Observational Study

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How readable are pharmaceutical leaflets in Türkiye?

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Abstract

This study evaluates the readability of pharmaceutical leaflets used in Türkiye. A total of 26 pharmaceutical leaflets, randomly selected from the website of the Republic of Türkiye Ministry of Health's Turkish Medicines and Medical Devices Agency, were analyzed based on the Ateşman Readability Formula. Within the scope of the research, the readability scores and levels of the texts presented under the headings "What X (X = name of the medicine) is and its indicated use," "What you need to know before you take or use X," "How to take or use X," "Possible side effects," and "How to store X" were calculated. The findings revealed that the majority of leaflets had a "difficult" or "very difficult" readability. In particular, the frequent use of long sentence structures and multisyllable words negatively affects readability. This situation makes it more difficult for individuals with low health literacy to access information and increases the risk of improper use of medications. The study emphasizes the need to restructure patient information materials using simple, clear, and understandable language. These findings provide important recommendations for pharmaceutical manufacturers and health communication specialists, contributing to the improvement of public health.

Keywords: health literacy, pharmaceutical leaflet, readability

1. Introduction

In health communication, literacy levels play a critical role in effective patient education and adherence to treatment. Health literacy encompasses the ability of individuals to obtain, understand, evaluate, and apply health-related information.[1] These skills are essential for individuals to make informed health decisions and to safely use their medications. However, in many countries, a significant portion of the population has limited health literacy. For example, in developed countries, 7% to 47% of the population has insufficient health literacy, while this rate is even higher in developing countries.[2] Inadequate health literacy makes it difficult for individuals to understand medical information and translate it into appropriate health behaviors, which, in turn, can lead to incorrect medication use and serious health problems.[1] Therefore, it is of utmost importance to present written information to patients in a manner that is easy to understand.

Pharmaceutical leaflets are essential documents for patient information, including details regarding the intended use of the medication, dosage, possible side effects, and storage conditions.[3] International regulatory agencies mandate that these documents be written in clear, simple, and understandable language. According to European Union legislation, it is a legal requirement that pharmaceutical leaflets be easily understandable by all users.[4] An ideal leaflet should be comprehensible to a wide audience, regardless of age or educational level, and adopt a user-friendly language and structure. In Türkiye, the formal and content-related elements that must be considered in the preparation of pharmaceutical leaflets are defined in detail in the relevant regulations[5] and guidelines.[6] Within this scope, standards concerning the formal characteristics of leaflets have been established under headings such as font size and typeface, organization and design of information, use of headings, print color, syntax, expression style, and paper quality, as well as the use of symbols and illustrated diagrams. These regulations aim to ensure that users can comfortably follow the text visually, while also understanding it accurately and clearly from a linguistic perspective. In this regard, not only the content but also the principles of comprehensibility and accessibility serve as fundamental criteria in the preparation of leaflets in Türkiye.

However, the literature reveals that many pharmaceutical leaflets are written above the average reading skills of the general public. In particular, long sentence structures, technical terms, small font sizes, and insufficient visual elements negatively affected the readability of leaflets.[4] A study conducted in Qatar found that only 2.2% of 45 diabetic medication leaflets examined had adequate readability.[2] This finding indicates that the vast majority of leaflets are difficult for the general public to understand.

The unreadability of leaflets can lead to incorrect or incomplete use of medications, which, in turn, reduces treatment success

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The data that support the findings of this study are available from a third party, but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are available from the authors upon reasonable request and with permission of the third party.

This study did not involve human participants.

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and may even cause adverse events.[7] Studies have shown that individuals with low health literacy, in particular, face greater difficulties in understanding leaflets, which negatively affects their adherence to medication regimens. Furthermore, it has been reported that a quarter of individuals who purchase over-the-counter medications never read leaflets, which increases the risk of misuse.[1] Another study found that only 42% of participants read all information on the leaflet when using over-the-counter medication for the first time, whereas 26% only reviewed the active ingredients.[8]

The target audience of pharmaceutical leaflets comprises patients who will use the medication, as well as their caregivers. Therefore, the content of these leaflets should be organized to be accessible and understandable by considering the needs of diverse user groups, such as children, the elderly, and individuals with low educational levels. As a result, regulatory guidelines recommend that leaflets be tested on actual users, specifically elderly individuals and those with low literacy levels.[4] For instance, the European Union prioritizes feedback from ordinary individuals, rather than healthcare professionals, in user tests.[9] In Germany, in addition to German leaflets, the availability of leaflets translated into Turkish has increased, either inside the medication box or on online platforms.[10] In this context, the readability of pharmaceutical leaflets is a critical research topic for effective patient education and medication safety. However, studies in this area are limited. The aim of this study was to assess the readability of pharmaceutical leaflets using objective criteria and to determine how well they are understood by the public. In doing so, the current state of patient information materials is analyzed, and suggestions are provided.

