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**The Use of Interactional Metadiscourse Markers in the Results
and Discussion Sections of Algerian Scientific Research Articles**

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Dedication

I dedicate this work to the greatest parents on earth, Cherif and Zohra, who enlighten my life with their love. They have always encouraged me to give my best in all domains. Without their support, I would be unable to achieve anything in my life.

To my sweet sister Manal, my lovely brothers Yanis and Amir

To my little cousins Elyana, Chanez and Juba

To dear Samy for his patience, help and encouragements

To all my friends

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Abstract

The present study aims at exploring the use of Interactional Metadiscourse Markers in the Results and Discussion sections of twenty (20) Algerian Scientific Research Articles. Four objectives have motivated our research. The first objective is to investigate whether all the five categories of Interactional Metadiscourse Markers are used in the Results and Discussion sections of Algerian Scientific Research Articles. The second objective is to explore what type of Interactional Metadiscourse Markers is mostly used in the Results and Discussion sections of Algerian Scientific Research Articles. The third objective is to examine whether the Algerian writers are aware of the importance of the use of each category of Interactional Metadiscourse Markers in the Results and Discussion sections of scientific papers. The last objective is to see whether all the Interactional Metadiscourse Markers that occur in the Results and Discussion sections of Scientific Research Articles are used effectively by Algerian scientific writers. In order to meet the objectives of the study, Hyland's (2005) metadiscourse framework is adopted. The data are gathered from twenty (20) Results and Discussion sections extracted from Algerian Scientific Research Articles, and from a structured interview conducted with four authors of the articles. As far as data analysis is concerned, a mixed method combining both qualitative and quantitative methods is adopted. The qualitative data are analyzed using Qualitative Content Analysis (QCA) while the Excel is used to analyze the quantitative ones. Our research findings reveal that all the five categories of Interactional Metadiscourse Markers are used in the Results and Discussion sections of Algerian Scientific Research Articles. However, the frequency of the use of each category differs as the most frequently used category is boosters followed by hedges, attitude markers, then self-mentions and finally engagement markers. In fact, the results demonstrate that the Algerian writers are aware of the importance of using some categories of Interactional Metadiscourse Markers, mainly, boosters, hedges and attitude markers; however, they lack awareness in using self-mentions and engagement markers. Finally, the results of the current study show that not all the Interactional Metadiscourse Markers that occur in the corpus are used effectively as many markers have been overused to express either certainty or uncertainty, which may have a negative impact on the credibility of the work, in addition to the misuse of self-mentions and engagement markers.

Key terms: Academic writing, Algerian Scientific Research Articles, Metadiscourse, Interactional Metadiscourse Markers, Results and Discussion sections.

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List of abbreviations

- ALJEST: Algerian Journal of Environmental Science and Technology.
- ASRAs: Algerian Scientific Research Articles.
- ASJP: Algerian Scientific Journal Platform
- IMMs: Interactional Metadiscourse Markers.
- MMUTO: Mouloud Mammeri University of Tizi-Ouzou.
- QCA: Qualitative Content Analysis.
- RAs: Research Articles.
- RDSs: Results and Discussion sections.
- SCRP: Scientific Research Publishing.
- SFG: Systemic Functional Grammar.
- SRAs: Scientific Research Articles.

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Statement of the Problem

Academic writing has always had a central role in the academics. It is thought about as a never-ending task since writing is one of the four main skills of language learning. Therefore, proficient writers argue that an effective writing involves, amongst other things, developing the audience's awareness and the ability to reflect and exploit that awareness in the way the text is written (Thompson, 2001). Put another way, in order to write an effective text, the audience's knowledge should be stressed as well as their ability to grasp the new knowledge that they will receive.

Academic writers should include, in any text, the use of a suitable language in an organized, sequential, and logical manner that affects the audience in a positive way by employing different linguistic resources. Among these resources, academic writers stress the importance of employing metadiscourse analysis in order to well organize their writings and explain the writer's point of view with regards to either the content or the reader (Hyland, 2000). Metadiscourse implies paying attention to the ways writers project themselves into their discourse to signal attitudes and commitments towards both the content and the audience of the text.

Metadiscourse, therefore, is an important feature of communication that seeks to skillfully distinguish opinion from fact in order to obtain a more panoramic view of the use of these writing strategies (Bailey, 2011). According to Hyland (2005) metadiscourse is a term advocated by Harris (1959) and has been developed by writers such as Vande Kopple (1985) and others. It is a concept that has generated an increasingly growing interest as it is conceived as essential for building writer-reader relations. As a linguistic device, it is significant to academic researchers, particularly writers of academic articles in that it strengthens their arguments and claims and improves the credibility of the text. Besides establishing interpersonal relations, which seek to drag the reader into the

discourse. The writer attempts to build a relationship with the reader and include him or her in the text, such as the use of the inclusive *we*. It is therefore widely used in current discourse analysis, pragmatics, and language teaching.

Admittedly, two dimensions of metadiscourse markers are introduced by Hyland and Tse (2004): *the interactive* and *the interactional* dimensions. They refer to the organization of the discourse and to the aspects that develop the relationship between the reader and the writer i.e., how the writer addresses the reader and how he or she expects the reader to respond.

The present study aims at identifying the use of Interactional Metadiscourse Markers (IMMs) in the Results and Discussion Sections (RDSs) of Algerian scientific research articles(ASRAs). After consulting a set of investigations that have explored the use of metadiscourse in academic fields, it has been noticed that there are many studies which have investigated this issue. For the sake of illustration, we have chosen different resources; first, a study conducted by Bouchemet in 2019, in Mentouri University in Constantine, Algeria. The research investigated the distribution of interactional metadiscourse in Algerian students' master dissertations' Introduction and Conclusion sections. In addition, it explored the differences in using these features. The research reveals that the distribution of the interactional features differs in the two sections.

Hussein, Khalil, and Abbas conducted a research in 2018 at the University of Baghdad in Iraq. This research aimed at comparing the usage of types and subtypes of metadiscourse markers by non-native Iraqi female students and native American female students. The study indicated that the American and the Iraqi female researchers use more interactive resources to present the abstract sections of their dissertations than interactional ones. However, the American students could engage their readers since their use of the IMMs was higher than their counterparts.

The last research is conducted by Yunik, Fabiola and Suharsono (2017) in the state of Surabaya, Indonesia. This work aimed at investigating the use of interactional categories of metadiscourse in the introduction sections of two dissertations written by more and less proficient writers graduated from a doctorate program. The results showed that the more proficient writers employed more variations of IMMs than the less proficient writers.

Evidently, metadiscourse is present in different fields and disciplines and it is studied from different standpoints. However, few researchers have investigated the use of IMMs in the RDSs of different Scientific Research Articles (SRAs). The RDSs are considered to involve an extensive reader-writer interaction. They enable the writer to get the attention of the audience as his or her first concern is to persuade the reader as well as the examiner to view the effectiveness of the research and the writer's perspectives (Thompson, 2013). For this reason, the use of metadiscourse markers is indispensable for expressing the reader-writer interaction.

As regards the English department in MMUTO, no previous works have tackled metadiscourse from any perspective. This field of research should receive much attention since metadiscourse is considered as a significant linguistic resource that seeks to organize any discourse in order to help both students and teachers reach proficiency in academic writing and mutual understanding. Consequently, this is an opportunity to implicate it to the library of our department as an important scientific and pedagogical reference.

Aims and Significance of the Study

The aim of the present study is to shed light upon the use of Interactional Metadiscourse Markers in the Results and Discussion sections of twenty (20) Algerian scientific research articles chosen from two different journals drawing on Hyland's

(2005) metadiscourse framework. The following objectives are addressed to form the purpose of this study:

- 1- To investigate whether all the five categories of Interactional Metadiscourse Markers are used in the Results and Discussion sections of Algerian Scientific Research Articles.
- 2- To explore what type of Interactional Metadiscourse Markers is mostly used in the Results and Discussion sections of Algerian Scientific Research Articles.
- 3- To examine whether the Algerian writers are aware of the importance of the use of each category of Interactional Metadiscourse Markers in the Results and Discussion sections of Scientific Research Articles.
- 4- To analyze whether all the Interactional Metadiscourse Markers that occur in the Results and Discussion sections of Scientific Research Articles are used effectively by Algerian scientific writers.

Research Questions and Hypotheses

- Q1. Do all the categories of Interactional Metadiscourse Markers occur in the Results and Discussion sections of Algerian Scientific Research Articles?
- Q2. What type of Interactional Metadiscourse Markers is mostly used in the Results and Discussion sections of Algerian Scientific Research Articles?
- Q3. Are the Algerian writers of Scientific Research Articles aware of the importance of the use of each category of Interactional Metadiscourse Markers in the Results and Discussion sections?
- Q4. Do the Algerian writers of Scientific Research Articles use all the Interactional Metadiscourse Markers that occur in the Results and Discussion sections effectively?

Correspondingly, and in response to the proposed questions, the following hypotheses are raised:

- H1. Not all the five categories of Interactional Metadiscourse Markers occur in the Results and Discussion sections of Algerian Scientific Research Articles.
- H2. Boosters is the most frequently used category in the Results and Discussion sections of Algerian Scientific Research Articles.
- H3. The Algerian writers of Scientific Research Articles are aware of the importance of the use of each category of Interactional Metadiscourse Markers in the Results and Discussion sections.
- H4. Algerian writers of Scientific Research Articles use all the Interactional Metadiscourse Markers that occur in the Results and Discussion sections effectively.

Research Techniques and Methodology

The present study is a corpus-based research that aims to investigate the use of IMMs in the RDSs of ASRAs in order to explore the use of these markers in the scientific fields such as chemistry, microbiology, and agronomy. The mixed methods approach is adopted in order to carry out our research, which is a combination of both the quantitative and the qualitative methods. Hyland's (2005) interpersonal metadiscourse checklist is used to classify metadiscourse markers with the aim of gathering quantitative data. In addition to that, a structured interview is conducted with the authors of the scientific articles in order to obtain qualitative data.

As regards the corpus, it is composed of twenty (20) RDSs extracted from ASRAs. They are written by Algerian authors from different scientific domains. The articles are collected from three credible research journals named Algerian Journal of Environmental Science and Technology (ALJEST), the Algerian Scientific Journal Platform (ASJP), and finally, an academic publisher of journals called Scientific Research Publishing (SCRIP). As far as data analysis is concerned, the quantitative data are analyzed

using the Microsoft Excel, while the qualitative data are analyzed using Qualitative Content Analysis (QCA).

The Structure of the Dissertation

The current research aims to reach specific objectives by following the traditional simple model, which embraces a General Introduction, four chapters and a General Conclusion. The General Introduction attempts to give a general inspection of the research that enables the readers to better understand the topic of investigation and its main objectives. The first chapter; Literature Review, delineates the main concepts and provides a brief review on empirical studies in relation to the current research, besides the adopted theoretical framework. Subsequently, the second chapter, which is a Methodological section, presents the research design, the research sample, and the procedure of data collection as well as the data analysis. The third chapter, called Presentation of the Findings is intended to present the results obtained from the conducted study. Accordingly, the Presentation of the Findings is followed by the last chapter named Discussion of the Findings, in which the outcomes are analyzed, discussed, and interpreted. Last and not least, the dissertation ends with a General Conclusion which is a summary of the key findings, implications of the findings and recommendations for further studies.

Introduction

This chapter is intended to review the relevant literature related to the current research, which investigates the use of IMM in the RDSs of ASRAs. It begins with a brief overview of the concept of metadiscourse, then its definition according to different scholars. It then tackles other important notions related to the theme under study, which are academic writing and its relation to metadiscourse, as well as the concept of genre. It then introduces research articles, scientific research articles and the presence of English Language in Algeria as key concepts of the present study; in addition to defining the RDSs and the role of metadiscourse. Furthermore, the chapter presents some of the well-known classifications provided by various scholars. The last part of the chapter concerns the theoretical framework on which this research is based.

1.1 A Brief Overview of Metadiscourse

Language is communicated in different ways and purchases different purposes. This urges the speaker, or the writer to adopt specific strategies to convey his or her point of view. Academic writers then, present certain data by taking into consideration the reader's needs and expectations and by making themselves visible in the text in order to explicitly involve the audience into the text and this process can be found in the form of metadiscourse (Dahl, 2004, cited in Malec and Rusinek, 2015).

Metadiscourse is a new concept in the fields of discourse analysis and language education. It is an important feature of communication which is mainly used to help readers understand the intended meaning of the text. The concept is first coined by Harris (1959) who believes that metadiscourse depicts the way of understanding language in use representing the writer's intention to guide the reader's perception of texts (Hyland, 2005). Researchers have afterwards developed the concept and have come up with different approaches to defining it. Among the most prominent researchers elaborating on the notion

of metadiscourse are the following authors: Williams (1981), Vande Kopple (1985), Hyland and Tse (2004), Hyland (2005) and Halliday (1994).

Metadiscourse has started from a functional perspective on language by referring to the Hallidayan Systemic Functional Grammar (SFG) (Ädel, 2006). In his approach, Halliday (1994) believes that the speaker communicates with messages that integrate expressions of three different kinds of meaning: ideational, interpersonal, and textual. According to Halliday (1973), the three metafunctions bring cohesion to discourse and give expression to people's experiences and show interaction with the audience. The ideational function is concerned with *"the expression of either or both the external or the internal world of our own consciousness"* (ibid: 66), for example, *Lactose is found in a cow's milk and in milk of other animals*. This statement provides only propositional content. The interpersonal function helps writers express their personalities and attitudes towards ideational material, for example, *doubtlessly, lactose is found in a cow's milk and in milk of other animals*. In this statement, the author shows his or her stance. Finally, Halliday (1973) claims that the textual function is about the way the ideational materials are cohesively related to the text, for example, *Lactose is found in not only cow's milk, but also in milk of other animals*. In this statement the author employs cohesive devices to bring more meaning to the statement.

The Hallidayan model is one of the most prominent interpretations of metadiscourse due to the fact that many scholars followed the three macro-functions in defining the concept of metadiscourse and this model has become known as the *"SFG-inspired model"* (Ädel, 2006:16).

1.2 Definition of Metadiscourse Markers

The term metadiscourse markers is adopted and developed by several analysts. The SFG-inspired model defines the notion of metadiscourse markers as *"The linguistic items which explicitly serve (either or both) of the interpersonal or textual functions and not serving*

the ideational function which views language as reflecting experience and logical reaction” (Ädel,2006:16) i.e., metadiscourse realizes one or two of the meta-functions proposed by the SFG theory. The interpersonal function shows the presence, the attitude and the personality of the author in the discourse. The textual function involves the reader into the text in order to organize the discourse. Therefore, the two functions are used to encode both the reader and the writer’s interaction and bring coherence and organization into the text.

Williams discusses the notion as writing that guides the reader and ‘*discourse about discourse*’ (Williams, 1981, cited in Crismore, 1983). He means that the writer introduces the primary discourse then embeds it with metadiscourse which is the second level of discourse in order to lead the reader through the text, for example ‘*the patient might be diagnosed with tuberculosis*’, the word *might* is a metadiscourse marker which leads the reader to understand the uncertainty of the information. Moreover, he states that metadiscourse is “*writing about writing whatever does not refer to the subject matter being addressed*” (ibid: 03). In fact, Williams (1981) deals with the notion from the perspective that all that is informational about the primary discourse is conclusively not metadiscourse and all that is devoted to help the reader understand the writer’s intended meaning is metadiscourse. For example, *we are running out of coffee*. The first example provides only informational content. *Actually, we are running out of coffee*. The second example helps the reader to confirm that the first statement is true.

Vande Kopple (1985) introduces metadiscourse as “*The linguistic material which does not add propositional information, but which signals the presence of an author*” (VandeKopple1985, cited in Hyland, 2005:18). In other words, it conveys the meaning beyond the primary proposition to show the author’s touch that’s aim is to lead the readers through the text. By the same token, Crismore (1983:02) has also presented metadiscourse as

“the author’s discoursing about discourse; it is the author’s intrusion into the discourse, either explicitly or non-explicitly to direct the reader rather than inform”. In fact, she believes that metadiscourse is text written namely about the primary discourse, which means that it is the strategies used to organize the text and engage the audience in the discourse. She has subsequently collaborated with many other researchers among them Markannen and Steffensen (1993) and has raised another definition.

Crismore et al. (1993) state that metadiscourse is *“the linguistic material in texts, either written or spoken, which does not add anything to the propositional content, but that is intended to help the listener or reader organize, interpret, and evaluate the information given”* (ibid:40). In this sense, they tend to separate metadiscourse from the ideational content of the text seeing that it does not affect the meaning of the text, but only serves control the understanding of the reader.

The definition has been further developed, Hyland and Tse (2004) claim that metadiscourse is a self-reflective linguistic device that writers employ throughout the text to refer to the text itself and to the writer’s arguments that shape the imagined readers’ needs and expectations, as well as the author’s attitudes and personality.

Metadiscourse brings coherence, intelligibility and credibility to the propositional content. In this perspective, metadiscourse is used to look beyond the ideational dimensions of texts to maintain the writer’s position and standpoints as well as to make the relationship that links both the author and the message and the author and the reader evident, as well as to make the readers involved in the text in a way that they could be able to obtain simplified and accessible meanings. Hyland (2005) states that the concept of metadiscourse refers to how writers connect into their texts to express their perspectives, stances and essentially their presence in order to involve the audience into the text to create an operative and effective social interaction.

For this purpose, Hyland (2005:37) reports “*Metadiscourse is the cover term for the self-reflective expressions used to negotiate interactional meanings in the text, assisting the writer (or speaker) to express a viewpoint and engage with readers as members of a particular community*”. This definition is considered to be different from the other definitions in the sense that it emphasizes the interpersonal meaning and stresses the relationship built between the writer and the text and the writer and the audience. In addition to that, it allows the author to establish a social engagement and make a particular impression and impact. For example, if an author writes an expression such as, *in the previous chapter, you may notice that*. He or she addresses the readers in order to engage them in the discourse to influence their opinion about what the writer claims.

1.3 Metadiscourse in Academic Writing

As it is already mentioned above, metadiscourse is an essential means of interaction used by authors to convey particular attitudes and beliefs to a particular audience. It is therefore important to academic writers since it helps them achieve a successful communication and enables the interlocutors to succeed in following the development of the text (Hyland, 2004). For instance, *the rise of consumption has had a significant impact on the market*. This example shows that, the author expresses his or her attitude towards the argument and communicates the importance of the claim by using the adjective *significant* in order to guide the reader through the text.

Academic writers tend to preserve their style of writing in order to attract readers. They use a reliable and simple language to communicate cohesive and intelligible ideas using metadiscourse markers. These markers strengthen the writer-reader interaction and establish a well-organized discourse, as well as contribute to hold together the different parts of the text. Inevitably, eliminating metadiscourse from a text would make it difficult for writers to convince the readers with the reliability and cohesion of the text.

1.3.1 Academic Genre

Academic writers tend to use language to package their thoughts and experiences in order to present them to a particular audience. Every author has his or her own style of writing and transmitting knowledge through different genres of writing. Metadiscourse studies give a great deal of importance and focus on different academic genres such as research articles, textbooks and dissertations (Hyland, 2005) and postgraduate dissertations (Swales, 1990). Therefore, the focus on the evolution and production of each genre demands the focus on the utilization of metadiscourse. Metadiscourse helps both writers and readers in following the very detailed information in order to get in touch with the pragmatic aspects of the text. In addition, it contributes in achieving the communicative purpose and facilitating the study of different academic genres (Hatipoglu et al. 2017).

