leguminosae          | Kharoub          | Good for stomach                                     | 0.94| 0.94 | 0.93| 0.61|
| *Chamaerops humilis* L.       | Arecaceae            | Doum             | only edible                                          | 0.46| 0.09 | 0.05| 0   |
| *Cistus creticus* L.          | Cistaceae            | Irgual           | cold, appetizer                                      | 0.14| 0.1  | 0.08| 0.03|
| *Cistus salvifolius* L.       | Cistaceae            | Irgual           | cold, appetizer                                      | 0.14| 0.1  | 0.08| 0.03|
| *Cladanthus arabicus* (L.) Cass| Compositae           | Aourzid          | Good for stomach and anemia                          | 0.38| 0.18 | 0.07| 0.03|
| *Cynara cardunculus* L.       | Compositae           | khrchouf Ibaldi  | only edible                                          | 0.78| 0.77 | 0.71| 0.45|
| *Cynodon dactylon* (L.) Pers  | Poaceae              | Njem             | only edible                                          | 0.77| 0.1  | 0.03| 0.02|
| *Cyperus rotundus* L.         | Cyperaceae           | Tamoussayt       | good for the hair                                    | 0.48| 0.04 | 0.01| 0   |
| *Diplotaxisssp.*              | Brassicaceae         | Bohmmou          | only edible                                          | 0.31| 0.19 | 0.12| 0.06|
| *Drinia maritima* (L.) Stearn | Asparagaceae         | Igufil           | only edible                                          | 0.3 | 0.09 | 0.04| 0.01|
| *Dysphania raumusoides* (L.)  | Amaranthaceae        | Mkhinza          | Fever                                                | 0.92| 0.86 | 0.8  | 0.5 |
| *Mosyakina&Clemants*          |                       |                  |                                                      |     |      |     |     |
| *Emex spinosa* (L.) Campd      | Polygonaceae         | Hammadh          | only edible                                          | 0.58| 0.35 | 0.26| 0.1 |
| *Foeniculum vulgare* Mill     | Apiaceae             | Besbas           | Aromatizer and good for stomach and the digestion    | 1   | 1    | 1   | 0.9 |
| *Glaucom corniculatum* (L.) Curtis | Papaveraceae     | Hbbosousou       | only edible                                          | 0.32| 0.3  | 0.26| 0.1 |
| *Glebionia coronaria* (L. Cass. ex Spach) | Compositae          | Guhouan          | calming and relaxing                                 | 0.43| 0.35 | 0.24| 0.1 |
| *Herniaria hirsuta* subsp. cinerea* (DC. Cott) | Caryophyllaceae     | hrast lahjar     | good for kidney stones                                | 0.53| 0.49 | 0.3  | 0.14|
| *Juncus acutus* L.            | Juncaceae            | Essmar           | only edible                                          | 0.5 | 0.15 | 0.07| 0.02|
| *Lathyrus clymenum* L.        | Leguminosae          | Iikir            | only edible                                          | 0.47| 0.25 | 0.15| 0.05|
| *Lavandula dentata* L.        | Lamiaceae            | Halhal           | cold, abdominal pain                                 | 0.38| 0.28 | 0.14| 0.06|
| *Lavandula mairei* Humbert    | Lamiaceae            | Guorzhial        | Cold                                                 | 0.34| 0.27 | 0.17| 0.05|
| *Lavandula stoechas* L.       | Lamiaceae            | Khzama           | Cold and good for the urinary tract                  | 0.87| 0.73 | 0.55| 0.33|
| *Malva sylvestris* L.          | Malvaceae            | Khobbiza         | only edible                                          | 1   | 1    | 0.97| 0.85|
Table 2: Continued…