Pharmaceutical leaflets are structured under standard headings such as medication description, intended use, usage instructions, precautions, side effects, storage conditions, and manufacturer information. This structure facilitates patients' quick access to information about medication and helps them use it correctly. However, for this information to be effectively communicated, text must be presented in a simple, understandable, and visually supported format. The readability of pharmaceutical leaflets is of vital importance, especially for the elderly and those with low literacy. Low health literacy can lead to the incorrect use of medications and negatively affect the treatment process.[11] Therefore, the adoption of user-friendly design elements such as simple language, appropriate font, visual support, and clear structure, is essential for leaflets. The findings obtained in this study will contribute to making leaflets more accessible, thereby enabling significant steps toward protecting public health.

The following questions were addressed in the study:

1. What are the readability scores and levels, according to the Ateşman Readability Formula, for the explanations made under the heading "What X (X = name of the medicine) is and its indicated use" in pharmaceutical leaflets?
2. What are the readability scores and levels, according to the Ateşman Readability Formula, for the explanations made under the heading "What you need to know before you take or use X?"
3. What are the readability scores and levels, according to the Ateşman Readability Formula, for the explanations made under the heading "How to take/use X" in pharmaceutical leaflets?
4. What are the readability scores and levels, according to the Ateşman Readability Formula, for the explanations made under the heading "Possible side effects" in pharmaceutical leaflets?
5. What are the readability scores and levels, according to the Ateşman Readability Formula, for the explanations made under the heading "How to store X" in pharmaceutical leaflets?
6. What are the readability scores and levels of pharmaceutical leaflets according to the Ateşman Readability Formula?

2. Methods

2.1. Study design

This cross-sectional study aimed to determine the readability of pharmaceutical leaflets by using document analysis, a qualitative research method. Qualitative research involves a multifaceted and interpretive process in which researchers use methods, such as field notes, interviews, conversations, photographs, and recordings, to make the world more understandable and interpretable.[12] In document analysis, different types of documents are examined systematically.[13]

2.2. Study materials

The 26 pharmaceutical leaflets analyzed in this study were not intended to quantitatively represent all medications available on the Türkiye market. However, the sample was constructed using purposive sampling to reflect the diversity of the commonly used pharmaceutical forms in the country. Within this scope, 2 leaflets were randomly selected from each of the following pharmaceutical forms: tablet, capsule, granule, syrup, drop, ointment, cream, gel, inhalation suspension, spray, suppository, injectable solution, and implant, resulting in a total of 26 leaflets. The study materials consist of the following pharmaceutical products: Ibuprofen Cold 200 mg[14] in tablet form and Lustral Special 100 mg,[15] Zoretanin 20 mg[16] in capsule form and Muscoflex Duo 50 mg,[17] Duchess 40 mg/5 mL[18] in granule form and Manuprin,[19] Coldaway Plus 100 mg[20] in syrup form and Gayaben,[21] Devit-3 50,000 IU/15 mL[22] in drop form and Ebixa 10 mg/g,[23] Hametan 25%[24] in ointment form and Acnedur 3%,[25] Bepanthen Plus 50 mg[26] in cream form and Travogen 1%,[27] Dolorex 1%[28] in gel form and Painex 5%,[29] Cortair 0.25 mg[30] in inhalation suspension form and Ventolin 100 µg,[31] Iliadin Merck 0.05%[32] in spray form and Otrivine Care 1 mg,[33] Procto-Glyvenol 20%[34] in suppository form and Ibu-Baby 125 mg,[35] Dodex 1000 µg[36] in injectable solution form and Dipromed 5 mg,[37] and Nexplanon 68 mg[38] in implant form and Leuprone 5.0 mg.[39] The pharmaceutical leaflets were randomly selected from the official website of the Turkish Medicines and Medical Devices Agency of the Republic of Türkiye Ministry of Health.[40]

2.3. Data collection tools

The Ateşman Readability Formula, shown in Figure 1, was used for data collection in this study. This formula is the Turkish adaptation of the Flesch Readability Formula modified by Ender Ateşman in 1997. According to the Ateşman Readability Formula, scores between 1 and 29 correspond to a very difficult level, 30 to 49 to a difficult level, 50 to 69 to an average difficulty level, 70 to 89 to an easy level, and 90 to 100 to a very easy level.[41]

2.4. Data collection

The data collection involved a series of systematic procedures. In the initial phase, criteria for counting sentences and determining word counts in the prospectuses included in the study were established. In this context, structures ending with a period (.), ellipsis (…), question mark (?), or an exclamation mark (!) were considered sentences; sequential sentences connected by commas (,) or semicolons (;) were treated as single sentences. After the sentences had been counted, word counting was performed. Any expressions separated by space were evaluated as

$$\textbf{\textit{Readability Score}} = 198{,}825 - (40{,}175x_1 - 2{,}610x_2)$$

x_1: Average word length in syllables

x_2: Average sentence length in words

Figure 1. Ateşman readability formula.[41]

words, regardless of whether they were meaningful. Written forms of expressions with numbers (e.g., twenty-five degrees Celsius instead of 25 °C, fourteen years instead of 14 years) and pronunciation of abbreviations (e.g., milligram instead of mg, millimole instead of mmol) were considered, and the word and syllable count for these expressions were determined. The accuracy of the data used in the calculations was verified by comparing the findings with those of the researchers.