Genre is an area of study that evolves through the evolution of discourse analysis. It is considered as a key concept in modern thought (Hyland, 2004). As with any developing field, genre is defined from different researchers, Swales (1990: 58) definition of the concept of genre:

A genre comprises a class of communicative events, the members of which share some set of communicative purposes. These purposes are recognized by the expert members of the parent discourse community, and thereby constitute the rationale for the genre. This rationale shapes the schematic structure of the discourse and influences and constrains choice of content and style. Communicative purpose is both a privileged criterion and one that operates to keep the scope of a genre as here conceived narrowly focused on comparable rhetorical action. In addition to purpose, exemplars of a genre exhibit various patterns of similarity in terms of structure, style, content and intended audience.

Swales (1990) separates the concept into different components; he states that for a discourse to be from a particular genre it must comprise the above-mentioned criteria, yet the communicative purpose is the most important criterion used to distinguish one genre from others. Another definition is that of Hyland (2004:04) “Genre is a term for grouping texts together, representing how writers typically use language to respond to recurring situations”. In broader context, the notion of genre has to do with the different classes of texts

that involve given communicative events that are structured and organized with respect to particular communicative purposes. It is used to comprehend the ways in which individuals use language to represent particular ‘*communicative situations*’ (ibid: 07). As Hyland sums up “*genres are resources for getting things done using language: they represent a repertoire of responses that we can call on to engage in recurring situations*” (ibid:01).

1.3.2 Research Articles

The research article genre plays an essential role in academic life (Swales, 1990). It remains the primary genre that authenticates knowledge and preserves academic studies. According to Bazerman (1988) and Swales (1990), the research article genre has received tremendous attention from different researchers of different fields of study due to its widely accepted role of presenting knowledge (Pho, 2013). Swales (1990: 93), defines a research article as:

A written text (although often containing non-verbal elements) usually limited to a few thousand words, that reports on some investigation carried out by its author or authors. In addition, the research article will usually relate the findings within it to those of others and may also examine issues of theory and /or methodology. It is to appear or has appeared in a research journal or, less typically, in an edited book-length collection of paper.

In a broader perspective, a research article is a piece of writing that aims at making new knowledge, by which writers engage with their audience taking into consideration their expectations and cognitive competences as well as their social and affective elements (Hyland, 2005). This shows another interesting side of a research article that is it focuses on more than just the ideational dimensions of texts. As stated by Douglas and Conrad (2009:126) “*a research article must contribute new knowledge to the field and convince other experts that this knowledge has scientific merit*”. In other words, research articles are intended to a particular audience that shares the same category and field of research as that of the author of the article and have background knowledge of the area of study. Naturally, the main aim of a research article is to find answers to specific questions

related to an investigation and bring new data in order to persuade the readers of the reliability of the research and its findings as well as its trustworthiness and significance in relation to the topic. The persuasion is perceived throughout the different sections of the whole article which is ordinarily composed of an abstract, succeeded by four major sections (Introduction, Methods, Results, and Discussion) and finally a conclusion. Every section has its own communicative goals and persuasive purposes that make the claims more valid. As for the Introduction section, the author convinces the audience of the worthiness of the investigation; in the Methods section, the writer persuades the readers that the data are well-processed; after that, the Result section seeks to show that the statistics are useful and significant; at last, in the Discussion section, the author convinces the readers of the validity and the authenticity of the findings of the study (Hunston, 1994; cited in Pho, 2013).

1.3.3 Scientific Research Articles

According to Hyland (2005), scientists provide data that might be criticized from other scientific writers as a method of communicating knowledge and raising critical questions that contribute to science and creativity. Day (1983:01) states that a scientific research article is “*a written and published report describing original research results*”. Essentially, a scientific research article is based on empirical evidence; that is, it brings new information to the field of research. As it is clearly stated by Hyland (2005:90) “*It is in research articles that writers exhibit both the relevance and the novelty of their work to colleagues*”.

1.3.4 Algerian Scientific Research Articles written in English

The presence of the English language in Algeria has been increasing over time. It is used as an instrument for scholarship and research. In fact, 48% of the national projects published between 1998 and 2003 in Algeria were published in English (Slougui, 2009; cited in Belmihoub, 2018). Therefore, Belmihoub (2018) claims that Algerian scientists produce most of their research articles in English. In addition, many scientific research institutions are

established to support the Algerian research and the majority makes great use of English language in their productions such as the Institute of Electrical and Electronic Engineering in Boumerdes. Consequently, English language has developed to be the language of research in Algeria.

1.3.5 Results and Discussion Section of a Research Article

A great deal of studies tend to focus on one or two individual sections of the research article which are either or both “*the Introduction section (Swales, 1981), or the Discussion section (Holmes, 1997; Peacock, 2002)*” (Pho, 2013:04). The description of the sections of scientific research articles: Introduction, Methods, Results and Discussion has attracted the attention of analysts, and has become an entrenched convention in traditional scientific disciplines (Douglas and Conrad, 2009). Every section has its specific communicative purpose that enables the readers to comprehend what the research stands for and what kind of information it is looking for to enrich the existing knowledge of the intended audience. In the RDSs, the writer should show and discuss every detail of the findings and should be interpretative and not descriptive in order to increase the reliability of the study. Our study gives more importance to the RDS since it seeks at effectively showing and interpreting the results of the research and arguing their significance.

1.3.6 The Role of Metadiscourse in Results and Discussion Sections

The RDS is considered as the most attractive part of any research article. It contains extensive writer-reader interaction due to the fact that the author provides his or her audience with the results of the investigation, and presents them with an interpretative and persuasive manner. The new data give birth to different reactions of the academic community. Thus, the choice of language is extremely important to ensure the construction of the interaction between the reader and the writer as well as to convince the readers of the significance of the study. Metadiscourse plays a great role in maintaining coherent arguments. That is to

say, metadiscourse markers are needed to convey the writer's claims and perspectives. They are used to guide the readers through the text, and help them capture the meaning of the discourse. As clearly stated by Hyland (2005), metadiscourse is conceptualized as the device that writers use to organize discourse and engage readers in the text. It is also used to "*help readers organize, interpret, and evaluate the information given*" (Crismore et al.: 40). This is exactly what the RDS demands.

1.4 Classification of Metadiscourse

The Hallidayan tripartite conception of meta-functions has inspired linguists in the field of metadiscourse to adopt the idea of the interpersonal and the textual functions in defining metadiscourse (Ädel, 2006). Therefore, researchers such as Williams (1981), Vande Kopple (1985), Crismore et al. (1993), and Hyland (2005) have developed the term of metadiscourse markers and have classified them according to the functions they perform in a text (Malcikova, 2011, cited in Malec and Rusinek, 2015).

1.4.1 Williams' Classification

Williams (1981) divides metadiscourse markers into three classes (Crismore, 1983: 7-8):

- 1) Hedges and Emphatics:** show the certainty and the uncertainty of the statements: apparently, seemingly, of course, as everyone knows.
- 2) Sequencers and Topicalizers:** guide the readers through the text: in the next section, it is my intention to discuss the problem of, in regard to, in the matter of, turning to.
- 3) Attributors and Narrators:** this class is concerned with the textual function of Halliday's framework. It informs the readers of how the text is created, where the information come from, and narrates the writer's ideas and opinions: observed, seen, so I attempted to, I was concerned with.

1.4.2 Vande Kopple's Classification

Vande Kopple (1985, cited in Hyland, 2005) has also been influenced by Halliday's theory of language and adopts it totally by dividing metadiscourse into textual and interpersonal. He believes that interpersonal metadiscourse helps the author show his or her personality towards the ideational content to build a relationship with the reader. On the other hand, textual metadiscourse is about relating the different parts of the text in order to create a cohesive and coherent text (Hyland, 2005).

Hence, Vande Kopple (1985, cited in *ibid*:32) categorizes metadiscourse markers into two main categories which are further divided into different subcategories:

1. Textual metadiscourse: it comprises three subcategories: a) text connectives containing: sequencers, logical or temporal connectives, reminders, announcements and topicalizers which make the discourse coherent such as, first, next, however, as I noticed in chapter one, in regards to; b) code glosses help the readers understand the text such as, in other words, that is; c) illocution markers '*make explicit to our readers what speech or discourse act we are performing in texts*' (*ibid*) such as, we claims that, to sum up.

2. Interpersonal metadiscourse: Helps the author establish relationships between both the text and the readers. It comprises four subcategories: a) validity markers containing: hedges, emphatics and attributers which show the writer's degree of commitment towards the propositional content such as, perhaps, might, clearly, it is obvious; b) narrators which inform about who said something such as, according to; c) attitude markers that show the writer's attitude towards the propositional content such as, surprisingly; d) commentary which is used to address readers directly such as dear reader, you may.

VandeKopple's classification is more developed compared with the other taxonomies. It is considered as the first model to trigger a great deal of practical studies and the most influential one as it is adopted by many other scholars, among them Crismore et al.

(1993). However, the categories are vague and functionally overlap, that is they are difficult to apply in practice; as illustrated by the difficulty in distinguishing between narrators and attributors, especially in academic writing (Hyland, 2005) and contain some limited sorts.

1.4.3 Crismore, Markannen and Steffensen's classification

Crismore, Markannen and Steffensen (1993) have performed a cross-cultural study of metadiscourse in persuasive texts written by American and Finnish university students (Aguilar, 2008). VandeKopple's taxonomy has been retained, "*refined and amended*" (Hyland, 2005:33) by Crismore et al. (1993) who has adopted the two main notions of textual and interpersonal metadiscourse in order to separate organizational and evaluative functions. Textual metadiscourse is divided into textual and interpretive markers; which are used in organizing the text to make it coherent and comprehensible; each of the categories is divided into various subcategories which are typically the same as VandeKopple's, but placed in different categories (textual and interpretive).

On the other hand, Interpersonal metadiscourse adopts VandeKopple's markers by either adding new classes such as *certainty markers* or dropping existing classes such as *emphatics and narrators*.

Category	Function	Example
Textual metadiscourse		
1. Textual markers		
-Logical connectives	-Connecting ideas	-Therefore, in addition
-Sequencers	-Indicate sequence	-First, next
-Reminders	-Refer to earlier text material	-As we saw in chapter one
-Topicalizers	-Indicate a shift in topic	-Well, now we move to
2. Interpretive markers		
-Code glosses	-Explain text material	-For example, that is
-Illocution markers	-Name the act performed	-In sum, I predict
-Announcements	-Announce material	-In the next section

Interpersonal metadiscourse		
-Hedges	-Show uncertainty	-Might, possible
-Certainty markers	-Show full certainty	-Certainly, know
-Attributors	-Inform and give source	-Smith claims that...
-Attitude markers	-Show the author's values	-Surprisingly, I hope
-Commentary	-Build relationship with readers	-You may not agree...

Table 1: Crismore et al.' categorization of metadiscourse (1993: 47-54)

Crismore et al. (1993) model is a revised version of VandeKopple's(1985) taxonomy; however, some ambiguities remained (Hyland, 2005). Hyland (ibid) claims that dividing textual metadiscourse into two categories that are supposed to account for the textual role of metadiscourse has no need since all the markers that convey textual function have already been proposed by VandeKopple.

1.5 Presentation of the Theoretical Framework

Our research is based on Hyland's (2005) interpersonal model of metadiscourse, which is considered as one of the most comprehensive and explicit frameworks designed for academic discourse, as well as the most correct and accurate compared to previous studies. Hyland (2005:37) claims, "*I propose a more theoretically robust and analytically reliable model of metadiscourse*".The main aim of this framework is to help writers establish an interactional milieu in their texts by guiding and involving their audience into the text.

The previous classifications of metadiscourse have adopted the Hallidayan tripartite conception of meta-functions; however, Hyland (2005) rejects the traditional views, i.e., the textual-interpersonal categories and points out to problems that VandeKopple's taxonomy poses. He then reports that metadiscourse is the cover term for the self-reflective expressions used to negotiate interactional meanings in a text, assisting the writer (or speaker) to express a viewpoint and engage with readers as members of a particular community.

1.5.1 The Key Principles of Metadiscourse

The framework proposed by Hyland follows three key principles that help to identify metadiscoursal features (Hyland and Tse, 2004: 159-167):

1) Metadiscourse is distinct from propositional aspects of discourse: Definitions of metadiscourse come between what is called the communicative content of discourse, and the material used to transparentize the author's beliefs and organize the content of the text. Writers opt for particular ways of expressing their perspectives that shape their own expectations in their audience. Hyland (2005) believes that propositional content of the text is generally used to refer to information about external reality.

According to Hyland (ibid:23) "*Metadiscourse is an essential part of any text and contributes to the ways it is understood and acted upon; it is not a separate and separable set of stylistic devices that can either be included or not without affecting how a text is presented and read*". That is metadiscourse cannot be completely separated from propositional content since it is the means by which the propositional meaning is made coherent. Therefore, writers support the propositional meaning with metadiscourse markers to better convey their stances and attitudes and to present clear information to a particular audience (Hyland and Tse, 2004), for example (1) *Covid-19 is an infectious disease.* (2) *Covid-19 is clearly an infectious disease.* The first sentence gives propositional information only; however, the second sentence gives both propositional and metadiscourse meanings.

2) Metadiscourse expresses writer-reader interactions: This principle rejects the duality of textual and interpersonal functions and suggests that all metadiscourse is interpersonal and emphasizes the reader's knowledge, text experiences and processing needs. The transitions and links that conjunctions mark between clauses can be oriented towards either the experiential or the interpersonal, to either propositional or interactional meanings. For the sake of illustration, some examples are taken from Hyland's book (2005:42-46):

- 1- *A marketing research project is undertaken to help resolve a specific marketing problem but first the problem must be clearly defined* (Marketing textbook).
- 2- *The city is a great place to visit, but would you want to bank there?* (Advertisement)

The conjunctions *but*, *first*, *then* can function ideationally connecting ideas and statements as it is illustrated in the first example; as well as interactionally to engage the reader in the discourse, that is the interpersonal use of conjunctions as illustrated in the second example.

3) Metadiscourse distinguishes external and internal relations: The third principle refers to the distinction between internal and external references. An internal relation connects events in the account and is solely communicative, while an external relation refers to those situations themselves. Examples taken from (ibid):

a) *In contrast to Western culture, Asian societies put emphasis on an interdependent view of self and collectivism.* (Textbook)

a. *A travel-card makes it possible to visit all these sites in one day.* (London guide)

b) *In contrast, these findings were not found, among the low collectivists.* (Ph.D. dissertation)

It is possible that Strauss will also pull out of the tour to Zimbabwe this winter. (Newspaper)

In the example (a), *in contrast* compares the characteristics of two cultures, *possible* represents an outcome as depending on certain circumstances, so the two statements are propositional (external). In example (b), *in contrast* flags a disjunctive relation, alerting the reader to a move away from the expectancies set up by the prior text, *possible* comments on the writer's estimation of possibilities, the two statements express metadiscoursal functions (internal).

Hyland adopts the two dimensions proposed by Thompson and Thetela (1995); the interactive and the interactional features in order to organize and evaluate features of

interaction, the model takes a "*slightly wider focus than Thompson's by including both stance and engagement features of interaction*" (Hyland and Tse, 2004:168).

1.5.2 Interactive and Interactional Metadiscourse Markers

1.5.2.1 The Interactive Resources

According to Hyland (2005), the interactive resource of metadiscourse represents the author's consciousness of the audience's knowledge and his or her attempts to satisfy their needs and expectations through forming and constraining the text in a rational and argumentative way that involves the management of information flow, rather than expressing experience. These metadiscourse markers allow writers to explicitly express their views and beliefs to engage with the audience and help them correctly interpret the text (ibid). Hyland classifies interactive metadiscourse into five major categories (ibid:50-52):

1. **Transition markers:** These markers help readers interpret links between ideas and pragmatic connections.
2. **Frame markers:** are markers that provide text boundaries and framing information about elements of the discourse.
3. **Endophoric markers:** refer to other parts of the text in order to direct readers and steer them toward a preferred interpretation such as, as noted above.
4. **Evidentials:** expressions taken from another source used to provide support for arguments.
5. **Code glosses:** help readers grasp the propositional meaning and the writer's intended meaning by rephrasing, illustrating and explaining.

1.5.2.2 The Interactional Resources

The interactional metadiscourse is concerned with the readers' involvement in the text and the writers' attempts to explicitly express their views to enable the readers to deliver their arguments and reactions as well as to establish a particular relationship with them. These

features are more related to interpersonality as they control the level of personality in order to relate the readers into the discourse and give them an opportunity to contribute to it by alerting them to the author's perspective towards both the propositional content and the readers (ibid).

The aim of our study is to identify the use of the interactional dimensions in the RDSs of ASRAs. The interactional category is composed of five subcategories; where the first two subcategories express doubt and certainty which is considered as one of the most important strategies adopted in academic writing. While the rest of the categories express the writers' stance and their explicit presence. In addition, they are for engaging the readers as part of the discourse.

Hyland (1998) claims that expressing doubt and certainty cannot be disassociated from academic writing. This is because boosters and hedges enable writers to use English flexibly to convince the degree of assurance in the claims they raise. Academic writers should be cautious in making linguistic choices that convey precision and avoid exaggeration, which may provoke a negative defensive reaction in readers. However, in scientific statements the use of boosters faintly prevails over the use of hedges, because generally, scientific claims seek to persuade readers of the novelty and the accuracy of new data.

1- Boosters: are used to intensify and increase the authors' certainty and conviction in their claims. These markers allow writers to be direct in stressing the information they provide, and accentuate their position in an utterance in order to limit any alternative voices (Hyland, 2005). Boosters are expressed impersonally using expressions such as, beyond doubt, definitely, clearly, in fact. For example, *the covid-19 pandemic has definitely healed the mother earth from pollution*. The marker *definitely* makes the statement more convincing.

- 2- Hedges:** are known as the cautious language that writers use to express their willingness to negotiate claims by avoiding absolute commitment. These markers are used to soften the intensity of the claims. In addition, they express the writers' subjective stance towards the information they present as a strategy to convince the audience of the accuracy of the arguments. Hyland (1998:120) states, "*Writers employ a certain amount of doubt as an evidentiary justification*". Contrary to boosters, hedges open a dialogue to readers to form alternative views. The kind of expressions like perhaps, maybe and probably. For example, *there might be a positive side of the covid-19 pandemic*. The marker *might* here, expresses the uncertainty of the statement.
- 3- Attitude markers:** are the features that "*express the writer's affective, rather than epistemic attitude to propositions*" (Hyland, 2005:53) i.e., writers express their opinions, stance, or assessment in a proposition rather than providing only cognitive information. They are used to convey *surprise, agreement, importance, and obligation*, and they are expressed by attitude verbs: *agree, prefer*; probability adverbs: *unfortunately, hopefully*; and adjectives: *appropriate, remarkable* (ibid). For example, *unfortunately, the covid-19 pandemic is causing too many deaths*. The word *unfortunately* expresses the author's affection. In scientific writing, attitude markers are not necessarily used to express the writer's affection. They are rather exploited to help writers express their attitudes in the form of agreement, importance, and necessity. Attitude markers are frequently used in scientific writing to enhance evaluation and importance in the discourse. However, according to Hyland (ibid), greater burden is put on boosters and hedges to create convincing discourse rather than attitude markers.
- 4- Self mentions:** present the degree of authors' presence in the text and how they include their character and stance towards "*their arguments, their community and their readers*" (ibid: 53). This is controlled by the occurrence of first-person pronouns: *I, we*;

and possessive adjectives and pronouns: *my, mine, our, ours* (ibid). For example, *I have collected data to complete our report about the victims of the covid-19 pandemic*. The pronoun *I* and the possessive adjective *our* express the presence of the author in the text. In scientific writing, writers seek to establish precise measurements and empirical data. Therefore, scientists tend to sidestep their explicit presence in order to emphasize the claims raised. Hyland(2005) asserted that scientists adopt a less personal style in their writings to strengthen the objectivity of their interpretations.