| Plant Name                          | Family    | Common Name   | Use(s)                                      | Value | Value | Value | Value |
|-------------------------------------|-----------|---------------|---------------------------------------------|-------|-------|-------|-------|
| Marrubium vulgare L                 | Lamiaceae | Mrouta        | disinfectant, good for the stomach and diabetes | 0.84  | 0.3   | 0.17  | 0.1   |
| Mentha pulegium L                   | Lamiaceae | Fluo          | Aromatizing, cold, cooling and refreshing   | 0.93  | 0.92  | 0.91  | 0.81  |
| Mentha rotundifolia (L.) Huds       | Lamiaceae | timija lmanta | Aromatizing, cooling, abdominal pain and refreshing | 0.67  | 0.63  | 0.56  | 0.39  |
| Mentha suaveolens Ehrh              | Lamiaceae | timija nwaman | Aromatizing, cooling, abdominal pain and refreshing | 0.94  | 0.9   | 0.85  | 0.7   |
| Mercurialis annua L                 | Euphorbiaceae | hourrigua lmalsa | Cooling                                   | 0.52  | 0.28  | 0.14  | 0.05  |
| Morus alba L                        | Moraceae  | Tüt           | only edible                                | 0.92  | 0.92  | 0.9   | 0.62  |
| Nasturtium officinale R.Br          | Brassicaceae | Gurnounch    | cold, and back pain                        | 0.4   | 0.36  | 0.3   | 0.07  |
| Olea oleaster Hoffmanns. & Link     | Oleaceae  | Jbouj         | only edible                                | 0.64  | 0.31  | 0.16  | 0.08  |
| Ononis natrix L                     | Leguminosae | Afzdad        | Anemia                                     | 0.26  | 0.12  | 0.07  | 0.02  |
| Opuntia ficus-indica (L.) Mill      | Cactaceae | Handia        | only edible                                | 0.95  | 0.95  | 0.95  | 0.7   |
| Papaver rhoeas L                    | Papaveraceae | Bellaaman   | measles and fever                          | 0.78  | 0.45  | 0.29  | 0.15  |
| Peganum harmala L                   | Nitrariaceae | Harmal       | cold, abdominal pain and fumigation        | 0.67  | 0.21  | 0.13  | 0.08  |
| Phoenix dactylifera L               | Arecaceae | Ablouh        | only edible                                | 0.95  | 0.95  | 0.93  | 0.72  |
| Portulaca oleracea L                | Portulacaceae | Trejla     | only edible                                | 0.97  | 0.97  | 0.94  | 0.84  |
| Quercus ilex L                      | Fagaceae  | Ballout       | only edible                                | 0.93  | 0.93  | 0.92  | 0.75  |
| Ridolfia segetum (L.) Moris         | Apiaceae  | Tabch         | liver disease                              | 0.36  | 0.25  | 0.14  | 0.05  |
| Rosa canina L                       | Rosaceae  | Tighfrt       | only edible                                | 0.41  | 0.28  | 0.2   | 0.02  |
| Rosmarinus officinalis L            | Lamiaceae | Azir          | Aromatizer, abdominal pain, cold           | 0.95  | 0.86  | 0.8   | 0.62  |
| Rubia peregrina L                   | Rubiaceae | Lfoua         | Anemia                                     | 0.76  | 0.73  | 0.61  | 0.4   |
| Rubus ulmifolius Schott             | Rosaceae  | Achddir       | only edible                                | 0.36  | 0.28  | 0.19  | 0.11  |
| Rumex palcher L                     | Polygonaceae | Selk        | only edible                                | 0.51  | 0.45  | 0.4   | 0.25  |
| Scyolumus hispanicus L             | Compositae | Guernina      | only edible                                | 0.81  | 0.79  | 0.67  | 0.4   |
| Silene vulgaris (Moench) Garcke     | Caryophyllaceae | Taghighacht | only edible                                | 0.27  | 0.05  | 0.01  | 0.01  |
| Taraxacum getatum Pomel             | Compositae | Jamra         | only edible                                | 0.16  | 0.03  | 0.01  | 0     |
| Tetraclinis articulata (Vahl) Mast  | Compositae | Aaraar        | abdominal pain and on wounds               | 0.67  | 0.33  | 0.19  | 0.08  |
| Thymus saturegioides Coss           | Lamiaceae | Zaatar        | Aromatizer, abdominal pain                 | 0.98  | 0.95  | 0.92  | 0.82  |
| Thymus willdenowii Boiss            | Lamiaceae | Zaaitra       | Aromatizer, abdominal pain                 | 0.9   | 0.89  | 0.86  | 0.72  |
| Urtica dioica L                     | Urticaceae | hourrigua lharcha | urinary pain, stomach and cold             | 0.79  | 0.26  | 0.16  | 0.06  |
| Ziziphus lotus (L.) Lam              | Rhamnaceae | Nbag          | Good for the stomach and intestines        | 1     | 1     | 0.99  | 0.86  |
FCR = 1; thus indicating that all informants have consumed this species before. While, *Ziziphus lotus* and *Malva sylvestris* were consumed at least once by 99% and 97% of informants, respectively. On the other hand, the highest recent consumption frequency (RCF) was observed in *Foeniculum vulgare* (RCF = 0.9), which indicates that 90% of informants consumed the plant in a period not exceeding the last two years.

The two species, *Taraxacum getulum* and *Calendula arvensis*, were respectively the least recognized (FR = 0.16) and the least used (FU = 0.3). The percentage of people who have consumed these two species at least once before was 1%, while none of our informants have consumed these two plants in the last two years (FR = 0).

**Correlations among the four frequencies:** The correlation analysis between the four frequencies (FR, FU, FC and FCR) was performed (Pearson correlation coefficient, r). Table 3 shows that the correlations between the different frequencies were all significant at the 0.01 level. The strongest correlation was observed between the consumption frequency and the use frequency (r = 0.990). This indicates that 99% of those who recognized the plant as edible had consumed it at least once before.