2.5. Data analysis

Based on the syllable, word, and sentence counts obtained from the analysis of the prospectuses, the average word and sentence lengths for each section of the prospectuses, including "What X is and its indicated use," "What you need to know before you take or use X," "How to take or use X," "Possible side effects," and "How to store X," were calculated. After calculating the average word and sentence lengths, the data were applied to the readability formula and readability scores for the explanations were computed. Subsequently, the readability of the explanations was determined.

2.6. Limitations of the study

This study was designed as a preliminary cross-sectional document analysis, aiming to provide an evaluation focused on the linguistic and structural features of pharmaceutical leaflets, rather than statistical generalizations. The study was limited to 26 pharmaceutical leaflets randomly selected from the Turkish Medicines and Medical Devices Agency website of the Republic of Türkiye Ministry of Health.[40] Additionally, all analyzed leaflets are medications approved by the Turkish Ministry of Health and are currently available on the market, which enhances the internal validity and representativeness of the sample. The research is confined to the results obtained by calculating the average word and sentence lengths from the examined leaflets using the Ateşman Readability Formula.[41]

3. Results

In this section of the study, the results derived from the analysis of syllables, words, and sentence counts in the sections of the prospectuses, including "What X is and its indicated use," "What you need to know before you take/use X," "How to take/use X," "Possible side effects," and "How to store X," are presented. In this context, a separate table was prepared for each section, and the data were processed and interpreted.

3.1. Readability of "What X is and its indicated use" in pharmaceutical leaflets

The results regarding the explanations in the "What X is and its indicated use" section of the pharmaceutical leaflets examined in this study are presented in Table 1.

The findings related to the explanations under the "What X is and its indicated use" heading in the leaflets selected as a sample in Table 1 show the average word and sentence lengths, readability scores, and readability levels. In this context, when evaluating the explanations in terms of word and sentence lengths, it can be observed that the word lengths range from 2.66 to 3.27, and sentence lengths range from 8.67 to 20.33. Furthermore, the explanations under this heading in the leaflets consist of words with an average of 2.92 syllables and sentences with an average of 12.98 words. When evaluating the readability scores and levels of the explanations under the "What X is and its indicated use" heading in the leaflets according to the Ateşman Readability Formula, it is observed that 15 of the 26 pharmaceutical leaflets are classified as "difficult," and 11 as "average difficulty."

In Table 1, the average readability score of the explanations under the "What X is and its indicated use" heading is found to be 47.82, indicating a "difficult" readability level.

3.2. Readability of "What you need to know before you take/use X" in pharmaceutical leaflets

Table 2 presents the results related to the explanations under the heading "What you need to know before you take/use X" in the pharmaceutical leaflets examined in this study.

Findings related to the explanations under the heading "What you need to know before you take/use X" in the pharmaceutical leaflets examined in this study are presented in Table 2. The average word lengths range from 2.91 to 3.28, and the sentence lengths vary from 9.25 to 27.41. Additionally, it is observed that the explanations under this heading consist of words with an average of 3.11 syllables and sentences with an average of 15.42 words. When evaluating the explanations under the heading "What you need to know before you take/use X" in the pharmaceutical leaflets according to the Ateşman Readability Formula, it is found that 18 of the 26 leaflets are classified as "difficult," 7 are classified as "very difficult," and 1 is classified as "average difficulty."

When examining Table 2, it can be concluded that the explanations under the heading "What you need to know before you take/use X" have an average readability score of 33.7, which places them at the "difficult" level.

3.3. Readability of "How to take/use X" in pharmaceutical leaflets

The results of the explanations under the heading "How to take/use X" in the pharmaceutical leaflets examined in this study are presented in Table 3.

The findings regarding the explanations under the heading "How to take/use X" in the pharmaceutical leaflets examined in this study are presented in Table 3. In this context, when evaluating the explanations in terms of word and sentence lengths, it is observed that the word lengths range from 2.62 to 3.23, and

Table 1

Readability of "What X is and its indicated use" section in leaflets.