5- Engagement markers: Hyland (2005) believes that engagement markers are used specifically to address readers either by making them part of the discourse in order to guide them to particular interpretations or grab their attention to make the text more credible. The use of questions and directives: *see, note, consider*; obligation modals: *should, must, have*; reader pronouns: *you, yours, inclusive we*, and interjections: *you may notice*; highlight the attendance of readers in the discourse and explicitly build a relationship with them (ibid: 53-54). For example: *To prevent the spread of the covid-19 disease, you should clean your hands often, maintain a safe distance and wear a mask*. The pronouns *you, your*, and obligation modal *should* are used to refer to the reader. As already noted above, scientists seem to downplay their explicit presence in the text, they also avoid the explicit engagement of the reader in order to highlight the objectivity of the claims. Hyland (2005) states that directives are the only engagement markers that occur in scientific writing.

Academic writers use IMM to add value and credibility to their texts, as well as to strengthen their claims and arguments, and anticipate to potential objections that may be received from the audience.

Conclusion

This chapter is dedicated to review the relevant literature related to our research study which investigates the use of IMMs in the RDSs of ASRAs. The chapter opens with an overview of the concept of metadiscourse and its definitions according to different scholars. Furthermore, it presents some important key notions that are close to the theme of investigation, including academic writing and its relation to metadiscourse, and the notion of genre; to open a perspective on the definition of research articles, scientific research articles, and the presence of the English language in Algeria, as well as results and discussion sections in relation to metadiscourse. Additionally, we have attempted to present the different taxonomies provided by various researchers in the domain and their evolution through time. At last, the chapter includes the presentation of the theoretical framework on which the study is based, relying on Hyland's (2005) interpersonal model of metadiscourse.

Introduction

This chapter describes the research design of the present study and the procedures of data collection and data analysis adopted to carry out the research on the use of IMMs in RDSs of ASRAs. The present chapter comprises three sections. The first section includes the description of the corpus of the study, which is a total of twenty (20) ASRAs that are collected from two Algerian research journals called ALJEST (Algerian Journal of Environmental Science and Technology), and ASJP (Algerian Scientific Journal Platform) and an online journal publisher called SCRP (Scientific Research Publishing). The second section is labeled the procedures of data collection, which refers to the tools used for gathering data including Hyland's (2005) interpersonal metadiscourse markers checklist as a manual corpus analysis and a structured interview. In addition, the context was taken into consideration since the study's concern is metadiscourse markers. As far as the third section is concerned, it contains the procedures of data analysis, and describes how the data obtained in the research process are analyzed.

2.1 Description of the corpus of the study

2.1.1 ALJEST Articles

The Algerian Journal of Environmental Science and Technology is an international research journal that was founded by the University of Boumerdes, faculty of Engineering in 2016. It publishes original research papers written in the English language. For the selection of the articles, eleven (11) articles written by Algerian authors have been selected. The selected articles happen to be from different domains including, Chemistry, Agronomy, Ethnobotany, Biochemistry, and Engineering. For each article, the following information is taken into account: the article's authors and their emails, the domain of the study as well as the year of publication.

2.1.2 SCRP's Articles

The Scientific Research Publishing is an academic publisher of English language academic journals and books. It has access to the areas of science, technology, medicine and economy; it was founded by Huaibei Zhou in 2007, in China. Concerning the selection of the articles, eight (08) articles written by Algerian writers were selected including the areas of: Chemistry, Meteorology, Marine- biology, Geology, Agronomy, and Microbiology. For each article found, the following information is taken into account, the article's authors and their emails, the domain of the study as well as the year of publication.

2.1.3 ASJP's Articles

Algerian Scientific Journal Platform is an electronic publishing platform that publishes Algerian Scientific Journals. It has access to different fields of study. However, only one article was chosen from this journal, which is also written by Algerian authors. The article's authors and their emails, the domain of the study as well as the year of publication are taken into account. All the gathered articles comprise an abstract, an Introduction section, a Methodology section, a Result and Discussion section, and a Conclusion.

2.2 Data Collection Procedure

With the aim of gathering reliable data to support the subject under investigation, that is IMMs in RDSs of ASRAs, we have opted for the use of Hyland's (2005) interpersonal metadiscourse markers checklist, and a structured interview conducted with four (04) authors of the articles chosen for investigation.

2.2.1 Hyland's (2005) Interpersonal Metadiscourse Markers Checklist

Our research follows Hyland's (2005) classification of IMMs in order to collect data.

Five different categories of interactional elements are presented: Hedges, Boosters, Attitude markers, Engagement markers, and Self-mentions.

- Hedges: are devices by which “*the writer withholds full commitment to a proposition; it is employed as an index to recognize the alternative voices, viewpoints, and possibilities*” (Hyland, 2005: 52).
- Boosters: express certainty and highlight the force and strength of propositions.
- Attitude markers: represent “*the writer’s attitude and judgment of the propositional content*” (ibid: 53).
- Engagement markers: address the readers explicitly, “*either to focus their attention or include them as discourse participants*” through second person pronouns, imperatives, question forms (ibid).
- Self-mentions: indicate the degree of the author’s explicit presence in the text represented through the first-person pronouns and possessive adjectives.

Interactional Markers	Function	Examples
Hedges	-withhold commitment and open dialogue	might, perhaps, possible
Boosters	-emphasize certainty or close dialogue	In fact, definitely, sure.
Attitude markers	-express writer's attitude to proposition	Unfortunately.
Self-mentions	-explicit reference to author(s)	I, we, me, our.
Engagement markers	-explicitly build relationship with reader	Consider, note.

Table 02: Hyland’s (2005) Analytical Framework of IMMs

2.2.2 Structured interview

Structured interviews are one-on-one conversations that are based on a pre-prepared planning which consist of a list of questions to be covered with every interviewee separately, by asking the same questions, in the same manner and order.

The interview is one of the most widely used research methods of data collection in academic studies. It is used to explain, explore and even understand the subject matter through direct face-to-face or phone conversations. This allows the researcher to obtain

reliable, appropriate and valid data about the topic of investigation. It includes different types of questions especially open-ended questions which explore the views of the respondents and give them freedom of expression, in addition to close-ended questions that shape pre-defined responses.

A structured interview containing seven (07) questions is conducted with four (04) authors of the articles. In fact, there are many authors who did not respond to our emails; therefore, we could interview only four (04) of them. The participants are interviewed orally and individually through a live audio video discussion on Skype in order to obtain details about the tone and the non-verbal reactions of the participants. The data have not been recorded but have been written down word for word (note taking). The aim behind interviewing the authors of the articles is to get in-depth information about the use of IMMs in the RDSs of ASRAs, as they are more knowledgeable of the fields of science. It also aims at knowing the reasons why the authors have used such markers. In addition, the interview aims at discovering the level of the authors' awareness of the importance and the role of each category of IMMs in the RDSs of ASRAs.

2.3 Data Analysis Procedures

This part includes the procedures used in order to analyze the data gathered from Hyland's (2005) interpersonal metadiscourse markers checklist and the authors' interview. Our corpus is analyzed following the mixed-methods research combining both quantitative and qualitative approaches. The quantitative approach emphasizes numerical and statistical measurements of data gathered from close-ended questions. While the qualitative approach uses non-numerical measurements and focuses on obtaining in-depth data through open-ended and conversational communication; it collects personal opinions, reasons, and explanations. As far as data analysis is concerned, the quantitative data

are analyzed using Microsoft Excel, whereas the qualitative data are analyzed through Qualitative Content Analysis (QCA).

2.3.1 The Microsoft Excel

Microsoft Excel is a program that is used to analyze and transform numerical data into statistics. In our study, it is used to analyze the quantifiable data collected through Hyland's (2005) checklist. Excel is known for its qualified data analysis and documentation. In addition to that, it transforms the data obtained into different forms such as tables and pie charts in order to help the user easily understand the results.

2.3.2 The Qualitative Content Analysis (QCA)

Qualitative Content Analysis is a non-statistical method. It is designed to analyse and interpret qualitative content and decrypt the hidden meaning. It is a method that is used to decipher open-ended questions. In our study, the QCA is used to analyse the answers gathered from the interview. Qualitative Content Analysis is defined as *“a research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns”* (Hsieh & Shannon, 2005:1278).

Conclusion

This chapter has shed light on the research design and the methodology followed in the study. It has started with the presentation of the corpus, namely the journal articles used to extract the ASRAs. It has also provided a clear description of the procedures of data collection and data analysis on which the study is based. It has shown that the work adopts the mixed-methods approach. On the one hand, quantitative data are gathered through Hyland's (2005) interpersonal metadiscourse markers checklist as a manual corpus analysis that is analyzed using the Microsoft Excel. On the other hand, the qualitative data obtained from the questions included in the interview are examined using Qualitative Content Analysis.

Introduction

This empirical chapter is designed to present the findings gained from the analysis of twenty RDSs extracted from ASRAs. In order to answer the research questions of our study, Hyland's (2005) interpersonal model of metadiscourse checklist is used as an investigative tool to get in-depth information about the distribution of the overall use of IMMs, as well as the use of each type and subtype. Additionally, a structured interview is implemented to discover how the writers of the articles make use of the IMMs and whether they are aware of the importance of these markers. Finally, based on the results of the first three research questions, we can provide answers to the last question which seeks to discover whether these markers are used in an effective way.

3.1 Presentation of the Results of Hyland's (2005) Interpersonal Model of Metadiscourse Checklist

3.1.1 Interactional Metadiscourse Markers in Algerian Scientific Research Articles

In fact, twenty (20) RDSs of SRAs written by Algerian authors are analyzed following Hyland's (2005) interpersonal model of metadiscourse checklist, and the findings are presented in the following table:

Interactional metadiscourse markers	Frequency
Boosters	373
Hedges	352
Attitude markers	249
Self-mentions	58
Engagement markers	03
Total	1035

Table 03: IMMs in the RDSs of ASRAs

The table above shows that IMMs, on the whole, are used by the ASRAs' writers while writing the RDSs with a total frequency of 1035. As it is clearly demonstrated in the table above, the frequency of each type is different. Boosters have the most frequent use (373) in the corpus, followed by hedges (352). The next rank is associated with attitude markers with a frequency of 249. Then comes the use of self-mentions with a

frequency of 58 markers, and finally the least frequently used type of IMM is engagement markers with a frequency of only 03 markers. Figure 1 adds a clear demonstration of what is inserted in table 03 about the frequency of each category of the IMM and their percentages.

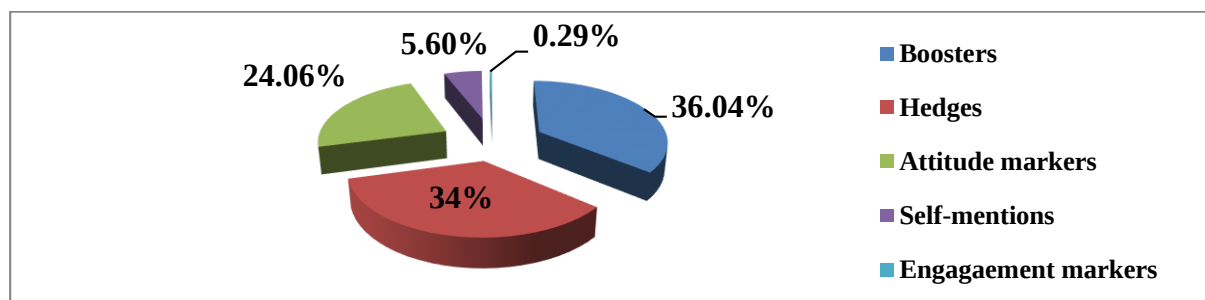


Figure 01: Frequencies of IMM in RDSs of ASRAs

The pie chart above reveals that 36.04% of the IMM that Algerian writers used to demonstrate and discuss the RDSs of SRAs are boosters. In addition, the use of hedges is very close to that of boosters, they occur very frequently (34%) in the corpus. In the third position, attitude markers occur with a frequency of (24.06%). Subsequently, self-mentions are used every so often (5.60%). Finally, engagement markers occur rarely in the corpus.

3.1.1.1 The Use of Boosters in the RDSs of ASRAs

As table 03 reveals, the most frequently employed markers in the RDSs of ASRAs are boosters. Interestingly, the table below shows that boosters are expressed by three subcategories: intensifier verbs, intensifier adverbs, and intensifier expressions.

Boosters	Words and Expressions	Frequency	Percentage %	Total
Intensifier Verbs	Demonstrate	06	1.61	228 = (61.12%)
	Indicate	33	8.85	
	Show	127	34.05	
	Prove	02	0.53	
	Know	04	1.07	
	Find	05	1.34	
	Found	35	9.38	
	Detect	01	0.27	
	Reveal	01	0.27	
	Determinate	01	0.27	
	Determine	08	2.14	
	Will	05	1.34	

Intensifier Adverbs	Really	01	0.27	109 = (29.22%)
	Fully	01	0.27	
	Precisely	01	0.27	
	Exactly	01	0.27	
	Clearly	06	1.62	
	Totally	03	0.80	
	Actually	01	0.27	
	Surely	01	0.27	
	Extremely	03	0.80	
	Completely	06	1.62	
	Directly	04	1.07	
	Unambiguously	01	0.27	
	Apparently	03	0.80	
	Indeed	09	2.41	
	All	38	10.19	
	All over	01	0.27	
	Too	03	0.80	
	Always	02	0.53	
	Never	01	0.27	
	In fact	02	0.53	
	Very	21	5.63	
Intensifier Expressions	Real	02	0.53	36 = (9.65%)
	Total	08	2.15	
	Clear	05	1.35	
	Complete	02	0.53	
	Overall	02	0.53	
	In reality	01	0.27	
	In all cases	01	0.27	
	Whole	01	0.27	
	Only	12	3.22	
	Direct	02	0.53	
Overall Total			36.04%	373

Table 04: The Use of Boosters in the RDSs of ASRAs

As it is clearly shown in the above table, the Algerian writers employed intensifier verbs most frequently (61.12%) to express certainty and commitment compared to the other subcategories. The table indicates that the verbs: *show* (34.05%), *found* (9.38%) and *indicate* (8.85%) are highly used compared to the rest of the verbs: *determine* (2.14%), *demonstrate* (1.61%), *will* (1.34%) and *detect* (0.27%).

Moreover, it is shown that intensifier adverbs are ranked in the second position with a frequency of 29.22%. It is demonstrated that the Algerian scientists used many intensifier adverbs to boost their arguments in the RDSs; however, only two adverbs appear persistently:

all (10.19%) and *very* (5.63%). The rest of the adverbs did not occur very frequently: *indeed* (2.41%), *completely* (1.62%), *extremely* (0.80%) and *exactly* (0.27%).

Finally, intensifier expressions are used with a frequency of (9.65%). This means that the Algerian scientists have used few expressions to intensify their arguments. As the majority of the expressions are adjectives: *only* (3.22%), *total* (2.15%), *clear* (1.35%), *overall* (0.53%) and *whole* (0.27%) and only two propositional phrases: *in reality* (0.27%) and *in all cases* (0.27%).

3.1.1.2 The Use of Hedges in the RDSs of ASRAs

The use of Hedges in the RDSs of ASRAs occupies the second rank with a frequency of (352 hedging expressions).

Hedges	Words and Expressions	Frequency	Percentage%	Total
Epistemic verbs	May	20	5.68	142 = (40.34%)
	May not	01	0.28	
	Might	08	2.27	
	Can	64	18.1	
	Could	12	3.40	
	Could not	01	0.28	
	Would	05	1.42	
	Seem	09	2.56	
	Seen	04	1.14	
	Suggest	07	1.99	
	Assume	02	0.57	
	Expect	06	1.70	
	Tend	03	0.85	

Probability Adverbs	Probably	12	3.40	172 = (48.86%)
	Relatively	15	4.26	
	Fairly	02	0.57	
	Mainly	14	3.98	
	Generally	09	2.55	
	Roughly	07	1.99	
	Nearly	02	0.57	
	Normally	01	0.28	
	Typically	03	0.85	
	Approximately	10	2.84	
	Likely	06	1.70	
	Mostly	30	8.52	
	Proportionally	01	0.28	
	Presumably	01	0.28	
	Closely	01	0.28	
	Usually	10	2.84	
	About	12	3.40	
	Almost	05	1.42	
	Sometimes	11	3.12	
	Somewhere	01	0.28	
	Somewhat	01	0.28	
	Above	06	1.70	
	Over	01	0.28	
	Around	07	1.99	
	Elsewhere	02	0.57	
	Maybe	02	0.57	
Epistemic Expressions	Several	08	2.27	38 = (10.80%)
	General	04	1.14	
	Possible	07	1.99	
	Not possible	01	0.28	
	Typical	01	0.28	
	Uncertainty	02	0.57	
	Majority	06	1.70	
	In case of	02	0.57	
	In general	03	0.85	
	Many	04	1.14	
Overall Total			34%	352

Table 05: The Use of Hedges in the RDSs of ASRAs

As it is obviously demonstrated in the table above, hedges are divided into three subcategories: the first subcategory is epistemic verbs, which occurs with a frequency of (40.34%). It is shown that the Algerian writers of SRAs have used many different verbs to hedge their claims. *Can* (18.18%) is the most frequently used epistemic verb in the corpus. The rest of the verbs are ranked from 0.28% to 5.68%.

The second subcategory which is the most used (48.86%) is called probability adverbs. The Algerian writers have used many probability adverbs to hedge their claims. The adverb *mostly* (8.52%) is highly used compared to the other adverbs. Followed by the adverb *relatively* (4.26%), then the adverb *mainly* (3.98%). The rest of the adverbs are ranked from 0.28% to 3.40%.

The last subcategory is epistemic expressions that are used with a frequency of 10.80%. The expression the most frequently used is the determiner *several* (2.27%), followed by the adjective *possible* (1.99%), then the noun *majority* (1.70%), and the rest of the expressions are ranked from 0.28% and 1.14%.

3.1.1.3 The Use of Attitude Markers in the RDSs of ASRAs

Attitude markers is another important type of IMM used by the ASRAs' writers to present their opinions and stances. Evidently, it is classified in the third position with 249 attitudinal expressions. Table 05 shows the division of attitude markers which is as follows: attitude verbs, attitudinal adverbs, and attitudinal adjectives.