**Comparison of means** (Table 4): The difference in means between women and men regarding the number of wild edible plants recognized was significant at the 0.05 level. The mean for women was 38.96 ±10.67, while men showed a mean of 34.85 ±11.65. For the age category, the difference of means was highly significant in favor of those aged 45 years and over (41.38±10.73). In addition, those working in non-agricultural fields recognized fewer wild edible plants than housewives and people working in agricultural fields. The educational level also showed a highly significant difference between people with low educational levels (illiterate and people with primary levels) and people with relatively high academic levels (middle school, high school, or university). In contrast, family type and income did not show significant differences.

**Table 3:** The correlation between the frequencies of recognition, use, general consumption and recent consumption.

|       | RF  | UF  | CF  | RCF |
|-------|-----|-----|-----|-----|
| RF    | 1   | 0.865** | 0.850** | 0.843** |
| UF    | 1   | 0.990** | 0.960** |
| CF    | 1   | 0.981** |
| RCF   | 1   |      |     |     |

**Table 4:** Comparison of averages by socio-demographic and economic status.

| Variables       | Number | Average recognized plants | Statistical test | Homogeneous groups |
|-----------------|--------|---------------------------|------------------|--------------------|
| **Sex**         |        |                           |                  |                    |
| Men             | 100    | 34.85 ±11.65              | t = -2.6 *       |                    |
| Women           | 100    | 38.96 ±10.67              |                  |                    |
| **Age**         |        |                           |                  |                    |
| Less than 45 years | 100    | 32.43±10.14               | t = -6.062 ***   |                    |
| 45 years and over | 100    | 41.38±10.73               |                  |                    |
| **Occupation**  |        |                           |                  |                    |
| Agricultural    | 58     | 37.64±11.44               |                  |                    |
| Non-agricultural | 52     | 32.98±11.62               | F = 4.517 *      | (1,3)              |
| Housewife       | 90     | 38.70±10.66               |                  |                    |
| **Education level** |      |                           |                  |                    |
| Illiterate Primary | 123    | 39.94±10.59               | F = 11.967 ***   | (1,2)(3, 4, 5)     |
| college level   | 34     | 34.80±09.41               |                  |                    |
| Middle school   | 27     | 34.67±11.25               |                  |                    |
| High school     | 8      | 21.00±05.24               |                  |                    |
| University      | 8      | 22.75±07.99               |                  |                    |
| **Family type** |        |                           |                  |                    |
| Simple          | 158    | 36.13±11.28               | t = -1.88 ns     |                    |
| Extended        | 42     | 39.81±11.21               |                  |                    |
| **Income**      |        |                           |                  |                    |
| Less than 3000 MDh | 140    | 37.37±11.49               | F = 4 ns         |                    |
| 3000 to 5000 MDh | 45     | 35.71±10.55               |                  |                    |
| More than 5000 MDh | 15     | 36.13±12.61               |                  |                    |

T = student test of comparison of 2 means; F = Fisher test of analysis of variance

* = test significant at the 5% level, ns = not significant, in brackets means that the means are equal
DISCUSSION

*Foeniculum vulgare* is a species widely consumed in Mediterranean countries (11,17,18). This species is known for its benefits on digestion and the function of the gastroenteric system. The other two species; *Ziziphus lotus* and *Malva sylvestris*, are known mainly for their nutritional use and they are among the most cited species in Morocco through many ethnobotanical studies, which could explain their high recognition and consumption frequencies (2,3,11,19).

The recognition of a wild plant as an edible species is strongly related to its consumption. Therefore, the consumption of wild edible plants represents several benefits; such as diversification of the nutrient resources and the development of the local economy (20,21). The valorization of these natural resources is of crucial importance in light of strategies that aim to respect biodiversity and prevent malnutrition in developing countries (22,23). Moreover, the promotion of these wild edible species can represent a source of food supplements, new therapeutic molecules, oils, and natural cosmetic products.

The sociodemographic characteristics of communities strongly influence their knowledge and interactions with the environment (24,25). The erosion of wild plant knowledge has been reported by several authors and it has been influenced by different variables, the most important of which are age and gender (26–28). The study conducted on the population of El-Jadida by Tbatou, Belahyan, and Belahsen (2016) and the study conducted by Ghanimi et al. (2022) in the Al-Haouz region have shown that older women have significant ethnobotanical knowledge about wild edible plants more than other people(11,29). This difference in favor of older women could be due to the traditional lifestyle of these women in addition to their preference to take herbal treatments instead of using pharmacy products (11,30).

This study is another warning signal to protect biodiversity by promoting these wild edible plants and documenting this knowledge among people who show a high level of traditional knowledge, especially in our case among elderly women.

In conclusion, wild edible plants occupy an important place due to their nutritional and therapeutic potential. The most appreciated species by the population of Messiwa was *Foeniculum vulgare*. On the other hand, it was observed that the people who have a high level of knowledge about WEPs were housewives, aged 45 years or more and with a low level of education. This trend is in favor of a modern lifestyle, which is beginning to replace increasingly traditional life. Therefore, this work can be the basis for other similar surveys to evaluate the erosion of knowledge which is in continuous decline.

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