Name of the medicine	AWL	ASL	Ateşman readability score	Ateşman readability level
Iburamin Cold 200 mg	2.98	11.5	49.09	Difficult
Lustral Special 100 mg	2.83	16.63	41.73	Difficult
Zoretanin 20 mg	3.02	12.89	43.85	Difficult
Muscoflex Duo 50 mg	2.91	14.33	44.51	Difficult
Duchess 40 mg/5 mL	3.01	10.07	51.62	Average difficulty
Manuprin	3.27	10	41.35	Difficult
Coldaway Plus 100 mg	2.72	14.89	50.69	Average difficulty
Gayaben	2.77	20.33	34.48	Difficult
Devit-3 50,000 IU/15 mL	2.85	10.4	57.18	Average difficulty
Ebixa 10 mg/g	2.66	11.67	61.5	Average difficulty
Hametan 25%	2.92	18.88	32.24	Difficult
Acnedur 3%	2.87	8.67	60.89	Average difficulty
Bepanthen Plus 50 mg	2.79	17	42.37	Difficult
Travogen 1%	2.82	13	51.6	Average difficulty
Dolorex 1%	3.12	11	44.77	Difficult
Painex 5%	2.84	13.13	50.46	Average difficulty
Cortair 0.25 mg	3.09	11.69	44.17	Difficult
Ventolin 100 µg	2.93	9.76	55.64	Average difficulty
Iliadin Merck 0.05%	3.16	12.91	38.18	Difficult
Otrivine Care 1 mg	2.92	13.82	45.44	Difficult
Procto-Glyvenol 20%	2.98	14.75	40.61	Difficult
Ibu-Baby 125 mg	2.69	16.14	48.63	Difficult
Dodex 1000 µg	2.68	11.1	62.19	Average difficulty
Dipromed 5 mg	2.95	10.31	53.4	Average difficulty
Nexplanon 68 mg	2.91	10.33	54.95	Average difficulty
Leuprone 5.0 mg	3.12	12.17	41.72	Difficult
Average	**2.92**	**12.98**	**47.82**	**Difficult**

ASL = average sentence length, AWL = average word length.

Table 2

Readability of "What you need to know before you take/use X" section in leaflets.

Name of the medicine	AWL	ASL	Ateşman readability score	Ateşman readability level
Iburamin Cold 200 mg	3.06	24.17	12.81	Very difficult
Lustral Special 100 mg	3.08	17.38	29.72	Very difficult
Zoretanin 20 mg	3.08	11.56	44.91	Difficult
Muscoflex Duo 50 mg	2.95	23.81	18.16	Very difficult
Duchess 40 mg/5 mL	3.02	13.94	41.11	Difficult
Manuprin	3.1	12.29	42.21	Difficult
Coldaway Plus 100 mg	3.04	27.41	5.15	Very difficult
Gayaben	3.01	17.16	33.11	Difficult
Devit-3 50,000 IU/15 mL	3.12	15.14	33.96	Difficult
Ebixa 10 mg/g	3.28	13.7	31.29	Difficult
Hametan 25%	3.22	9.25	45.32	Difficult
Acnedur 3%	3.25	13.33	34.79	Difficult
Bepanthen Plus 50 mg	3.07	12.79	42.11	Difficult
Travogen 1%	3.25	11.82	37.41	Difficult
Dolorex 1%	3.15	11.06	43.41	Difficult
Painex 5%	3.08	13.22	40.58	Difficult
Cortair 0.25 mg	3.17	14.33	34.07	Difficult
Ventolin 100 µg	3.22	11.56	39.29	Difficult
Iliadin Merck 0.05%	3.2	19.18	20.21	Very difficult
Otrivine Care 1 mg	3.16	15.92	30.32	Difficult
Procto-Glyvenol 20%	3.22	11.67	39	Difficult
Ibu-Baby 125 mg	3	23.7	16.44	Very difficult
Dodex 1000 µg	2.91	12.22	50.02	Average difficulty
Dipromed 5 mg	3.14	18.8	23.61	Very difficult
Nexplanon 68 mg	3.06	13.63	40.32	Difficult
Leuprone 5.0 mg	3	11.96	47.08	Difficult
Average	**3.11**	**15.42**	**33.7**	**Difficult**

ASL = average sentence length, AWL = average word length.

sentence lengths vary between 7.52 and 15.57. Furthermore, the explanations under this heading in the leaflets consist of words with an average of 2.91 syllables and sentences with an average of 11.51 words. When evaluating the explanations under the heading "How to take/use X" according to the Ateşman Readability Formula, it is found that 17 of the 26 pharmaceutical leaflets fall into the "average difficulty" category, while 9 are considered "difficult."

Table 3

Readability of "How to take/use X" section in leaflets.