Attitude markers	Words and Expressions	Frequency	Percentage %	Total
Attitude Verbs	Presume	01	0.40	34 = (13.65%)
	Consider	06	2.41	
	Appear	04	1.61	
	Notice	03	1.21	
	Predict	02	0.80	
	Estimate	02	0.80	
	Highlight	03	1.21	
	Must	01	0.40	
	Agree	01	0.40	
	Desire	01	0.40	
	Affirm	01	0.40	
	Assess	01	0.40	
	Should	07	2.81	
	Should not	01	0.40	
Attitudinal Adverbs	Seriously	01	0.40	
	Significantly	09	3.61	
	Essentially	06	2.41	
	Unusually	01	0.40	
	Remarkably	03	1.21	
	Greatly	02	0.80	

	Considerably	03	1.21	56 = (22.49%)
	Positively	02	0.80	
	Necessarily	05	2	
	Ultimately	03	1.21	
	Especially	06	2.41	
	Strongly	05	2	
	Specifically	02	0.80	
	Critically	02	0.80	
	Effectively	01	0.40	
	Namely	01	0.40	
	Preferentially	01	0.40	
	Commonly	01	0.40	
	Sufficiently	01	0.40	
	Particularly	01	0.40	
Attitudinal Adjectives	Surprising	02	0.80	159 = (63.86%)
	Fascinating	01	0.40	
	Important	18	7.23	
	Significant	15	6.02	
	Main	24	9.64	
	Positive	06	2.41	
	Strong	07	2.81	
	Exceptional	01	0.40	
	Appropriate	02	0.80	
	Highest	14	5.62	
	Difficult	07	2.81	
	Satisfactory	01	0.40	
	Interesting	04	1.61	
	Magnifying	01	0.40	
	Unique	02	0.80	
	Good	04	1.61	
	Well	06	2.41	
	Best	04	1.61	
	Better	05	2	
	Top	03	1.21	
	Optimal	10	4.01	
	Major	20	8.03	
	Optimum	01	0.40	
	Perfect	01	0.40	
Overall Total			24.06%	249

Table 06: The Use of Attitude Markers in the RDSs of ASRAs

The above table demonstrates the way the ASRAs' authors utilize attitude markers in the RDSs. It shows that attitude markers are divided into three different subcategories: attitude verbs are used with a frequency of (13.65%). It can be noticed that half of the attitudinal verbs occur rarely with a frequency of (0.40%). However, the rest of the verbs are used more frequently and the attitude verb the most frequently used is the modal verb *should*

(2.81%), followed by the verb *consider* (2.41%), *appear* (1.61%), *notice* (1.21%) and estimate (0.80%).

Attitude adverbs are used with a frequency of (22.49%). The results show that the majority of the adverbs are infrequently used, as twelve out of twenty adverbs occur between (0.40%) and (0.80%). Nevertheless, the rest of the adverbs are frequently used and occur between (1.21%) and (3.61%).

Finally, attitudinal adjectives which are the most used subcategory in attitude markers is of a frequency of (63.86%). The above table shows that a high number of attitudinal adjectives are used in the corpus. The majority of the adjectives are frequently used and stand between (1.61%) and (9.64%) and the most frequently used adjectives are *main* (9.64%), followed by *major* (8.03%), *important* (7.23%), and significant (6.02%). The rest of the adverbs are scarcely used and stand between (0.40%) and (0.80%).

3.1.1.4 The Use of Self-Mentions in the RDSs of ASRAs

Self-Mentions occupy the fourth rank (58) in the use of IMMs in the RDSs of ASRAs as it is clearly shown in table 03. Regarding the words and the expressions used in this category, table 07 shows all the frequencies in details.

Self-mentions	Frequency	Percentage %	Total
We	29	50	58 = (5.60%)
Our	24	41.38	
Us	05	8.62	

Table 07: The Use of Self-Mentions in the RDSs of ASRAs

The table above shows that the use of Self-Mentions occurs with a frequency of (5.60%) and it is restricted to employing only three words which are *we*, which is the most frequently used marker (50%), followed by the possessive adjective *our* (41.38%) that approximates the use of the pronoun *we*, and finally the use of the pronoun *us* with a frequency of (8.62%).

3.1.1.5 The Use of Engagement Markers in the RDSs of ASRAs

It is notable in the third table that Engagement Markers have the lowest frequency of occurrence (03) in the RDSs of ASRAs. In fact, ASRAs' writers avoid using such markers and prefer engaging their audience in an inexplicit manner. The following table shows more details.

Engagement markers	Frequency	Percentage %	Total
Our	01	33.33	03 = (0.29%)
Note	02	66.67	

Table 08: The Use of Engagement Markers in the RDSs of ASRAs

The table shows that the use of engagement markers in the RDSs of ASRAs is rare and only (0.29%) are used: the determiner *our* which includes both the writer and the reader is used only once, besides the imperative verb *note* which occurred twice to engage the reader into the text.

3.2 Presentation of the Interview Results

The structured interview is conducted with four (04) authors of the ASRAs. Its purpose is to get detailed information about how the writers of the chosen articles incorporate IMMs in their writings, and how they look upon them. The reason is also to know why they used such markers and what influence their use. The interview also aims at discovering the level of the authors' awareness of the importance and the role of each category of IMMs.

- **Question one: Have your teachers taught you how to write the results and discussion section of your research papers?**

This question aims at knowing whether the authors of the articles have been taught how to write the RDSs of their research papers. All of the four authors state that they have not got any courses concerning the methodology of writing a scientific article in general, nor the results and discussion sections in particular. They have rather made their own researches

and have worked alone in order to write an effective research. One of the four authors said, *“We worked all alone, and we made our own researches”*.

If yes, how?

According to the authors’ responses, their teachers have not taught them any kind of writing skills. Therefore, there was no answer to this part of the question.

- **Question two: Have your teachers taught you or trained you how to use interactional metadiscourse markers in the results and discussion section of your research papers?**

According to the four authors’ responses, the teachers of the scientific domains have not provided their students with any course or training concerning the fundamentals of writing. They have rather stuck to teaching them the basics of their domains. One of the authors, reports, *“Our teachers have never taught us the strategies and the methods to use while writing, and they have never mentioned anything about interactional metadiscourse markers”*. Another author asserts, *“Our teachers have taught us only what is related to chemistry”*.

- **Question three: Do you use interactional metadiscourse markers while writing your results and discussion section?**

This question is asked to know whether the authors of the articles are familiar with the use of IMMs and whether they make use of them to present and discuss the findings of their studies. According to the findings, all of the four authors have used IMMs even though they are not familiar with what this concept means until I have provided them with an explanation; however, they have used words and expressions that convey their perspectives depending on their domains without knowing that these words are called Interactional Metadiscourse Markers. One of the authors states, *“This is the first time I learn*

about this concept, but I actually used such words especially attitude markers in order to grab the readers' attention and give value to the results of my research".

- **Question four: Among the five categories of interactional metadiscourse markers, which one do you use the most in the results and discussion section of your research?**

This question seeks to know which category of the IMMs is mostly used in ASRAs and what influences the authors to choose such markers. The results reveal that the use of these markers depend on the domain of study they belong to. Two authors state that they have used more attitude markers and hedges compared to the other categories while the other authors have focused on using boosters in large amounts.

Justify your answer?

As it is already mentioned in the first part of the answer, the use of IMMs depends on the domain of study of each author. In this respect, one of the respondents says, *"We use more attitude markers and hedges than the rest of the other categories because in economics nothing is certain, and sometimes the empirical results contradict with the real results"*. Another author asserts, *"Chemistry is considered as an exact science; this means that the use of boosters is more than indispensable in our work since it boosts the validity of the results"*.

- **Question five: How often do you use each one of the five categories of interactional metadiscourse markers?**

As far as this question is concerned, the majority of the respondents assert that they always use boosters when presenting and discussing their RDSs. On the other hand, only two of the authors state that they always use hedges and attitude markers, while the other two respondents state that they use hedges and attitude markers only sometimes. Concerning self-mentions, some of the authors assert that the use of this category is rare, while some others claim that they never use them at all. When it comes to the use of engagement markers, all

of the authors respond negatively and reveal that they never use such markers. According to the authors' responses, we can say that the use of IMM in ASRAs is as follows:

Boosters have the highest proportion of use compared to hedges and attitude markers that appear differently depending on the domain of study, and go from always to sometimes, whereas self-mentions do not occur regularly. On the other hand, taking into consideration the negative responses of the authors concerning the use of engagement markers, we conclude that the ASRA's authors never use engagement markers while writing the RDSs.

- **Question six: Do you think that the use of boosters increases the credibility of the results and discussion sections in particular and in the scientific research articles in general?**

All the authors state that the use of boosters would certainly increase the authenticity and the credibility of the results and discussion section in particular, as it is the most important part of the research where the writer exposes the findings of the investigation. In addition, boosters should be highly used in scientific research articles since scientific knowledge is generally about precision and accuracy. In this concern, one of the authors says, *"Yes, of course the use of interactional metadiscourse markers increases the credibility of the entire work whether the results and discussion section in particular or the research in general because they show that the data gathered from the investigation are valid and this is how a scientific research should be"*.

- **Question seven: According to you, what categories of Interactional Metadiscourse Markers must be used the most in the results and discussion sections of scientific research articles? Why?**

The rationale behind this question is to investigate the authors' beliefs about which categories they believe convenient to write an effective RDSs of SRAs. All the interviewees encourage the use of boosters as the main category for presenting and discussing the results of

scientific investigations saying that they give the author the power to show the results with confidence. One author says, *“I think boosters should be frequently used while writing the results and discussion section because they show that the writer knows what he is talking about, and they give much importance and value to the results”*. Some of the respondents add hedges and attitude markers to boosters since they believe that using several categories highlights both the strengths and the weaknesses of the study from different angles, one author reports, *“I think the use of boosters, hedges and attitude markers all together give much more credibility to the data obtained since they show both the strengths and the weaknesses of the results”*.

Conclusion

The present chapter has presented the findings of the current study. First, it has presented the results obtained from the analysis of twenty (20) RDSs of ASRAs in the light of Hyland’s (2005) interpersonal metadiscourse markers checklist. Second, it has presented the data obtained from the structured interview conducted with four (04) authors of the ASRAs. With the aim of providing detailed explanations, the next chapter is devoted to the interpretation and the discussion of the results described in this chapter.

Introduction

The present chapter is devoted to the discussion of the findings presented in the previous chapter. The findings arise from the analysis of twenty (20) Results and Discussion sections extracted from Algerian scientific research articles following Hyland's (2005) interpersonal model of metadiscourse checklist, in addition to the interviews conducted with four (04) authors of the articles. The results are interpreted in relation to what has been presented in the previous chapters. This includes the objectives of the research along with the advanced questions and hypotheses. The discussion presents every category in isolation and discusses the findings in details.

4.1 Discussion of the ASRAs' RDSs' Findings in the light of Hyland's (2005)

Interpersonal Modal of Metadiscourse

4.1.1 The Overall Use of IMM in the RDSs of ASRAs:

The Results and Discussion section of Scientific Research Articles is an area that conveys new knowledge. Therefore, metadiscourse is used as the most important writing strategy in the process of presentation, explanation and persuasion of claims and data. The results displayed in the previous chapter, mainly the responses of the interview and the analysis of the articles shown in Table 03 reveal the frequent use of IMM in the RDSs of ASRAs with a total frequency of 1035 words, where all of the five categories are used. Nevertheless, the frequency of occurrence of each category is different. The frequent use of IMM in the corpus could be related to the fact that the RDS is the most important part of a research article where arguments and claims have to be highlighted and perceived, Hyland (1998:30) claims, "*results constitute the core of the research article*".

4.1.1.2 The Use of Boosters

In terms of the use of Boosters, it has been found that Algerian writers have used more boosters with a frequency of (36.04%) to present their propositions and claims in the RDSs of SRAs. This can be explained with reference to the fact that the articles chosen for

investigation are scientific, and science is known for its precision. As a result, writers of ASRAs tend to emphasize on what they have found and write their RDSs more based on facts and prove their claims with an authoritative voice to restrain any alternatives. In this respect, one of the authors argues, “*I believe that I used more boosters while writing my results and discussion section because they show that the writer masters his or her research and gives importance to the results of his or her study*”. Boosters are used impersonally to infer certainty to propositions and do not explicitly show the writer’s presence in order to intensify the writers’ views and claims. They are also used to involve the reader with closing the dialogue and avoiding direct engagements. In this regard, Hyland (2005) states that boosters present the proposition with conviction while making involvement with readers, yet they restrict alternative voices. According to the results, the Algerian writers have used intensifier verbs, intensifier adverbs and different intensifier expressions to boost their propositions.

4.1.1.2.1 Intensifier Verbs

Boosters are expressed through the use of intensifier verbs with the highest frequency (61.12%). This can be related to the fact that verbs are used to strengthen the relationship between data and claims. The verb *show* is the most frequently used (34.05%). Writers used this verb to show their confidence towards the explanations or the findings they provide. In this respect, Hyland (2005) states that verbs such as, *show* and *establish*, strengthen the relationship between data and claims. The verb *show* is not chosen randomly, it is rather chosen because it directs the reader to particular knowledge as a strong verb that indicates a fact to be true and valid. An example is extracted from one of the articles under investigation for the sake of illustration: *Chemical analysis of the crude diatomite shows the predominance of silica* (47.52%). Subsequently, the verb *found* (9.38%) has also an important position in the corpus. It is used to prove what the writers have attained from their investigation and determine it as being true. Another example is

taken from the corpus for the sake of demonstration: *Significantly, higher Cu concentrations were found in pregnant female dolphins*. Another verb, which is used with high frequency, is the verb *indicate* (8.85%). It is used to give evidence to the statement and show the results of the research, for example, *the slow modification of the residual values' signs on the plot against order function, indicate a negative correlation among the residual values*. Although only twelve verbs are used to intensify the claims raised by the writers in the corpus; the high frequency of the three verbs: *show*, *found* and *indicate*, made of the intensifier verbs the most frequently used subcategory to boost the confidence of the writers' claims. The other verbs that occur in the corpus such as, *determine* (2.14%), *demonstrate* (1.61%), *will* (1.34%) and *detect* (0.27%) are infrequent.

From the results we can say that the Algerian writers exaggerated in using the verb *show* to boost their claims, as it takes 34.05% of the overall use of boosters in the corpus. This may be because Algerian writers have a limited repertoire, and this might be due to the fact that English is a foreign language in Algeria. It can also be due to the fact that the Algerian teachers of scientific domains focus only on teaching the essentials of the scientific fields and neglect to teach their students how to write an effective research. This idea is reinforced by the answers of the authors of the articles under investigation, as one of them claims, “*Our teachers have never taught us the strategies and the methods to use while writing*”.

4.1.1.2.2 Intensifier Adverbs

In the second rate, intensifier adverbs are used to indicate emphasis and prominence. In our research, we have found many intensifier adverbs, as 29.22% of the total use of boosters is taken by adverbs. This can be related to the fact that adverbs are used not to demonstrate what the findings are, but to boost the value of the findings demonstrated, the degree and the way they are presented. The function of an adverb in general is to describe verbs and adjectives. In our study, intensifier adverbs raise the intensity of intensifier verbs.

An example is taken from one of the articles under investigation: *Figure 6 (c) and (d) clearly show that the pores were released*. In this example, the most important word is the intensifier verb *show*, and the role of the intensifier adverb is to add more certainty to the claim and this is the reason that makes it occupy the second position. The adverb *all* is the most frequently used adverb in the RDSs of ASRAs as it takes 10.19% of the total use of the boosting markers. This can be due to the fact that this adverb is used when the author includes every outcome of his or her study as a way of replacing either the quantitative or the qualitative data or even both, for example, *In fact, all of the surveyed farms strongly desire the total elimination of interest rates of bank credits*. In this example, the writer uses the adverb *all* in order to convince the readers of the correctness of his or her claims. The adverb *very* is found to be the second most frequently used adverb with a frequency of (5.63%). This can be due to the fact that it is an adverb which is used to intensify adjectives, for example, *the influence of the stirring time of Methylene blue adsorption by clay is a very important step*. In this example we can see that the adverb *very* adds more power to the adjective *important* in order to strength the statement. However, the extra use of the adverb *very* may lead the reader to consider the claim as being unconvincing. For instance, comparing between the use of *very important* and *vital* which has exactly the same meaning as *very important*:

- a) *The influence of the stirring time of Methylene blue adsorption by clay is a very important step.*
- b) *The influence of the stirring time of Methylene blue adsorption by clay is a vital step.*

Considering the examples (a) and (b), we can say that the use of the adjective *vital* is more powerful than the use of the adverb *very* to intensify the adjective *important* i.e., the adjective *vital* gives more intensity to the statement compared to the expression *very important*. Therefore, the writers could have used more adjectives to avoid the overuse of the adverb

very. The results reveal that, only two out of twenty-one adverbs are used with high frequency, while the rest of the adverbs are infrequent. Considering the two frequent adverbs used, we can say that Algerian writers have a limited repertoire even though they used many adverbs, but the fact that they stick to using the adverbs *all* and *very* and neglected the other adverbs can question their writing capacities. This, again, might be because the Algerian scientific teachers did not provide their students with the needed background of writing strategies. It might also be because the English language is a foreign language in Algeria, and the Algerian writers are not used to writing English articles, especially scientific articles.

In view of the results of the intensifier adverbs used in the corpus, we can say that the Algerian writers tend to make frequent use of intensifier adverbs to add emphasis to the claims they raise in order to convince the reader of the validity of the results. However, they overused some adverbs and neglected some others. This shows that the Algerian writers have a strong vocabulary concerning the intensifier adverbs, but they do not know how to use it.

4.1.1.2.3 Intensifier Expressions

The least frequently used subcategory for boosters is the intensifier expressions with a frequency of (9.65%). The reason behind such results can be that ASRAs' authors prefer to present their findings using more intensifier verbs as they demonstrate the results and intensifier adverbs as they boost the value of those results. The adjective *only* has the highest occurrence in the corpus as it takes (3.22%) of the overall use of the boosting markers, followed by the adjective *total* (2.15%); however, the rest of the expressions such as the adjectives *direct* (0.53%), *real* (0.53%) and the propositional phrase *in reality* (0.27%) are infrequent. We then can notice that adjectives are the most frequently expressions used, which may be because they strengthen nouns i.e., they strengthen facts, for example, *the government declared total confinement*. The statement is clear, but the adjective *total* adds an authoritative element to the statement which makes it more convincing.

Interestingly, from the above-mentioned examples, it is clearly shown that the second hypothesis is true. Boosters is the most frequently used category in the corpus. It can be noticed that the Algerian writers are aware of the importance of using boosters in the RDSs of SRAs, as they strongly demonstrated their findings and claims with a great use of intensifier verbs and adverbs. This means that they presented their arguments and data emphatically in order to show confidence and correctness, and they limited the use of intensifier expressions including adjectives in order not to seem more likely to describe their findings and be more objective. However, it is obviously shown that the Algerian writers have a limited repertoire as they overused some markers and neglected some others, especially when they overused the adverb *very* which could be replaced by stronger words. This may pose a great problem in convincing the readers of the writers' competencies. Therefore, the results demonstrate that some of the booster markers are effectively used and some others are ineffectively used.

4.1.1.3 The Use of Hedges

Hedging is an important means by which writers can express their plausible reasoning rather than certain knowledge by reducing the degree of intensity of the claims (Hyland, 2005). The findings reveal that hedges are highly used in the corpus (34%). This has probably to do with the fact that the RDSs are more likely to contain contested claims, which need more negotiation of arguments and recognition of alternative views. This goes in tune with the research findings of Skelton (1997, cited in Hyland, 1998) which show that the occurrence of hedging comments is very high in the Discussion sections. The results of the current study show that the use of the hedging markers is approximate to that of boosters which may be related to the fact that authors tend to use hedges in order to insure against overstating assertions and to create an appropriate balance between scientific caution and assurance in order to avoid any rejection of their arguments (Hyland 2005). Thus, Algerian writers seem to consider the degree of precision in their claims by employing boosters accompanied by a

certain degree of doubt in order not to lose the credibility of their claims and make the audience accept them as facts. Hyland (1998), states that scientific truth can be manipulated to persuade readers using hedges, and it is often based on the writer's plausible reasoning that the statement is well-accepted by the readers. This means that hedging is a strategy that is based on linguistic choices that the authors use to convince the readers of the accuracy of the claim. However, the frequency of hedges is close to that of boosters, which may cause certain equality between certitude and doubt that may, in turn, lead to confusing and misunderstanding the results. That is to say, the reader will not be able to know whether to trust the writer or not. According to the results, different hedging expressions were used: epistemic verbs, epistemic adverbs and epistemic expressions.

4.1.1.3.1 Epistemic Verbs

Algerian scientific writers tend to hedge their claims using epistemic verbs (40.34%). Thirteen(13) various epistemic verbs are used in the corpus, including two types: modal auxiliary verbs such as *can*, which occupies 18.18% of the total use of hedges, followed by the auxiliary verb *may* (5.68%), and lexical verbs such as *seem* (2.56%) and *suggest* (1.99%). Epistemic verbs are used to express the author's viewpoint and his or her judgment of the fact being claimed, soften its intensity and allow new perspectives. As it can be noticed from the results, modal auxiliaries are used with high frequency. This goes along with the results of Adams Smith's study (1984, cited in Hyland, 1998:53-54) of probability in RAs, which shows that "*typically (54%) of the RAs were marked by modals*". Hyland (ibid) reports "*the occurrence of modal verbs varies according to the communicative purpose of each section; however, they are greatly represented in Discussion sections*". Although the use of modal verbs has a great impact on persuading the audience of the validity of the claims raised in the RDSs, the overuse of the verb *can* might have a negative impact on the arguments that writers attempt to convey, as it may lead to reducing

the force of the claims and will further enable the audience to question the truth of the claims, and bring the rejection of the results. In this regard, Hyland (1998:04) claims, “*scientific statements can be weakened using a variety of strategies which limit the confidence invested for the claim made in the research*”.

4.1.1.3.2 Epistemic Adverbs

Epistemic adverbs are the most used hedging expressions in the corpus. They occupy the highest frequency of occurrence in the RDSs of ASRAs (48.86%). This could be related to the fact that adverbs provide information about the degree, the frequency and the circumstances of the results such as, *the higher level (64m) takes sees an increase in approximately 100%*. Here, the adverb *approximately* expresses degree and level. Table 05 shows that numerous epistemic adverbs were used in the RDSs. The adverb *mostly* is the most commonly used adverb (8.52%). ASRAs’ writers used the adverb *mostly* in order to bring the audience into agreement in a soft way by generalizing the results and avoiding total certainty, which is considered to be a persuasive strategy, for example, *Contents in lycopene and other carotenoids vary mostly with growth conditions*. The writer here could have used the adverb *absolutely* or *categorically* in order to convince the reader of the claim he or she states; however, he or she chooses to use the epistemic adverb *mostly* which convinces the audience in a cautious way. It can be noticed from the results, that there is not a dramatic shift between the occurrence of each epistemic adverb, as their frequencies go from 0.28% to 8.52% such as, the adverb *mostly* (8.52%), the adverb *about* (3.40%), followed by *sometimes* (3.12%), *approximately* (2.84%), *generally* (2.55%), *usually* (2.84%), *around* (1.99%) and *presumably* (0.28%). The use of these adverbs shows that the writer used the epistemic adverbs appropriately, as he or she did not stick to using only one or two adverbs in order to minimize the precision of the findings. We then can say that the Algerian writers made appropriate use of the epistemic adverbs in order to establish valid

scientific claims and avoid rejection, for instance, *A top thickness of about 40 cm.* the result here is not precise, but the meaning is clear, and this is a positive angle of expressing the truth of the claim without making any boundaries to the views of others, which is a good strategy to win the confidence of the audience. This is similar to the results reached by Dubois (1987, cited in Hyland, 1998) in her study about imprecision in scientific genre. She found that hedges are used to diminish the quantitative precision of scientific claims and adverbs such as *about*, are most often used. Hyland (ibid) claims that his RAs corpus reveals the use of imprecision mainly in the RDSs.

4.1.1.3.3 Epistemic Expressions

The least frequently used subcategory to limit the intensity of scientific claims is epistemic expressions (10.80%). It includes epistemic adjectives, epistemic nouns and determiners. The most commonly used expression is the determiner *several* (2.27%). It shows that the writer does not provide the exact number of data and avoids precision. It means that the writer again, uses imprecision to convince the audience of the validity of the results, which is a positive point that seeks to minimize the certainty of the claim. An example is taken from one of the articles for the sake of illustration: *several compositions were observed.* The number of compositions is not mentioned, and the writer prefers to keep it general in order to restrain the strength of the claim. Another expression which is commonly used is the adjective *possible* (1.99%). This can be related to expressing the writer's beliefs and opinions in a way that hides his or her direct judgment, for example, *Smith (1999) suggested that it is possible to hypothesize a range of liver concentrations within which this regulation is active.* In this example the author gives his or her opinion indirectly, making of it a scientific fact. According to Hyland (1998), *possible* is one of the most frequent adjectives in RAs. The noun *majority* (1.70%) is used to give less weight to the claim and reduce the strength of the assertion to make it more convincing. For example, *the majority of surface*

contains variable concentrations. If the writers say, *'the entire surface'*, it would not be reasonable, and would be severely criticized by the audience. Therefore, the writers used the noun *majority* in order to protect themselves from criticism and to persuade the audience of the truth of the proposition. The rest of the expressions such as the preposition *in case of*, the adjective *general* and the noun *uncertainty* occurred between 0.28% and 1.14%. We then can say that Algerian writers made use of different expressions to hedge their claims, but they did not get much attention as the use of the epistemic adverbs and verbs.

Appealingly, Algerian scientific writers tend to hedge their claims very frequently when presenting and discussing their findings. From the results discussed above, we can say that epistemic adverbs take the lead for hedging arguments raised in the RDSs as a strategy of achieving accuracy and convincing the audience. It is obvious that Algerian writers made appropriate use of epistemic adverbs. The use of epistemic verbs is also elevated, the writers used (13) different verbs because their role is to express the author's opinion and judgment; however, they stuck to using the modal auxiliary verb *can* with an extremely high frequency, compared to the rest of the verbs. This can give a negative image to the competences of the Algerian scientific writers as if they do not have enough awareness of the writing skills, which may make them seem to be as nonprofessional writers. Therefore, we can say that epistemic verbs are not effectively used in the RDSs. This could be related to the fact that Algerian scientists have never been taught the fundamentals of writing nor the use of IMMs in the RDSs in particular and in the SRAs in general. In this sense, one of the writers claims, "*Our teachers have never taught us the strategies and the methods to use while writing and they have never mentioned anything about interactional metadiscourse markers*". As regards Algerian writers, they do not give much attention to the use of epistemic expressions which comprises adjectives, nouns and prepositions, but they are used effectively to soften the degree of certitude in the arguments.

4.1.1.4 The Use of Attitude Markers

Attitude markers are used to express the authors' subjective stance, their attitudes and evaluations towards the findings of the research. The overall inclusion of attitudinal metadiscourse takes 24.06% of the total occurrence of IMM in the corpus. The expression of attitudinal values is ranked in the third position after boosters and hedges. This is confirmed by some of the respondents of the structured interview and one of them asserts, *"I think the use of boosters, hedges and attitude markers all together give much more credibility to the data obtained since they show both the strengths and the weaknesses of the results"*. This is probably because attitude markers emphasize the influential attitudes towards propositions rather than cognitive ones, which means that they do not focus on knowledge, but on the author's attitude towards that knowledge. In this view, Hyland (2005:53) states, *"Attitude markers indicate the writer's affective rather than epistemic, attitude to propositions"*. It can be also related to the fact that scientific writers avoid the overuse of personal opinions in order to preserve the scientific nature of their claims. This means that they shed more light on the importance of the scientific facts rather than individual interpretations. These findings are in line with those gained by Khedri et al. (2013) in their study about Interactional Metadiscourse Markers in Academic Research Article Result and Discussion Sections. It was found that only 30% of attitudinal metadiscourse markers occurred in their corpus. The results of the current study identified that ASRAs' writers made use of different types of attitude markers. To this end, we divided them into three subcategories: attitude verbs, attitudinal adverbs and attitudinal adjectives.

4.1.1.4.1 Attitude Verbs

Attitude verbs are used by authors to express their opinions, judgment and attitudes towards either their own research or others' research. It is important to note that many attitude verbs were found in the corpus (14 verbs), yet the majority of these verbs occur very infrequently. Therefore, only 13.65% of the total use of attitude markers was occupied by

attitude verbs. They are the least frequently used attitudinal lexicon in the corpus. The obligation modal verb *should* (2.81%) is the most recurrent attitude verb in the corpus. As stated by Hyland (2005), the use of obligation modals such as *should* and *must* in the discourse, expresses the operation of engaging the reader into that discourse i.e., obligation modals are used as engagement markers. Nevertheless, the results of the current study show that 2.81% of the use of attitude markers is occupied by the affirmative form of the obligation modal verb *should*, its negative form *should not* (0.40%), and the obligation modal *must* (0.40%), which are supposed to express the inclusion of the reader into the text. However, the pragmatic analysis of the interactional resources of metadiscourse that occurred in the corpus of the current study shows that the writer did not try to explicitly include the audience into the discourse, but he or she used these obligation modals in order to convey obligation and importance. As claimed by Hyland (2005:53): “*Instead of commenting on the status of information, its probable relevance, reliability or truth, attitude markers convey surprise, agreement, importance, and obligation*”. An example is taken from one of the articles investigated for the current research: *Such behavior should be ascribed to the Lewis acid properties of the TBA cations*. In this example, the obligation modal *should* expresses importance i.e., it expresses the author’s attitude towards the discourse.

The verb *consider* (2.41%) is the second most recurrent attitude verb in the corpus. Its use is perhaps related to the expression of importance such as, *Due to the physical and chemical heterogeneity of the substrate this ratio should be considered as a very broad estimation*. This example shows that the verb *consider* is used to convey importance. As it can be noticed from the results, many attitude verbs are used in the corpus, but the authors tend to employ them scarcely. It is obviously shown that the majority of the verbs occur with low percentages that go from 0.40% and 0.80%, such as *agree*, *must*, *assess*, *presume*, *estimate* and *predict*. The rest of the verbs occur between 1.21% and 2.81%, such as *notice*

(1.21%), *highlight* (1.21%), *appear* (1.61%), *consider* (2.41%) and *should* (2.81%). The scarceness of attitude verbs in the RDSs of ASRAs can be related to the fact that Algerian writers gave more importance to the use of intensifier and epistemic verbs to strengthen their claims rather than attitude verbs. It can also be related to the fact that English is a foreign language for these writers, and this may be the reason why they have such a limited repertoire.

4.1.1.4.2 Attitudinal Adverbs

In second rate, attitudinal adverbs used by Algerian scientific authors to express their personal judgments and opinions are of a frequency of (22.49%). Surprisingly, attitudinal adverbs are used infrequently compared to epistemic and intensifier adverbs. However, twenty (20) different attitudinal adverbs were used. The majority of these verbs occurred infrequently and stood between 0.40% and 0.80%, such as the adverbs: *particularly*, *commonly*, *critically*, and *greatly*. The rest of the adverbs occurred frequently between 1.21% and 3.61%, such as the adverbs, *significantly*, *especially*, and *essentially*. The frequencies of the adverbs are not high, but the number of the adverbs used is quiet high which is probably related to the authors' expression of different aspects such as, evaluation, importance, agreement, and obligation. It can also be related to the evaluation of the outcomes of the authors' researches or those of others in order to convince the audience of the validity of the claims and statements. For example, *it seems to us that the main factor that can contribute significantly to change this situation is to bring the input supply structures to farmers in these disadvantaged areas*. In this example, the author evaluates and assesses the outcomes of his or her own research employing the adverb *significantly* to convey the importance of the statement. The adverb *especially*; for instance, *especially workers in the informal economy*; in this example, the emphasis is put on the workers to present them as the prominent issue in informal economy. Another adverb which is quiet highly used is the

adverb *essentially* that tend to show the importance of the claims raised in the RDSs. For example, *the physical adsorption is essentially distinguished by the speed and spontaneity of the system at higher temperatures*. This statement has a clear meaning without the adverb *essentially*; however, when the writer added it, he or she emphasized the importance of the statement. Remarkably, the Algerian authors exploited attitude adverbs not to show their feelings towards the proposition, but to assess and evaluate them by stressing their importance. In light of the results shown above, attitudinal adverbs were effectively used to express the authors' attitude in the form of importance, necessity, agreement, and obligation.

4.1.1.4.3 Attitudinal Adjectives

Significantly, attitudinal adjectives are the recurrently used attitude markers in the ASRAs' RDSs with a frequency of (63.86%). This is probably because the nature of adjectives in general is to modify nouns which represent information in our case and add more details to the sentence. In other words, writers take advantage of these adjectives to directly accord the information with a descriptive item that indicates the writer's attitude toward that information. For instance, *when the rate of the porcelain powder is higher, the dispersion becomes difficult*. In this example, the writer judges the dispersion as being difficult; he or she gives his or her opinion in the statement. The results show that twenty-four (24) different attitudinal adjectives were used by ASRAs' writers. The adjective *main* seems to have the highest occurrence (9.64%), followed by the adjectives: *major* (8.03%), *important* (7.23%), *significant* (6.02%), *highest* (5.62%) and *optimal* (4.01%). Particularly, the majority of the adjectives seem to stress the significance and the prominence of the results. It is probably because the authors tend to emphasize the importance of the outcomes rather than express surprise, agreement, and obligation. It is clear that the ASRAs' writers are aware of the importance of the use of attitude markers in the RDSs as they express the importance of the claims rather than the authors' feelings and emotions.

Through all the articles, attitude markers seem to be frequently used. They occupy the third position after boosters and hedges. They are devices that show the author's attitude and affection towards the new knowledge obtained from the research or that of previous research. However, the results discussed above, and the examples provided show that all the attitudinal expressions used in the RDSs of ASRAs are far from expressing affection and emotions towards the claims. It can be then said that Algerian scientists prefer to use attitude markers that express significance, obligation and assessment: first, attitudinal adjectives are used to highlight the findings, then attitudinal adverbs are used to evaluate the outcomes of their research and those of others, and finally attitude verbs are used to present their opinions, stances, and attitudes. We can then say that Algerian scientific writers used attitude markers effectively.

4.1.1.5 The Use of Self-Mentions

Self-mentions indicate the level of the author's presence in the text. They are strategies used by authors to construct a particular authorial identity. Surprisingly, self-mentions are occasionally used in the RDSs of ASRAs with a frequency of (05.60%). They unexpectedly appear in almost every article under investigation. The results show that only three (03) expressions were used: the personal pronoun *we* occupied 50% of the total use of self-mentions in the corpus, followed by the possessive adjective *our* (41.38%), and the lastly used is the personal pronoun *us* (8.62%). It can be clearly noticed that the authors used only personal pronouns and possessive adjectives which show the author's explicit presence in the text, neglecting any implicit presence such as the use of *the writer* or *the researcher* to refer to the author. The ASRAs' authors seem to project themselves in their RDSs to present their findings, reinforce their arguments and persuade readers to accept their claims. Still, using personal pronouns and possessive adjectives in scientific writing might be considered non-binding. Generally, scientific researchers seek to present factual claims by being more objective and stress the empirical data to convince the audience of the accuracy of

their outcomes. It is believed that employing the writer's explicit presence while reporting the findings and the claims would make the research less objective and would lead it to failure. Yet, this does not mean that scientists do not express their opinions, but they should keep their presence implicit by employing more attitude markers. In this regard, Hyland (2005:148) claims:

Scientists can downplay their personal role in the research to highlight the phenomena under study, the replicability of research activities and the generality of the findings. By electing to adopt a less intrusive or personal style, they suggest that research outcomes are unaffected by individuals, strengthening the objectivity of their interpretations and subordinating their own voice to that of nature.

The outcomes of the current research reveal that Algerian scientific writers made use of self-mentions to emphasize their arguments. An example is extracted from one of the articles under investigation: *we found two types of bank credit without interest rates*. In this example, the writer used the personal pronoun *we* to show his or her findings; although he or she could have used the passive voice or words such as *the writer* or *the researcher* to avoid explicitness and make the claim more prominent and convincing, for instance, *two types of bank credit without interest were found*. The use of the passive voice is more convincing and more attractive than the use of words that explicitly refer to the author.

The interviewees' responses demonstrate that the use of self-mentions in the RDSs of ASRAs is rare, which is correct. However, some of them have responded that they have never used such markers in their research papers as their domains reject any subjective opinions. After analyzing all the articles under investigation, it was found that some self-mention markers were used in the interviewees' articles. This shows that the Algerian scientists have made use of self-mentions without realizing it. This might be because they unconsciously used these markers or because they are not familiar with what Interactional Metadiscourse Makers are.

From the results and the examples mentioned above, it seems that ASRAs' writers are unaware of the importance of keeping their presence implicit while writing the RDSs of

SRAs. This means that self-mentions are not effectively used. This may be caused by the fact that they did not get any instructions about the correct way of writing RDSs. In this sense, one of the interviewees asserts, “*Our teachers have taught us only what is related to chemistry ,and we have never been taught anything about interactional metadiscourse markers*”. This justifies the ineffective use of self-mentions in the corpus.

4.1.1.6 The Use of Engagement Markers

Engagement markers is the least frequently used category in the corpus. The markers used are the possessive adjective *our* which occurred only once, and the imperative verb *note* which occurred twice. According to the interview, the authors of the Algerian scientific papers claimed that they never use engagement markers; however, the possessive adjective *our* was found in one of the interviewee’s article who claimed that engagement markers are never used in his domain. It can then be related to the spontaneous use of language or to the fact that the writer is unaware of the difference between self-mentions and engagement markers, as Hyland (2005) claimed that the possessive adjectives are part of self-mentions. However, in this case, the author used the possessive adjective *our* as an inclusive word, where he or she includes the reader. An example where the possessive adjective *our* is used, is extracted from the interviewee’s article: *Due to the limitations of the SIR models the current analysis does not enable us to determine the impact of the negative oil choc on the Algerian economy, especially that our economy is sensitive to such chocks*. In this example, the writer have used both the pronoun *us* and the possessive adjective *our* in order to express the author’s explicit presence in the text. However, when he said “...*the current analysis does not enable us to determine the impact...*” he was speaking about himself or herself as a researcher i.e., he or she was using a self-mention marker. And when he or she said, “*our economy*”, he or she unintentionally included the entire Algerian community i.e., the possessive adjective *our* was used as an engagement marker. In fact, the use of the possessive

adjective *our* as a self-mention marker in the previous example is totally correct, but when we pragmatically analyzed the content of the statement where this latter is used, we came to a conclusion that this marker did not only express the author's presence in the text as the author claimed in his or her answers on the interview's questions, but it also engaged the reader into the text i.e., it was used as an engagement marker, which is not correct. As a result, engagement markers are not effectively used in the corpus as the Algerian scientists do not make the difference between what self-mentions and engagement markers are. This may be because the Algerian scientists did not get any information about what the concept of metadiscourse means or how to use it in their writings.