Name of the medicine	AWL	ASL	Ateşman readability score	Ateşman readability level
Iburamin Cold 200 mg	2.83	10.38	58.04	Average difficulty
Lustral Special 100 mg	2.75	12.16	56.61	Average difficulty
Zoretanin 20 mg	2.92	9.33	57.16	Average difficulty
Muscoflex Duo 50 mg	2.94	10.53	53.23	Average difficulty
Duchess 40 mg/5 mL	2.79	12.03	55.34	Average difficulty
Manuprin	2.91	10.73	53.9	Average difficulty
Coldaway Plus 100 mg	2.62	14.19	56.53	Average difficulty
Gayaben	3.04	12.35	44.46	Difficult
Devit-3 50,000 IU/15 mL	2.63	14.3	55.84	Average difficulty
Ebixa 10 mg/g	2.7	11.33	60.78	Average difficulty
Hametan 25%	3.08	8.93	51.78	Average difficulty
Acnedur 3%	2.96	10.88	51.51	Average difficulty
Bepanthen Plus 50 mg	2.86	9.53	59.05	Average difficulty
Travogen 1%	3.11	10.46	46.58	Difficult
Dolorex 1%	2.96	11.07	51.01	Average difficulty
Painex 5%	3.04	10.32	49.76	Difficult
Cortair 0.25 mg	2.91	10.09	55.58	Average difficulty
Ventolin 100 µg	2.86	12.85	50.39	Average difficulty
Iliadin Merck 0.05%	2.9	14.37	44.81	Difficult
Otrivine Care 1 mg	2.91	10.76	53.83	Average difficulty
Procto-Glyvenol 20%	3.23	7.52	49.43	Difficult
Ibu-Baby 125 mg	2.82	14.19	48.5	Difficult
Dodex 1000 µg	2.9	12.19	50.5	Average difficulty
Dipromed 5 mg	2.99	15.57	38.06	Difficult
Nexplanon 68 mg	3.01	12.38	45.59	Difficult
Leuprone 5.0 mg	3.05	10.71	48.34	Difficult
Average	**2.91**	**11.51**	**51.79**	**Average difficulty**

ASL = average sentence length, AWL = average word length.

From Table 3, it can be seen that the average readability score for the explanations under the heading "How to take/use X" is 51.79, indicating an "average difficulty" level.

3.4. Readability of "Possible side effects" in pharmaceutical leaflets

The results regarding the explanations in the "Possible side effects" section of the pharmaceutical leaflets examined in this study is presented in Table 4.

The explanations under the heading "Possible side effects" in the pharmaceutical leaflets selected as samples in this study are presented in Table 4. The table includes the average word and sentence lengths as well as the readability scores and levels. It can be seen that the word lengths range from 2.66 to 2.87, and sentence lengths range from 11.74 to 29.72. Furthermore, the explanations under this heading in the leaflets consist of words with an average of 2.79 syllables and sentences with an average of 17.26 words. When the explanations under the heading "Possible side effects" are evaluated according to the Ateşman Readability Formula, it is found that 11 out of the 26 leaflets are classified as "difficult," 10 are "average difficulty," and 5 are "very difficult."

Based on Table 4, the average readability score for the explanations under the heading "Possible side effects" is 54.86, indicating a level of "average difficulty."

3.5. Readability of "How to store X" in pharmaceutical leaflets

The results related to the explanations in the "How to store X" of the pharmaceutical leaflets examined in this study are presented in Table 5.

The average word and sentence lengths, along with readability scores and levels for the explanations under the "How to store X" section in the pharmaceutical leaflets selected as the sample, are presented in Table 5. In this context, when evaluating the explanations in terms of word and sentence lengths, it can be observed that word lengths range from 2.86 to 3.49, and sentence lengths range from 6.67 to 8.63. Additionally, the explanations in the leaflets under this heading consist of words with an average of 3.22 syllables and sentences with an average of 7.65 words. When evaluating the readability scores and levels of the explanations under the "How to store X" heading in the pharmaceutical leaflets according to the Ateşman Readability Formula, it is found that 17 out of 26 leaflets are categorized as "difficult," while 9 are categorized as of "average difficulty."

Based on Table 5, the explanations under the "How to store X" heading are found to have an average readability score of 49.31, which corresponds to the "difficult" level.

3.6. Comprehensive readability assessment of the entire pharmaceutical leaflets

This section presents a comprehensive readability analysis of all the pharmaceutical leaflets reviewed in this study. The evaluation encompasses all sections of the leaflets, including the "What X is and its indicated use," "What you need to know before you take/use X," "How to take/use X," "Possible side effects," and "How to store X." Relevant data are presented in Table 6.

Table 6 presents the average word and sentence lengths, as well as the readability scores and levels, for the pharmaceutical leaflets selected as the sample. It can be observed that the word lengths range from 2.89 to 3.09, while the sentence lengths vary between 10.63 and 23.01. Additionally, the explanations in the leaflets consist of words with an average of 2.97 syllables and sentences with an average of 14.14 words. When evaluated using the Ateşman Readability Formula, it is found that 21 of the 26 leaflets are classified as "difficult," 4 as "very difficult," and 1 as of "average difficulty."

From Table 6, it can be concluded that the explanations regarding the use of the medication have an average readability

Table 4

Readability of "Possible side effects" section in leaflets.