Concerning the use of the imperative verb *note*, it is explicitly used to address the readers and build a relationship with them as a way of preventing objections. For example, *note the existence of large porcelain particles having geometric shapes and other very small which appear as a powder in the sample 40wt.* In this example, the writer incorporates the readers in his or her argument to make them part of the discourse and guide them to a particular interpretation. Hyland (2005) claims that science research articles employ imperatives such as *see* and *note*, and almost never include other forms.

It can be clearly noticed from the results presented above that ASRAs' writers did not use engagement markers effectively. This might be because some markers can play the role of both self-mentions and engagement markers at the same time, which is the case for the possessive adjective *our*. They do not differentiate engagement markers from self-mentions, and this might be due to their lack of awareness of what IMM is.

From the discussion of the findings of each category of IMM and the examples provided, it is clear that Algerian scientific writers use all of the five categories of IMM while composing their RDSs. Boosters is the most recurrent category (36.04%), followed by hedges (34%), then attitude markers (24.06%), and self-mentions (05.60%) and finally

engagement markers (0.29%). This shows that Algerian scientific writers used all IMM's categories in their RDSs. This answers the first two questions of our research which were, "Do all the Interactional Metadiscourse Markers' categories occur in the Results and Discussion sections of Algerian Scientific Research Articles?" and "What type of interactional metadiscourse markers is mostly used in the Results and Discussion sections of Algerian Scientific Research Articles?" It is clearly shown from the extensive divergence of the occurrence of each category of IMM's that the Algerian writers are aware of the importance of the use of each category in the RDSs. However, when we analyzed every category in isolation, we reached the conclusion that Algerian writers are aware of using some categories, and unaware of using some others. Boosters were used with high frequency to intensify the accuracy of the findings. Hedges come after boosters to soften the intensity of the claims in order not to avoid rejections. Attitude markers followed the use of hedges to evaluate the findings and to show their importance. However, the explicit presence of the author expressed by self-mentions and engagement markers shows that the Algerian writers are unaware of the importance of these two categories as they could have used them implicitly to show more objectiveness and validity. This answers the third research question which was, "Are the Algerian writers of Scientific Research Articles aware of the importance of the use of each Interactional Metadiscourse Marker in the Results and Discussion sections?" As regards, the last research question of our study which was, "Do Algerian writers of Scientific Research Articles use Interactional Metadiscourse Markers effectively in the Results and Discussion sections?" the results obtained show that each category is used differently. First, boosters are divided into three parts: intensifier verbs, intensifier adverbs and intensifier expressions which comprise adjectives and prepositional phrases. The intensifier verbs were used correctly and occupied the highest position in expressing certainty; however, the overuse of the verb *show* which occupied 34.05% of the total use of boosters was quite exaggerating

and may have a negative impact on the writer's image and reputation. Concerning the intensifier adverbs, they occurred in great number, but the authors preferred to focus on the use of only two adverbs: *all* and *very*, and neglected the rest of the verbs. As we have already explained, the adverb *very* is considered as one of the adverbs that are used very frequently, especially in speaking, but when writing scientific articles, it would be preferable to limit its use and replace it by more powerful words. Regarding the use of intensifier expressions, both the adjectives and the prepositional phrases are appropriately used. In addition, the overuse of the adverb *all* to generalize the finding might cause the rejection of the findings and consider the research to be vague. We can conclude that overusing words and neglecting others can create a negative image of the writers' writing competencies. This shows that boosters are not effectively used. Second, the use of hedging to minimize the certainty of the claims is a positive point that Algerian writers have used, especially by using epistemic adverbs and epistemic expressions to negotiate knowledge claims. However, the writers' choice of epistemic verbs shows their lack of vocabulary knowledge as they used the modal auxiliary verb *can* with an extremely high frequency compared to the other verbs, as it occupied 18.18% of the total use of hedging markers. Nevertheless, we can say that the majority of the hedging expressions are effectively used. Third, Algerian scientists seem to cautiously express their opinions and attitudes towards the knowledge obtained. They seem to have effectively used all the attitude markers. Then, self-mentions are generally used to indicate the presence of the authors in the discourse. However, in scientific research, writers tend to downplay their explicit presence in the text by using expressions such as *the writer* and *the researcher*. While the outcomes of our research pointed out that Algerian scientists refer to themselves explicitly. Consequently, self-mentions are not effectively used by Algerian scientific writers. Finally, the results obtained from the analysis of the articles and the structured interview show that Algerian writers do not distinguish engagement markers from self-

mentions as they used markers that express the writer's presence in the text instead of that of the reader. Altogether, Algerian writers of SRAs did not use all the five IMMs effectively, and this answers the last research question negatively.

Conclusion

This chapter has discussed the findings of the present study, for the sake of providing answers to the research questions. The results of every category of IMMs have been discussed in isolation. First, the overall use of IMMs has been presented. Then, the outcomes of each category have been discussed in details. Finally, the research questions and the hypotheses of the current study have been answered.

The current study has investigated the use of Interactional Metadiscourse Markers in Algerian Scientific Research Articles, more precisely in the Results and Discussion Sections. This research has attempted to answer four basic research questions which are at the same time its objectives. The first objective has aimed to investigate whether all the five categories of IMMs are used by Algerian writers in the RDSs of SRAs. The second objective has intended to explore the type of IMMs mostly used by Algerian writers in the RDSs of SRAs. As for the third objective, it has aimed at exploring whether the Algerian writers are aware of the importance of the use of each category of IMMs in the RDSs of SRAs. Finally, the last research question has attempted to analyze whether the IMMs are used effectively in the RDSs of ASRAs. This work has been conducted relying on Hyland's (2005) Interpersonal Model of Metadiscourse.

To answer the advanced research questions and evaluate the validity of the suggested hypotheses, the study has relied on the mixed-methods research, combining both qualitative and quantitative research methods. In order to gather the needed data, two research instruments have been adopted. Hyland's (2005) Interpersonal Metadiscourse Markers Checklist has been used to analyze twenty (20) ASRAs. In addition, an interview has been conducted with four (04) authors of the articles. The quantitative data have been analyzed using the Microsoft Excel while the qualitative data have been analyzed according to the QCA.

Based on the outcomes reached in the previous chapters, mainly the Results and Discussion chapters, the examination of the use of the five categories of IMMs, the analysis of the twenty (20) RDSs of ASRAs have revealed that Algerian writers used all of the five categories of IMMs. This leads to the disconfirmation of the first research hypothesis which contended that not all the five categories of IMMs occur in RDSs of ASRAs. Moreover, both the analysis of the articles and the answers of the interviewees have affirmed that Algerian

scientists made extensive use of boosters in order to raise claims and arguments in the RDSs. They are aware of the importance of boosters in intensifying the reliability of the arguments and emphasizing the strength of the commitments. Therefore, this leads to the confirmation of the second research hypothesis suggesting that boosters are the most frequently used category in the RDSs of ASRAs. Furthermore, the results have shown that the Algerian writers are aware of the importance of using boosters, hedges and attitude markers, but they are unaware of using self-mentions and engagement markers. In closing, the third hypothesis which put forward that the Algerian writers of SRAs are aware of the importance of the use of each category of IMMs in RDSs is partly confirmed. Finally, the discussion of the findings of the articles and the structured interview have indicated that not all the IMMs that occur in the RDSs of ASRAs are used effectively. It is clearly demonstrated that some of the boosting markers and the hedging expressions are used effectively and some others are not; however, all the attitude markers are effectively used. Regarding the use of self-mentions and engagement markers, the results have designated that they are used ineffectively. In fact, it is deduced that Algerian scientific writers do not use all IMMs effectively. It may be enlightening at this point, to disconfirm the last research hypothesis which suggests that Algerian writers use all IMMs in an effective way.

Notably, this study has demonstrated the way IMMs are used in the RDSs of ASRAs. We hope that this humble work contributes to the field of metadiscourse and provides some clarity to the issue, as the fact of finding that all IMMs are used in ASRAs and that Algerian scientific writers need improvement in terms of discourse and writing. That said, we cannot deny the limitations encountered while conducting our research. The first limitation is the fact that metadiscourse should be looked at from a pragmatic perspective. Therefore, we had to analyze every article more than four times in order to assure the accuracy of the findings, and this was time-consuming. The second difficulty is the small number of the participants in the

interview, as we have asked many authors to answer the questions of the interview, but only four of them have accepted to answer our questions.

The present study will hopefully clear the way for further research on this area. It is recommended for future researchers, who may be interested in conducting the same research topic, to examine the use of metadiscourse in the other parts of research articles such as abstracts, Introductions and Literature Review or conclusion sections. Another suggestion to further research in this field is in relation to the use of metadiscourse in textbooks. In addition, the use of both Interactive and Interactional Metadiscourse Markers in discourse such as presidential speeches can be investigated.

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Appendix A: ALJEST's Articles

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Alfa stems (*stipatenacissima* L as substrate for water denitrification

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ARTICLE INFO	ABSTRACT/RESUME
<i>Article History:</i> Received : 22/09/2017 Accepted : 25/02/2018 <i>Key Words:</i> Alfa stems; Nitrate; Biological treatment Heterotrophic denitrification Natural support	<i>Abstract:</i> Biological denitrification of drinking water was studied in up-flow laboratory reactors packed with alfa stems (<i>stipatenacissima</i> L) which served as the sole carbon source as well as the only physical support for the microorganisms. The highest rates of denitrification were observed in fresh reactors during their first week of operation and the efficiency of the process declined thereafter. The addition of fresh alfa stems brought about a temporary improvement of the denitrification performance and a regime of one weekly addition prevented the deterioration of a reactor which was operated for 5 months. The rate of denitrification was affected by the water velocity and decreased at velocities above 0.054 m.d⁻¹. Colour and soluble organic carbon associated with fresh alfa stems removed by adsorption on powdered activated carbon

I. Introduction

Surface and subsurface water pollution by nitrate is an important environmental issue, because of both its toxicity and widespread occurrence, thus 50 mgNO₃⁻ l⁻¹ was set as maximum contaminant level and guide value. Decrease of nitrate concentration is often required for drinking water in order to meet the standard of 11.29 mg nitrate-N per l in water for human consumption [1]. Among various methods available (physical, chemical-physical and biological) for the removal of nitrate, biological removal (denitrification) is considered to be the most economical and environmentally sound to be feasible on a large scale. The removal of nitrate is typically obtained using reverse osmosis, ion exchange and electrodialysis that are considered as expensive processes because of construction and management costs. The main disadvantage of these processes is the generation of nitrate concentrated waste stream. Recently, taking into account the environmental impact concerns, application of biological processes gained an increasing interest. Biological denitrification process via both autotrophic and heterotrophic ways is basically a bacteriologically-mediated process where nitrate is

converted into nitrogen gas in the absence of oxygen. Denitrification is the reduction of nitrate to N₂ carried out by aerobic bacteria which, in the absence of dissolved oxygen, can use nitrate nitrogen as a terminal electron acceptor. Most biological denitrification processes are based on heterotrophic bacteria utilizing organic carbon in the form of a simple compound (e.g. ethanol, methanol, acetate). However, complex carbon sources such as cellulose-rich materials can also be used and we have recently studied the feasibility of using news paper [2] and cotton [3] as carbon sources for the remediation of nitrate-polluted groundwater. Microorganisms capable of degrading cellulose (cellulolytic microorganisms) are widely distributed in nature and usually occur in mixed culture with organisms which degrade associated polymers. Initial cellulose degradation requires direct physical contact between the enzyme molecules and the surface of cellulose and complete degradation depends on the concerted action of various enzymes (cellulases) which may act in synergism [4]. Cellulose is a basic component of all plant materials and constitutes the most abundant renewable resource in the world, with an estimated production rate of 4.10¹⁰ ton per year [5]. It is a linear glucose

polymer with hydrogen bonding between hydroxyl groups of neighboring parallel chains and is organized in fibers in close association with lignin and hemicelluloses (cotton is an exception being the purest form of naturally occurring cellulose). Thus, alfa stems is a complex mixture of cellulose, hemicelluloses, pectins and lignins, of which xylans and others xylose polymers constitute about 25 % [6]. Alfa stems resists at the great variation of temperature (-19 °C) in Rogassa region in the Algerian western south, while supporting the very hot summers (+40 °C). Following the observations on the ground and laboratory, showed that the optimal photosynthetic activity of the Alfa takes place at the temperature ranging between 15 and 25 °C. The relatively low temperature lower than 4 °C, slow down the assimilation and delay germination [7] The capacity of alfa stems to support water denitrification has been shown by others [3], used field and laboratory reactors packed with alfa stems mixed with sand or with sand and maërl in the treatment groundwater observed removal of nitrate in alfa stems filters designed to remove particulate matter from effluents prior to their application in drip irrigation.

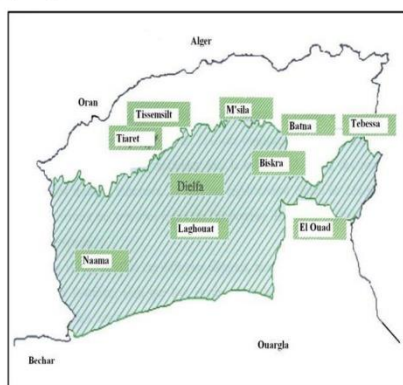


Figure 1. Stepic region presentation

II. Objective

The main objective of the project was to determine the denitrification rates obtainable under various Condition in deep bed filters supplied with natural gas. The experiments were planned in two stages.

The objective of stage I was to establish a baseline of operation by running the filter containing coarse sand (2-3 mm diameter) with methanol as a carbon source prior to using natural gas (95 % methane, hence will be referred to as methane in the future text) as the entire carbon source.

III. Materials and methods

III.1 Experimental apparatus

The reactor routinely used were glass columns, 50 cm high and 8 cm diameter, packed with 103 g alfa stems with a thin layer of glass wool placed at each end. Slightly larger columns (55 cm high and 10 cm diameter) were used when addition of 20 g of fresh alfa stems carried out because their design made it easier to open at the bottom where the new substrate was added, they were packed with 1 g of alfa stems so that the same filling ratio (41g alfa per l) was used in all experiments. The columns were inoculated with a small amount of alfa removed from an active denitrification column and the original inoculum was a mixture of forest and garden soils. The freshly packed columns were filled with feed solution (tap water amended with 22.6 mg nitrate- Nl^{-1} and 3 mg l^{-1} phosphate). After this inoculation period, the reactor were started up (day 0) in an upflow mode (Figure 2).

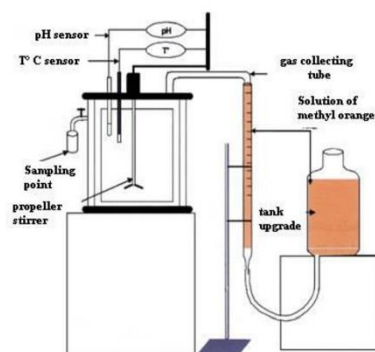


Figure 2. Scheme of semi continuous reactor and gas system collect

Water velocities v ($v = Q/A$, where Q is the measured flow rate and A is the cross section of the column) were calculated in mh^{-1} .

Unless otherwise indicated, the ambient temperature was maintained at 25 °C. Influent and effluent samples were tested for nitrate, nitrite, ammonia, pH, dissolved organic carbon (DOC) and bacterial counts.

III.2 Water source

Considering the typical characteristics of groundwater located in the province of Algiers, described by parameters as turbidity (0.4 NTU), nitrate (1.63 mg l^{-1}), alkalinity (42 $\text{mg CaCO}_3 \text{ l}^{-1}$), total organic carbon, $\text{TOC} = 0.3 \text{ mg l}^{-1}$, and UV absorbance at 254 nm, $\text{UV}_{254} = 0.8 \text{ m}^{-1}$) to attain uniformity throughout the experiments, a synthetic water sample was prepared using tapwaterspikedwith potassium nitrate, KNO_3 (100

mg/l as NO_3^-) and potassium phosphate, K_2HPO_4 (3mg/l as P).

III.3 Growth area of alfa stems

Alfa stems is a hardy perennial grass of the family of the grasses ones. This is an endemic of the western Mediterranean, which grows on the semi arid grounds of the North Africa and the south Spain[8] estimated the alfa covered surface is in hectares approximately at 4.5 million in Algeria (Figure 1).

In Algeria, the species grows mainly on the high plateaus in mixture with the sparte in an alternation of vegetation studied by the authors [9]. It is the western south steppes of the country that one meets the vast and greatest esparto expanses (1.2 million hectares in the Saida region, Table 1).

Table 1. Chemical composition of alfa stems

composition	Proportion(% report/ratio of The absolute dry plant
Cellulose rate	24.00
Hemicelluloses rate	28.00
Lignin rate	19.50
Humidity	10.00
cender	4.50
Extractedwithcoldwater	2.50
Extractedwithbenzene	1.90



Figure 3. Tuft of alfa stems which decays



Figure 4. Compact tuft of alfa stems

III.4 Analytical procedures

Nitrate was determined by the method [10] and nitrite and ammonia were assayed according to APHA

IV. Results and discussion

IV.1 Nitrate removal and water quality

A freshly inoculated reactor was operated for 2 months during which the water velocity was regulated to allow breakthrough of nitrate up to 6 $\text{mg } \text{--}\text{Nl}^{-1}$ (Figure 2). High rates of nitrogen elimination were observed during the first days of operation when little nitrate and nitrite washed out at a water velocity of 0.086 mh^{-1} (Figure 5). The soluble fraction of carbon present in the fresh alfa stems allowed rapid microbial growth and the fast colonization of the substrate so that high removal of nitrate was observed at the start-up.

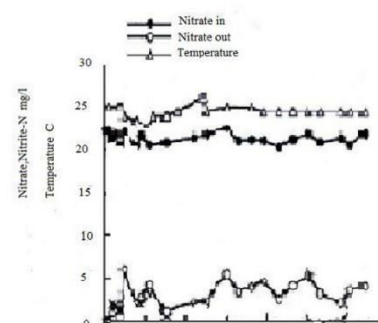


Figure 5. Concentration of nitrate-N in the influent and concentrations of nitrite

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Breakthrough of nitrite was always gradually lowered to 0.023 m h^{-1} in order to keep the breakthrough of nitrate within the set limit of 6 mg N l^{-1} . This indicated a continuous deterioration of the denitrification performance of the reactor which can be attributed to quantitative and qualitative changes in the substrate. 40 % of the initial weight was lost and 11 g of alfa stems were consumed per g of N eliminated. Due to the physical and chemical heterogeneity of the substrate this ratio should be considered as a very broad estimation only. It can be assumed that all water soluble components and a good proportion of the cellulose and hemicelluloses had been lost by the end of the experiment while lignin and mineral components remained unchanged.

The number of colony forming bacteria in the effluent was in the order of $10^6 \text{ bacteria ml}^{-1}$ and this is within the range found in denitrification with simple carbon sources (Figure 6).

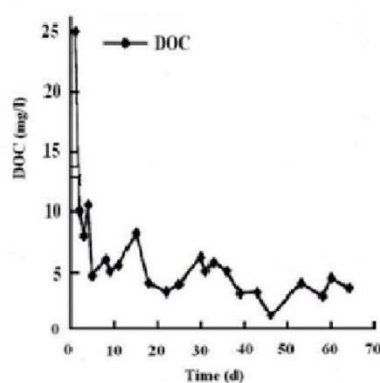


Figure 6. Concentration of nitrite-N in the influent and pH and concentration of nitrate-N

IV.2 Effect of water velocity

Breakthrough of nitrate and nitrite started at 0.054 m l^{-1} , followed by a continuous increase of the former (up to approximately 12 mg N l^{-1}) while the latter stabilized below the concentration of 5 mg N l^{-1} (Figure 7).

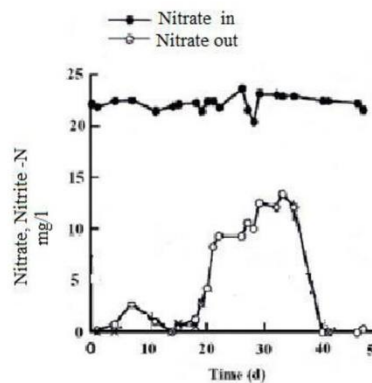


Figure 7. Concentration of nitrate-N in the influent and concentrations of nitrate-N

The highest rate of denitrification ($0.053 \text{ g N removed l}^{-1} \text{ d}^{-1}$) was observed at the water velocity of 0.054 m d^{-1} and the lowest (approximately $0.032 \text{ g N l}^{-1} \text{ d}^{-1}$) at 0.092 m h^{-1} and thereafter. The decrease in efficiency was somewhat exaggerated by changes taking place in the substrate. This could be deduced from the breakthrough of nitrite and nitrate when the water velocity was lowered again while complete removal of nitrogen had been achieved earlier at the same water velocity (Figure 8). By day 40 the weight of alfa stems had been reduced by 42 %.

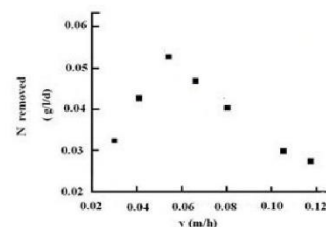


Figure 8. Effect of water velocity on the removal of nitrogen in the reactor

Thus, water velocity plays an important role in the denitrification performance of the system and the reasons for the sharp decrease in efficiency at the higher velocities may include wash-out of bacteria, wash-out of extracellular enzymes and wash-out of solubilized substrate.

V. Conclusion

In North Africa, the *Stipa Tenacissima* L., constitutes an essential element of fight against the turning into a desert and an essential factor of the maintenance of balance pastoral; from the economic point of view, it is of industrial interest some: like raw material in water treatment.

Currently the combined action of the many clearing and repeated, the excessive pasture, a prolonged cycle of dryness to which the ignorance of the plant is added partly, make that we attend a progressive regression of the alfa. Very few investments intellectual or financial were consented there, at the moment when the country attaches a great importance to the natural sources.

Safeguarding, the development and the rational exploitation of the *Stipa Tenacissima* L. are major trumps necessary for the development of the Algerian steppe areas.

On the basis of these result, we can affirm that the denitrification performance process can ensure, after a choice of a suitable parameters. In fact, the system is affected by quantitative and qualitative changes of the carbon source. So, the addition of fresh alfa stems temporarily improves the performance.

Water velocity has a marked effect on the denitrification performance of the system.

Alfa stems is a suitable carbon source for water

Water velocity has a marked effect on the denitrification performance of the system.

Denitrification and, at the same time, can serve as the sole support for bacterial growth.

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Article 02:

Valorization of brown algae (*Cystoseira caespitosa*) from local region in Algeria for sodium alginate extraction and their application in the immobilization of microbial pectinases

By Benmalek and Benchabane (2019)

Boumerdes University (ALGERIA)

<http://www.aljest.org/index.php/aljest/article/download/12/12>

Article 03:

Discoloration of contaminated water by an industrial dye: Methylene Blue, by two Algerian bentonites, thermally activated

By Feddal et al. (2019)

University of Mostaganem (ALGERIA)

<https://aljest.org/index.php/aljest/article/download/10/10>

Article 04:

Evaluation by X-ray fluorescence (XRF) of major and trace elements accumulated in *Xanthoria parietina* (L.) Th. Fr. (1860) indicating levels of pollution in Blida area (Algeria)

By Kouadri et al. (2019)

University of Blida 1 (ALGERIA)

<https://www.aljest.org/index.php/aljest/article/download/252/251>

Article 05:

Valorization of by-products from the olive oil extraction: evolution of chemical and spectroscopic characteristics during composting

By Bourbia et al. (2016)

MMUTO (ALGERIA)

<https://www.aljest.org/index.php/aljest/article/download/154/153>

Article 06:

Study of the physical and thermal properties of composite polymers of high density polyethylene (HDPE) -porcelain obtained by experimental approach

By Boussak and Chemani (2018)

University of Boumerdes (ALGERIA)

<http://dlibrary.univ-boumerdes.dz:8080/bitstream/123456789/5708/1/Boussak%20h..pdf>

Article 07:

Valorization of tomato peel waste carotenoids in different oil matrices

By Zidani et al. (2018)

University of Boumerdes (ALGERIA)

<https://aljest.org/index.php/aljest/article/download/124/123>

Article 08:

Characterization between crude diatomite and diatomite Treated chemically

By Benzemat et al. (2019)

University of Oran (ALGERIA)

https://www.researchgate.net/profile/Cherrak_Rachida/publication/337894418

Article 09:

Comparative study of biosorption of Cu⁺², Ni⁺², Cd⁺², Zn⁺² and Co⁺² ions on the Pleurotusmutilusbiomass

By Madani et al. (2018)

University of Algiers (ALGERIA)

<https://www.aljest.org/index.php/aljest/article/download/48/48>

Article 10:

Evaluation of the quality of the ground of the lake of Reghaïa in heavy metals and study of their distribution on the surface

By Dellici et al. (2018)

University ofBoumerdes (ALGERIA)

<https://www.aljest.org/index.php/aljest/article/download/56/56>

Article 11:

The occurrence of Diclofenac in the particulate phase of wastewaters

By Kermia and Djebbar-Fouial (2016)

University ofAlgiers (ALGERIA)

<https://www.aljest.net/index.php/aljest/article/view/153>

AppendixB:SCRP's Articles

Article 01:



Advances in Bioscience and Biotechnology, 2016, 7,539-544

<http://www.scirp.org/journal/abb>

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Chemical Composition and Antioxidant Potential of *Pistacialentiscus*L. Essential Oil from Oran (Algeria)

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Abstract

Essential oil from the leaves of *Pistacialentiscus*L. growing in the Oran region in the west of Algeria was obtained by hydrodistillation with a 1.26 % yield on a dry weight basis. Spectrophotometric analyses were employed to highlight the scavenger capacity of this oil using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) test. Twenty com- pounds were identified by GC and CG/MS analyses, and the main part of the com- pounds of the oil was terpinene-4-ol (41.24%) and α -terpineol (7.31%), α -pinene(9.48%), limonene (09.11%), β -myrcene (10.5%), *p*-cymene (8.67%) and α -phellan- drene (2.20%), β -caryophyllene (12.62%) as major compounds. The DPPH test shows that *Pistacialentiscus*essential oil possesses antiradical activity. A linear correlation (correlation coefficient $R^2 = 0.995$, $P < 0.001$) was found between the reduction of DPPH stable free radical and the concentration of *Pistacialentiscus*essentialoil.

Keywords

Pistacialentiscus, Terpinene-4-ol, Essential Oil, Antioxidant Activity

1. Introduction

Pistacia lentiscus L. is an aromatic member of the Anacardiaceae family. In Algeria, *P. lentiscus* L. occurs in various regions, the aerial parts of *P. lentiscus* L. has traditionally been used against several diseases [1]. Mastic gum from *Pistacia* has been used by folkloric medicine for the relief of upper abdominal discomfort, stomachaches, dyspepsia and peptic ulcer [2].

Several biological activities have been attributed to the essential oil from aerial parts of *P. lentiscus* L. such as their antifungal, antibacterial and antimicrobial effect [3][4][5].

Some works reported the chemical composition of the essential oil from aerial parts of *P. lentiscus* L. of diverse countries of the Mediterranean region [6]-[20]. The chemical composition of the essential oil derived from the aerial parts is not clear; it is greatly influenced by both geographical origin and isolation technique.

The aim of this work was to evaluate antioxidant activities of the essential oil from aerial parts of *P. lentiscus* L. from the region of Oran (Algeria), in relation with the composition of their compounds.

1. Materials and Methods

Plant Material

Leaves of *Pistacia lentiscus* of the region of Oran were collected in June 2015, during the period of full flowering. Voucher specimens were identified and deposited in the herbarium of the Agricultural Institute in Algiers, Algeria.

Isolation of the Essential Oil

The air-dried plant material (80 g), both leaves and flowers, was hydro distilled in an all-glass apparatus according to the method recommended by the European Pharmacopoeia [21]. The essential oil obtained was dried over anhydrous sodium sulfate. Yield based on dry weight of the sample was 1.26%.

GC

Analytical GC was carried out on a Varian (Palo Alto, CA) model 3300 gas chromatograph fitted with a fused silica MFE1 capillary column (50 m × 0.25 mm, film thickness

0.25 µm), with N₂ as the carrier gas at a flow rate of 1.5 mL/minute, in split mode, with the temperature programmed to rise from 95°C to 240°C at 4°C/minute. The injector temperature was 250°C, the detector used was a flame ionization detector, and the detector temperature was 300°C. Injection volume for all samples was 0.1 µL.

GC/MS

Analyses were carried out on an Agilent (Palo Alto) 6890 gas chromatograph fitted with a fused Agilent 19091S-433HP-5MS column (30.0 m × 0.25 mm; film thickness 0.30 µm; temperature programmed from 40°C to 280°C at 4°C/minute) with He as the carrier gas at a flow rate of 1 mL/minute. The chromatograph was coupled to an HP5973A mass spectrometer (Hewlett Packard, Palo Alto).

Identification of Components

Most constituents were identified by means of GC/MS. Some components were tentatively identified by comparing their retention indices on both chromatographic columns with those of authentic compounds and with literature data [22][23].

Antioxidant Test Free Radical Scavenging Activity (DPPH) Method

The antioxidant activity was measured by a modification of the DPPH radical scavenging method of Ramo *et al.* [24]. Two hundred microliters of distilled water was mixed with 160 μ L of DPPH (0.5 mM in ethanol), and then 40- μ L samples of the oil in ethanol (ranging from 2.50 to 20 μ L/mL) were added. The mixture was shaken and left to stand at room temperature. The absorbance (A) was measured 30 minutes later at 517 nm. The inhibition potential (IP) (as a percentage) is measured using the formula:

$$IP = \left(\frac{A_{DPPH} - A_{sample}}{A_{DPPH}} \right) \times 100$$

Statistical Analysis

All evaluations of antioxidant activity were performed twice. The experimental data were expressed as means $\pm$ standard deviation (S.D). The correlation coefficient of antioxidant activity was determined using Excel programme and Origin 6.

1. Results

Hydrodistillation of dried leaves of *P. lentiscus* yielded 1.26%. Twenty compounds, representing 97.63% of the oil, were identified. Results of the qualitative determination of the different constituents, together with those of the quantitative analysis are compiled in **Table 1**. The main compounds were oxygenated monoterpenes, characterized by the great prevalence of terpinene-4-ol (41.24%) and α -terpineol (7.31%), α -pinene (9.48%), limonene (9.11%), β -myrcene (10.5 %), *p*-cymene (8.67 %) and α -phellandrene (2.20%), β -caryophyllene (22.62%) as major compounds.

As shown in **Figure 1**, the *P. lentiscus* essential oil reduced the stable free radical DPPH in a concentration-dependent manner. The relationship between the antiradical activity and the concentration of *Pistacia lentiscus* essential oil (**Figure 1**) was positive and significant ($R^2 = 0.995$, $P < 0.001$).

The extract concentration producing 50% inhibition was calculated (**Figure 1**); it represents 0.39 mg/ml, corresponding to 0.05 mg/mL ascorbic acid (data not shown).

1. Discussion

These results show that *Pistacia lentiscus* is rich in oxygenated monoterpene.

To the best of our knowledge this work is therefore the first report on the essential oil of *Pistacia lentiscus* from Oran Algeria.

In other countries of the Mediterranean region, several studies have been studied the chemical composition of *P. lentiscus* L. oil [6]-[20] and several compositions were observed. Myrcene (39.2%), which is the major compounds of our essential oil, has also the abundant compound in the samples from Morocco (38%) [4], France (76.9%) [6], Spain (27%) [7], Italy (25.2%) [8] and Algeria (23.0% - 33.1%) [9].

On the other hand, α -pinene was the major compound of the essential oils from Morocco (16.1%-38.5%) [10], Algeria (20.0%-34.2% and 19%) [9] [19], Tunisia (16.8%) [11], Greece (24.9%-9.4%) [12], Italy (14.8%-22.6% and 18%) [13] [14], Spain (13.0%) [15] and France (31.9%) [6].

In our study terpinene-4-ol was by far the major component (41.24%) accompanied

Table 1. Percentage of essential oil composition of *P. lentiscus*.

Peak number	Compound	Kovats index	Percentage (%)
1	α -pinene	928	9.48
2	β -Myrcene	948	0.9
3	α -phellandrene	964	2.20
4	β -pinene	966	t
5	Cis-ocimene	976	t
6	Unknow	998	-
7	3-carene	1005	0.8
8	δ -Carene	1012	t
8	Limonene	1018	09.11
9	p-Cymene	1028	8.67
10	p-cymen-8-ol	1042	t
11	Terpinolene	1052	t
12	Linalool	1082	1.4
13	Verbenol	1122	0.7
14	Terpinene-4-ol	1137	41.24
15	Borneol	1138	0.8
16	α -terpineol	1174	7.31
17	2-Undecanone	1290	0.7
18	Isodene	1419	0.9
19	Unknow	1458	-
20	β -caryophyllene	1494	12.62
22	Globulol	1530	0.8

Components are arranged in order of MFE1 elution, t: trace percentage (%) ≤ 0.6.

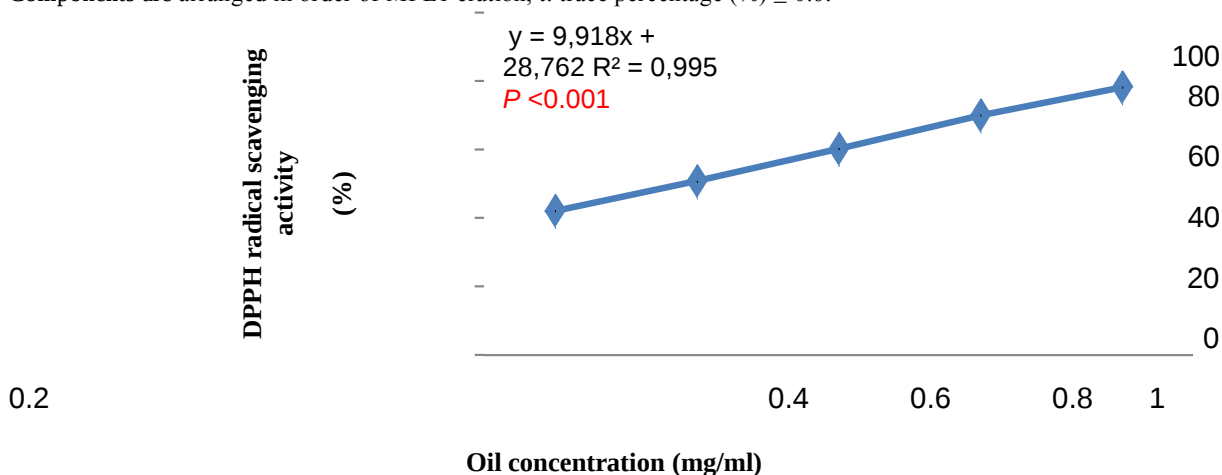


Figure 1. Positive correlation between the reduction of DPPH stable radical and the concentration of *Pistacialentiscus* essential oil.

by limonene (09.11%), β -myrcene (10.5 %) and β -caryophyllene (12.62%). it is worth noting that this oil is the richest source of naturally occurring terpinene-4-o that has been found.

Besides, terpinen-4-ol was mainly present in the oils from Morocco (14.5%-19.3%) [10], Algeria (17.3%-34.7%) [16], Turkey (30.0% and 29.2%) [17] [18], and France (25.6%) [6]. Other chemotypes were also reported: longifolene (16.4%-12.8% Algeria) [19] limonene (47.0% France and 44% - 29% Algeria) [6] [9]; β -caryophellene (19.3% - 13.1% Algeria [9] and 31.5% Italy [20].

The antioxidant activity of *Pistacialentiscus* essential oil may provide a protective effect from oxidative stress-related diseases.

As a result, the antioxidant activity of the essential oil was generally ascribed to the terpenes.

1. Conclusion

In conclusion, essential oil from *Pistacialentiscus* and its components generally displayed strong antioxidant properties, which are useful in daily life in foods and as preventive agents against various diseases.

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Article 02:

Heavy Metals in Soft Tissues of Short-Beaked Common Dolphins (*Delphinusdelphis*) stranded along the Algerian West Coast

By Larbi et al. (2014)

University of Blida (ALGERIA)

<http://dx.doi.org/10.4236/ojms.2014.42012>

1. Results

In this work we will focus on heavy metals and their possible effects on marine mammals. Heavy metals are usually divided into essential (Zn, Cu, Ni, Fe) and non-essential metals (Cd, Pb).

The mean, range and standard error (SE) of the studied elements for the analyses wet weight liver, blubber and muscle of the species, the (SE) is based on a number of samples corresponding to three (03) replicates of each one.

Summarized descriptive statistics of Cu, Fe, Cd, Pb, Zn and Ni concentration in muscle, blubber and liver tissues of Common dolphins (*Delphinusdelphis*) were listed in Table 3.

Among these tissues, liver is the most important accumulating organ for the metals to choose. Cu, Fe and Zn were significantly lowest in blubber and muscle and significantly higher in liver, but no significant difference was recorded for Ni ($p < 0.05$) which the concentrations ranged from 43.40 to 55.38 $\mu\text{g/g}$.

However, the trace elements not essential, their concentration are ranged from 0.21 to 0.39 $\mu\text{g/g}$ for Cd and 0.21 to 6.62 $\mu\text{g/g}$ for Pb, no sex-related difference in Pb and Cd concentrations was observed ($p < 0.05$).

In general, the concentration of Cu in all organs increased with sex and maturity ($p < 0.05$), however Zn, Pb, Ni were independent of maturity.