Name of the medicine	AWL	ASL	Ateşman readability score	Ateşman readability level
Iburamin Cold 200 mg	2.78	28.48	12.81	Very difficult
Lustral Special 100 mg	2.83	28.24	11.42	Very difficult
Zoretanin 20 mg	2.84	13.25	50.15	Average difficulty
Muscoflex Duo 50 mg	2.83	29.72	7.56	Very difficult
Duchess 40 mg/5 mL	2.76	17.71	41.72	Difficult
Manuprin	2.67	14.4	53.97	Average difficulty
Coldaway Plus 100 mg	2.78	28.76	12.07	Very difficult
Gayaben	2.74	14.21	51.66	Average difficulty
Devit-3 50,000 IU/15 mL	2.79	14.58	48.68	Difficult
Ebixa 10 mg/g	2.81	11.8	55.14	Average difficulty
Hametan 25%	2.77	13.85	51.39	Average difficulty
Acnedur 3%	2.72	13.31	54.81	Average difficulty
Bepanthen Plus 50 mg	2.79	15.91	45.23	Difficult
Travogen 1%	2.78	12.44	54.67	Average difficulty
Dolorex 1%	2.74	11.74	58.1	Average difficulty
Painex 5%	2.84	14.68	46.41	Difficult
Cortair 0.25 mg	2.85	12.95	50.53	Average difficulty
Ventolin 100 µg	2.9	13.29	47.63	Difficult
Iliadin Merck 0.05%	2.83	19.24	34.91	Difficult
Otrivine Care 1 mg	2.78	16.41	44.31	Difficult
Procto-Glyvenol 20%	2.82	13.19	51.11	Average difficulty
Ibu-Baby 125 mg	2.78	25	21.89	Very difficult
Dodex 1000 µg	2.81	15.56	45.32	Difficult
Dipromed 5 mg	2.87	19.23	33.33	Difficult
Nexplanon 68 mg	2.83	14.4	47.55	Difficult
Leuprone 5.0 mg	2.66	16.43	49.08	Difficult
Average	**2.79**	**17.26**	**54.86**	**Average difficulty**

ASL = average sentence length, AWL = average word length.

Table 5

Readability of "How to store X" section in leaflets.

Name of the medicine	AWL	ASL	Ateşman readability score	Ateşman readability level
Iburamin Cold 200 mg	3.13	8.38	51.21	Average difficulty
Lustral Special 100 mg	3.17	7.67	51.45	Average difficulty
Zoretanin 20 mg	3.25	7.38	48.99	Difficult
Muscoflex Duo 50 mg	3.24	8.17	47.33	Difficult
Duchess 40 mg/5 mL	3.49	6.83	40.79	Difficult
Manuprin	3.38	6.67	45.62	Difficult
Coldaway Plus 100 mg	3.21	8.5	47.68	Difficult
Gayaben	3.25	7.38	48.99	Difficult
Devit-3 50,000 IU/15 mL	2.86	10	57.82	Average difficulty
Ebixa 10 mg/g	3.09	7.71	54.56	Average difficulty
Hametan 25%	3.33	7.25	46.12	Difficult
Acnedur 3%	3.34	6.71	47.12	Difficult
Bepanthen Plus 50 mg	2.97	8.63	56.98	Average difficulty
Travogen 1%	3.3	7.57	46.49	Difficult
Dolorex 1%	3.31	7.75	45.62	Difficult
Painex 5%	3.24	7	50.39	Average difficulty
Cortair 0.25 mg	3.02	7.67	57.48	Average difficulty
Ventolin 100 µg	3.24	7.46	49.19	Difficult
Iliadin Merck 0.05%	3.33	7.29	46.02	Difficult
Otrivine Care 1 mg	3.43	6.78	43.33	Difficult
Procto-Glyvenol 20%	3.25	7.63	48.34	Difficult
Ibu-Baby 125 mg	3.11	7.88	53.31	Average difficulty
Dodex 1000 µg	3.27	7.33	48.32	Difficult
Dipromed 5 mg	3.25	7.44	48.84	Difficult
Nexplanon 68 mg	3.36	7.86	43.32	Difficult
Leuprone 5.0 mg	3.02	8	56.62	Average difficulty
Average	**3.22**	**7.65**	**49.31**	**Difficult**

ASL = average sentence length, AWL = average word length.

score of 42.55, which corresponds to a "difficult" level. Figure 2 illustrates the distribution of the average readability scores of the pharmaceutical leaflets reviewed in this study categorized by their respective sections. The average readability scores range from 33.7 to 54.86. When the pharmaceutical leaflets examined in the study are evaluated as a whole, the highest readability score was found under the section "Possible side effects" with a score of 54.86, while the lowest readability score was observed

Table 6

Readability of reviewed leaflets.

Name of the medicine	AWL	ASL	Ateşman readability score	Ateşman readability level
Iburamin Cold 200 mg	2.94	20.35	27.6	Very difficult
Lustral Special 100 mg	2.94	17.81	34.23	Difficult
Zoretanin 20 mg	2.98	11.69	48.6	Difficult
Muscoflex Duo 50 mg	2.91	20.72	27.84	Very difficult
Duchess 40 mg/5 mL	2.91	13.06	47.83	Difficult
Manuprin	2.96	11.68	49.42	Difficult
Coldaway Plus 100 mg	2.89	23.01	22.66	Very difficult
Gayaben	2.95	14.73	41.86	Difficult
Devit-3 50,000 IU/15 mL	2.86	14.12	47.07	Difficult
Ebixa 10 mg/g	2.96	11.99	48.68	Difficult
Hametan 25%	3.03	10.93	48.57	Difficult
Acnedur 3%	3.03	11.6	46.82	Difficult
Bepanthen Plus 50 mg	2.91	13.09	47.75	Difficult
Travogen 1%	3.08	11.3	45.6	Difficult
Dolorex 1%	2.98	11.01	50.37	Average difficulty
Painex 5%	2.98	12.4	46.74	Difficult
Cortair 0.25 mg	2.99	11.7	48.16	Difficult
Ventolin 100 µg	2.97	11.87	48.52	Difficult
Iliadin Merck 0.05%	3.05	16.53	33.15	Difficult
Otrivine Care 1 mg	2.99	13.11	44.48	Difficult
Procto-Glyvenol 20%	3.09	10.63	46.94	Difficult
Ibu-Baby 125 mg	2.9	20.24	29.49	Very difficult
Dodex 1000 µg	2.87	12.65	44.08	Difficult
Dipromed 5 mg	3.03	16.08	35.13	Difficult
Nexplanon 68 mg	2.99	12.93	44.95	Difficult
Leuprone 5.0 mg	2.9	12.51	49.67	Difficult
Average	**2.97**	**14.14**	**42.55**	**Difficult**

ASL = average sentence length, AWL = average word length.

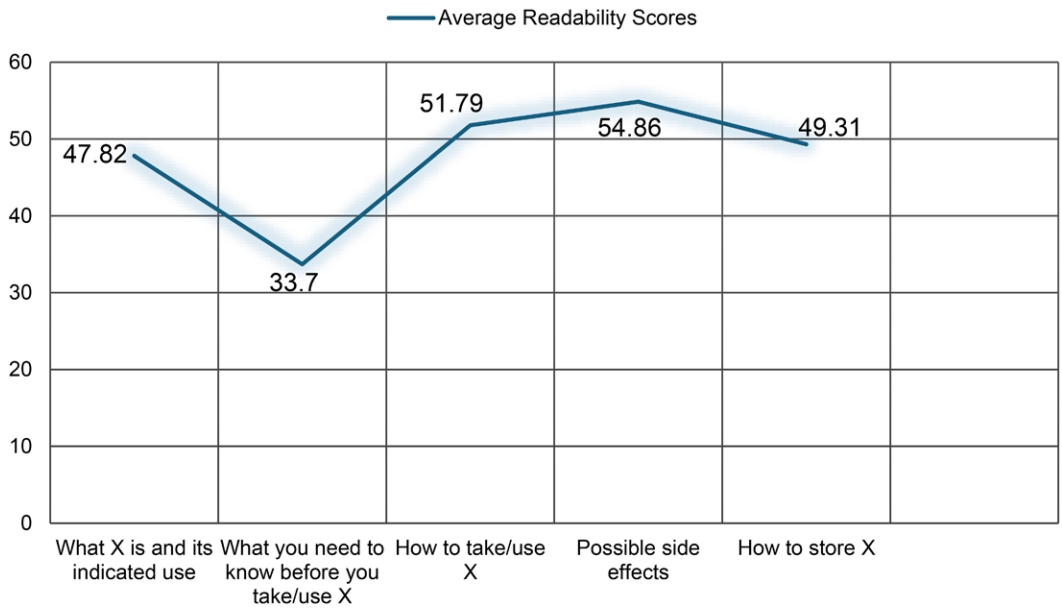

Figure 2. Average readability of leaflet sections.

under the section "What you need to know before you take/use X" with a score of 33.7.

4. Discussion

The Ateşman Readability Formula is the Turkish adaptation of the Flesch Reading Ease formula. It calculates a readability score between 1 and 100, based on the average sentence length (in words) and average word length (in syllables). These scores were used to determine whether a text was very easy, easy, average difficulty, difficult, or very difficult to read. The formula is strong in terms of its compatibility with the structural features of the Turkish language, ease of implementation, and widespread use in education, media, and public texts. However, it has limitations such as not accounting for semantic complexity, contextual clues, graphical/diagrammatic support, and user experience. It was not originally developed in the healthcare field as a text-specific assessment tool. Nevertheless, it has been effectively applied to patient information texts concerning conditions such as acute rheumatic fever,[42] amblyopia,[43] breast cancer,[44] congenital hearing loss,[45] diabetes,[46] laryngeal cancer,[47] and varicose veins,[48] as well as to consent forms

related to emergency interventions,[49] cardiovascular surgery,[50] oral and maxillofacial surgery,[51] and urology and general surgery.[52] Since English-specific formulas such as Gunning Fog Index, Simple Measure of Gobbledygook, and Flesch-Kincaid cannot be directly applied to Turkish, the Ateşman Formula, which aligns with the structural characteristics of the Turkish language, was preferred in this study. In this study, 26 pharmaceutical leaflets randomly selected from the official website of the Turkish Medicines and Medical Devices Agency of the Republic of Türkiye Ministry of Health were examined for readability. Pharmaceutical leaflets were prepared to ensure that the medication is used safely and effectively by patients. Therefore, it is crucial that these documents be easily readable and understandable by users. The findings obtained from this study reveal that the majority of the examined leaflets fall within the "very difficult" and "difficult" readability levels. These results are consistent with those of previous studies. For instance, in a study[53] conducted on leaflets related to hormone replacement therapy and birth control pills, it was determined that all of the samples were categorized as "difficult" or "very difficult." In a similar study conducted in Qatar, the average Flesch Reading Ease score of patient information brochures related to antidiabetic medications was found to be 37.71, which corresponds to a "difficult" level. The readability level of these brochures is emphasized as directly affecting individuals' health decisions.[2]

A comprehensive study conducted in the United States found that 2585 patient information materials published in high-impact medical journals were written at a reading level well above the recommended 6th to 8th-grade level.[54] This situation complicates the public's ability to understand these materials and effectively use the health information provided. Indeed, the complexity of the language used in health communication hinders individuals' access to health information and makes it difficult for them to correctly interpret and apply this information.[55] In this context, it is highlighted that pharmaceutical leaflets should be prepared in a clearer language, considering the characteristics of the target audience.

Another issue frequently emphasized in the literature is the potential negative impact of the complexity of the language used in pharmaceutical leaflets on public health. The density of medical terms and the use of long sentence structures in patient information texts negatively affects readability.[56] The current study supports these findings, showing that the sentences in the leaflets are generally composed of an average of 14 words and 3-syllable words. Another study revealed that individuals with low health literacy had difficulty understanding both prescription and over-the-counter pharmaceutical leaflets.[57] This once again underscores the limiting effect of the complex structures in leaflets on access to information.

Significant differences in readability were observed between different sections of the leaflets. The sections titled "What X is and its indicated use" were classified at the "difficult" level with an average score of 47.82. The word lengths in this section range from 2.66 to 3.27, while sentence lengths vary between 8.67 and 20.33 words. These structures complicate the reader's understanding. Similarly, the explanations under the heading "What you need to know before you take/use X" were found to be at the "difficult" level, with an average score of 33.7. The average sentence length in this section reaches 15.42 words, and word lengths were also at higher levels. These findings emphasize the importance of using simple, clear, and understandable language in health communication. The section titled "How to take/use X" was considered less challenging, with explanations rated at the "average difficulty" level, with an average score of 51.79. This suggests that the explanations were written in a simpler language, allowing readers easier access to the information. A similar trend was observed under heading "Possible side effects." This section was rated "average difficulty," with an average score of 54.86. It was emphasized that the explanations in this section should be simplified to reduce concerns regarding the treatment process. Otherwise, complex explanations can lead to misunderstandings by patients or prevent them from using medications correctly. Finally, the sections under the heading "How to store X" were rated as "difficult" with an average score of 49.31, with high word and sentence lengths standing out. In particular, for elderly individuals and those with reading difficulties, it is crucial to simplify this information.

This study provides a readability assessment solely at the textual level, and the high readability scores obtained do not provide direct evidence that users fully comprehend the text. In future research, employing methods such as comprehension tests conducted with users or eye tracking analyses may offer more in-depth and holistic insights into the relationship between readability and understanding. Overall, these findings suggest that the language used in pharmaceutical leaflets does not meet the target audience's understanding and application capacity. In societies with low health literacy, particularly in developing countries, the importance of using clear and simple languages becomes even more critical.[58] In this context, simplifying the language of pharmaceutical leaflets with the contributions of health communication and language education experts will contribute to improving both individual and societal health outcomes. Moreover, promoting the use of simple and understandable language is an important step toward increasing overall health literacy. Accordingly, it is recommended that alternative versions of drug leaflets composed of simplified and more accessible content be developed to ensure that patients with low literacy levels can understand them. The effectiveness of such materials can be further enhanced by incorporating supportive elements such as visuals, diagrams, and icons. Collaboration between language experts and public health professionals is essential to ensure that the content is accurate, clear, and suitable for the target audience. Additionally, leveraging digital tools to design interactive leaflets is considered a promising strategy to improve users' access to information and enhance their comprehension.

Therefore, the results of this study serve as an important guide for health professionals, pharmaceutical manufacturers, and regulatory bodies. By ensuring the accurate transmission of information through effective health communication, individuals' health behaviors are positively influenced, and their access to healthcare services is facilitated.

Author contributions

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