In the pregnant female, the concentration of Cu is significantly higher (39.63 $\mu\text{g/g}$) by contribution the other tissues, Fe are present at higher in the muscle (140.45 $\mu\text{g/g}$), pregnant females exhibited significantly higher ($p < 0.05$) Fe muscle concentrations compared to those in foetus.

However, the concentration of Cd is ranged from 0.21 to 0.45 $\mu\text{g/g}$, is present slightly higher; in liver the other tissues, Cd concentration were usually lower than 0.39 $\mu\text{g/g}$, except in specie (N°: 02) is slightly higher in blubber (0.32 $\mu\text{g/g}$) in relation to the 0.30 $\mu\text{g/g}$ in liver.

There were significant differences in specie (N°: 03) one notice that the concentration of the Pb is higher by reports the other with the mean concentrations which did not exceed 6.62 $\mu\text{g/g}$ in blubber, and is continued by the species (N°: 01; 02) with a maximum in the liver of specie (N°: 01).

2. Discussion

Due to the rarity of the references in Algeria, it is difficult to compare the results obtained in this study, but can be critically evaluated with those levels recorded by Shoham-Frideret *al.* (2009) [18], in the Levantine basin of the eastern Mediterranean; Lahayeet *al.* (2007) [19], in French coasts and Carvalhoet *al.* (2002) [20], in West Atlantic.

In our study Cu, Fe, Cd, Zn concentration measured were generally lower than those reported elsewhere for blubber, muscle and liver tissues of Mediterranean dolphins, with exception of the Nickel (Ni) and lead (Pb).

In addition, significantly higher ($p < 0.05$) the essential metals concentration were found in

liver. Furthermore, concentration of Cu, Fe, Cd, Zn are close to or below the detection limited in the liver and muscle of all specimens, the liver was shown to be the most important accumulating organ for this metals, due to its role in detoxification and storage [21]-[23]. The level of Cd is at the level of the detection limit and whenever measurable are rather constant in all the analyses tissues. Renal dysfunction has been linked to Cd concentration in liver exceeding 20 µg/g w. wet [24].

The detectable levels of Cd (0.31 - 0.45 µg/g wet weight) in levels indicating a diet predominant in fish [25], according to the works of Boutiba (1992) [15] the food régime of *D. delphis* of the Algerian coasts is composed of fish and cephalopods who appear in, respectively, to the rate of 93.56% and 6.44% in the stomachs of this species. But cephalopods are known to contain for higher levels of metals than fish [26].

Table 3. Trace element levels (Mean ± SE; µg/g w.wt.) in the muscle, the blubber and the liver of *Delphinus delphis* :(M: Muscle; B: Blubber; L: Liver).

Tissus	Cu	Fe	Cd	Pb	Zn	Ni
M (N° 01)	0.79 ± 0.07	143.97 ± 2.82	0.39 ± 0.04	3.74 ± 1.19	18.53 ± 0.73	45.97 ± 7.59
B	0.07 ± 0.01	36.92 ± 3.44	0.21 ± 0.10	3.88 ± 1.27	20.72 ± 0.77	52.59 ± 5.58
L	10.13 ± 0.07	165.36 ± 3.27	0.45 ± 0.06	4.12 ± 1.37	70.35 ± 6.32	53.29 ± 2.90
M (N° 02)	0.50 ± 0.06	92.07 ± 2.69	0.25 ± 0.03	3.76 ± 0.57	15.03 ± 2.26	50.88 ± 5.17
B	0.11 ± 0.05	41.91 ± 4.57	0.32 ± 0.07	4.47 ± 0.35	14.96 ± 2.11	43.40 ± 6.54
L	4.75 ± 0.73	121.33 ± 23.53	0.30 ± 0.03	5.32 ± 0.12	48.80 ± 5.42	48.74 ± 4.95
M (N° 03)	1.10 ± 0.06	64.71 ± 1.59	0.30 ± 0.05	4.77 ± 1.34	8.07 ± 0.30	52.14 ± 1.77
B	0.06 ± 0.02	33.53 ± 1.73	0.33 ± 0.04	6.62 ± 2.11	7.95 ± 0.39	53.50 ± 2.30
L	7.33 ± 0.80	149.85 ± 2.42	0.32 ± 0.05	4.17 ± 0.24	54.63 ± 1.59	55.38 ± 2.67
M (N° 04)	0.69 ± 0.07	73.44 ± 6.33	0.33 ± 0.02	1.48 ± 0.18	27.51 ± 1.89	50.15 ± 4.80
B	0.35 ± 0.02	49.24 ± 3.82	0.29 ± 0.04	1.02 ± 0.40	25.60 ± 2.14	48.47 ± 3.69
L	13.50 ± 0.20	142.05 ± 5.21	0.34 ± 0.04	1.68 ± 0.05	29.79 ± 3.68	50.63 ± 5.60
M (N° 05)	9.96 ± 0.55	140.45 ± 14.76	0.23 ± 0.02	0.64 ± 0.26	17.56 ± 1.69	46.62 ± 7.26
B	4.82 ± 1.34	36.58 ± 7.54	0.23 ± 0.02	0.45 ± 0.13	12.62 ± 2.94	46.08 ± 3.81
L	39.63 ± 6.76	123.16 ± 2.54	0.34 ± 0.05	1.95 ± 1.03	30.71 ± 5.64	44.66 ± 4.70
M (N° 06)	0.57 ± 0.08	81.03 ± 9.74	0.32 ± 0.04	0.94 ± 0.29	26.71 ± 8.04	42.46 ± 7.36
B	0.07 ± 0.01	38.45 ± 8.14	0.31 ± 0.04	0.41 ± 0.02	23.45 ± 2.20	47.40 ± 1.96
L	3.62 ± 0.28	132.63 ± 3.03	0.35 ± 0.04	0.57 ± 0.19	33.75 ± 2.24	49.88 ± 3.37
M (N° 07)	0.63 ± 0.11	118.52 ± 5.98	0.30 ± 0.03	0.25 ± 0.10	23.59 ± 2.65	49.84 ± 1.73
B	0.50 ± 0.08	75.36 ± 2.82	0.30 ± 0.03	0.21 ± 0.01	16.75 ± 3.34	52.44 ± 3.35
L	0.48 ± 0.08	99.24 ± 15.55	0.31 ± 0.04	0.26 ± 0.03	23.48 ± 2.35	50.30 ± 1.33

Pb liver levels were higher to other studies, except for three dolphins (N°: 1; 2; 3) that showed a liver concentration a value for greater in dolphin (N°: 3), Pb concentrations in foetus were not correlated to Pb concentrations in their mother.

It has to be noted that values ranging from 0.38 to 7 µg/gwet weight in the liver of four bottlenose dolphins, one common dolphin and one striped dolphin from the Irish Sea have been reported [3] [21].

However, these values indicate that Pb concentrations in liver of these individuals are a lot of agreement with those gotten in the literature.

Even when only intraspecific variation is considered, Pb concentrations were highly variable among the same age class of this study, and no clear general pattern could be shown regarding to the geographical origin of stranding or the species.

Among factors affecting individual variation, diet is probably one of the most important, and most persistent contaminants are incorporated into the body of mammals via food [5].

Most of the studies dealing with Pb in marine mammals have been carried out on soft tissues, in which Pb concentrations are often very low (less than 1 µg/g wet weight) [27].

In order to assess pollutant transfer between parent and offspring, much higher Cu concentration has been reported in all tissues of mother dolphin.

In the present study, Cu concentrations in liver were lower than values previously published, and the significant differences of Cu were detected in pregnant females and for the foetus especially in liver, the particular higher levels encountered in the liver of foetus, points out an important transplacental transfer of this metal [28][29].

Law *et al.* (1991) [21] suggested that it is possible to hypothesize a range of liver concentrations within which this regulation is active, for example, approximately 3 - 30 µg/g for Cu.

Significantly higher Cu concentrations were found in pregnant female dolphins compared to non-pregnant female suggesting that Cu may be required for growth and development of the embryo [30].

Another study suggested that these higher Cu and Zn concentrations in juveniles might relate to a biochemical requirement in newborns or a very low excretion rate of these elements by the fetus [28].

Disruption of essential element homeostasis is a powerful mechanism of metal toxicity [31], but conversely, essential element status also regulates the toxicity of heavy metals, intensifying the health effects in times of essential element deficiency and affording some protections where micronutrient status is adequate [32].

Therefore, these elements are not likely to have significant toxicological impacts on the dolphin populations in this study.

The element measured at highest concentration in this study was the Nickel, where it was in the range of 42.46- 55.38 µg/g, for example, younger dolphins appear to have higher Ni level than pregnant mother.

In mammals generally, dietary nickel is poorly absorbed and relatively nontoxic [4], but we found an order of magnitude higher range of Ni concentrations (2.36 - 47.8 mg/ kg) than the reported range of 0.05 - 0.49 mg/kg in striped dolphins sampled between 1977 and 1980 in Japan [4].

Nevertheless, apart from metal body burden data, only limited information is available, especially on the related health effects.

The metal accumulation is also influenced by age, length, weight, sex and the sea area where dolphins live [7]

[33] [34], but in this work for the seven specimens examined, it has not been possible to establish a correlation between metal concentrations and length or sex, the number of specimens was rather small, and it is difficult to offer a conclusive statement that geographic location is a contributing factor to these element concentration differences in the tissues of Common dolphins.

Samples for trace measurements in cetaceans generally originate of stranding into single events, the chemical levels may not reflect sometimes those of healthy population since stranded Individuals could suffer from diseases or parasitism's and additionally exhibit a poor nutritional status [35].

Article 03:

Dehydrocyclization of n-Hexane over Heteropolyoxometalates Catalysts

By Eid et al. (2013)

MMUTO (ALGERIA)

<http://dx.doi.org/10.4236/aces.2013.31010>

Article 04:

Quantification and Qualification Analysis of the Heat Waves Using Heat Wave Norm in the Region of Bechar (Algeria) during the Period 1951-2010

By Oubadi et al. (2020)

University of Oran (ALGERIA)

<https://doi.org/10.4236/acs.2020.103015>

Article 05:

Situation of the Technical and Financial Assistance According to Farms Opinions in Some Mountainous Regions of Tlemcen Province (Algeria)

By Hattab and Gaouar (2016)

University of Tlemcen (ALGERIA)

<https://dx.doi.org/10.4236/as.2016.75031>

Article 06:

Effect of Hydrochloric Acid on the Structural of Sodic-Bentonite Clay

By Bendou and Amrani (2014)

University of Boumerdes (ALGERIA)

<https://dx.doi.org/10.4236/jmmce.2014.25045>

Article 07:

Petro-Mineralogical Analysis of Sedimentary Phosphate of Marine Origin, Case of the Locality of El Kouif (Algerian-Tunisian Confines)

By Boulemia et al. (2015)

University of Tebessa (ALGERIA)

<https://dx.doi.org/10.4236/ojg.2015.53015>

Article 08:

Fossil Fish Teeth in Phosphatic Series of Jebel Dyr (Algerian-Tunisian Border Area)

By Boulemia and Hamimed (2018)

University of Tebessa (ALGERIA)

<https://dx.doi.org/10.4236/ojg.2018.812065>

Appendix C: ASJP's Articles

Article 01:

(The article is very long; therefore, we extracted only the Results and Discussion Section)

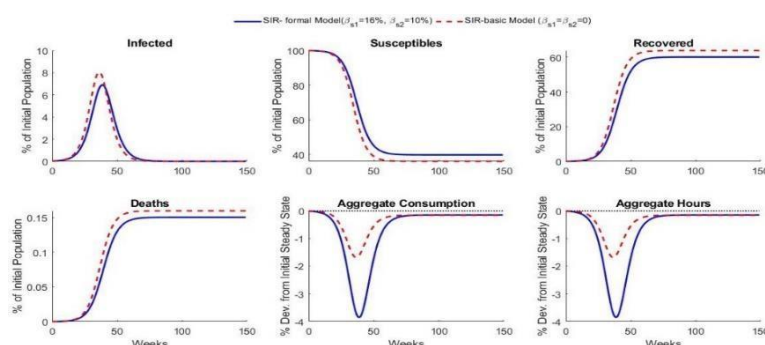
1- RESULTS

In this section, empirical results for the three SIR models implied to study the impact of informal economy on COVID-19 dynamics are presented. At first, results of the basic SIR model is provided in addition to the modified SIR-formal model and the SIR-all model which is the general model that counts for both formal and informal economic decisions. Second robustness check is done by using different parameters values. Third, the results of optimal confinement policy associated with SIR-all model is provided.

4.1- basic SIR model

Figure 1 shows that the infection is more severe in the basic SIR model than in the SIR-formal model. However, the economic impact is less severe in basic SIR model. The red dashed lines in below represents the equilibrium population dynamics implied by the SIR-formal model. The share of the initial population that is infected peaks at 8.04%. Subsequently, this share falls because there are less susceptible individuals to infect. Theoretically, 64% of the population ultimately becomes infected; meaning roughly 27.52 million Algerian eventually become infected. A mortality rate of 0.25% implies that the virus kills roughly 6880 individuals in Algeria. Turning to aggregate consumption the plot shows a recession of 1.68%. In the post-pandemic steady state, real GDP and population are both 0.2% lower than in the initial steady state. Depending on these changes, the average aggregate consumption in the first year of the pandemic falls by 0.64%. Similarly, hours worked decline by 0.2% in the post-pandemic steady state.

Figure 1: SIR-formal against basic SIR model



Source: Authors own construction

4.2. SIR-formal model

Unlike the basic SIR model the modified SIR-formal model catches the impact of individual's economic decision on the dynamics of the pandemic. From the blue solid curve in figure 1 it's clear that individuals reduce the likelihood of getting infected by lowering their consumption and hours worked 3.8%. The share of the initial population that is infected peaks at 6.89% which is less than the predicted peak by basic SIR model. Theoretically, 61% of the population ultimately becomes infected, meaning roughly 26.23 million Algerian eventually become infected. A mortality rate of 0.25% implies that the virus kills roughly 6480 individuals in Algeria. Average aggregate consumption in the first year of the pandemic falls by 1.54%, hours worked decline smoothly falling by 3.85%.

4.3- SIR-all

When the SIR model takes in consideration the size of the informal economy. The share of the initial population that is infected peaks at 6.71%. Subsequently, this share falls because there are less susceptible individuals to infect. Theoretically, 60% of the population ultimately becomes infected, meaning roughly 25.8 million Algerian eventually become infected. A mortality rate of 0.25% implies that the virus kills roughly 6350 individuals in Algeria. Turning to aggregate consumption the plot shows a recession of 2.15%. hours worked decline smoothly falling by 10.5% in the post-pandemic steady state.

4.4- Robustness Check

The table below represents robustness check where a variation of key parameters in SIR-all model is used. First, the mortality rate is changed to 0.5% and 0.7%. This variation raises the severity of the recession as individuals reduce their consumption and work to decrease the chances of being infected. Despite the concomitant fall in peak infection rates, the cumulative death rate, and the number of deaths rise. Second, the Long-run probability to either recover from the COVID-19 or dies is changed to 54% and 74%. The results suggest that the higher long-run infection rate, the larger is the decrease in consumption. Third, the control parameter for productivity of infected workers is changed to 70% and 90%. Summarily, the lower is ϑ^i the larger is the average consumption decline, the peak infection rate.

Table 3: robustness check

Values %	Consumption%	Peak infection%	Death%
Mortality rate β_d			
2.5	-2.15	6.61	0.15
5	-3.6	6.25	0.28
7	-4	6	0.39
Long-run probability to either recovers from the COVID-19 or dies			
54	-1.29	4.13	0.12
64	-2.15	6.61	0.15
74	-2.5	10.26	0.17
productivity of infected workers ϑ^i			
70	-2.29	6.18	0.14
80	-2.15	6.61	0.15
90	-1.96	7.07	0.15

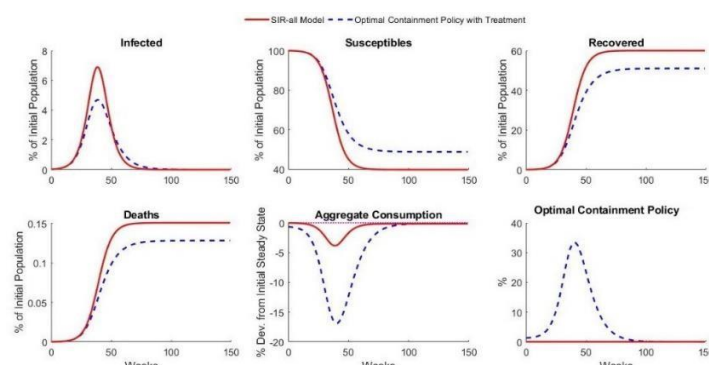
Source: Authors own construction

4.5- Optimal containment policy

Similarly, as with the very Ramsey problem, it's important to stand on the policy tools available. There are many ways in which governments can decrease social interactions. Examples of containment measures such as closing down of stores and cafes ... etc. to maximize social welfare a sequence of 150 containment rate was computed. The iteration was carried until the optimum solution was found.

As shown in the figure 2 the optimal containment rate increases from 1.5% at the start of the period to reach a maximum of 33% in week 37. This increase reduces the infection rates to reach a maximum of 4.7% after it was 6.85% and reduces the mortality rate of 0.13%; this containment roughly saves the life of 8300 persons. However, a much severe recession is associated with containment policy. As shown in aggregate consumption falls 16.5%, and in the first year it falls to 7.87%

Figure 2: SIR-all with optimal containment policy



Source: Authors own construction

5- Discussion

To show that economic discussions to reduce consumption and work has many impacts on the dynamics of COVID-19 pandemics in Algeria. This paper provides a comparison between basic SIR model and modified model named SIR-formal; this decision shrinks the severity of the pandemic in terms of infected individuals and death numbers. This is a direct result of susceptible individuals lowering the likelihood of getting infected; these same decisions sever the size of recession caused by the pandemic measured by the fall in aggregate consumption and aggregate hours worked. This decrease reflects two major factors:

- The COVID-19 virus causes infected individuals to be less productive at work. The associated negative income effect pulls down the consumption of infected people;
- The death toll caused by the pandemic permanently reduces the size of the workforce.

And this can be seen in figure 1 where the infection is less severe in the SIR-formal model than in the basic SIR model. These results are in line with the finding of (Buera, Fattal-Jaef, & Hopenhayn, 2020) and (Hall, Jones, & Klenow, 2020)

Furthermore, to demonstrate the interaction of informal economy and COVID-19 pandemic. SIR-all model is constructed. It combines economic decision and actions made by individuals in both formal and informal economy. In comparison between SIR-formal and SIR-all empirical results showed less infection peak in SIR-all. This can be explained by the individuals to cut back their interaction in informal economy to reduce the probability of getting infected. However, the degree of recession in the SIR-all is more severe.

This results highlights the importance of counting for the size of informal economy when analyzing the interaction of COVID-19 pandemic and economy. This raises the importance of paying attention to the size of informal economy. Especially workers in the informal economy are more vulnerable to this shock because they don't have an alternative source of income this point was highlighted (ILO, 2020b).

The previous results are validated by choosing different parameters values validate this result, a higher mortality rates push individuals to lower their consumption and working hours. More cut back by individuals more severe economic recession. The same outcomes are associated with productivity rates and long-run mortality rates.

The intensity of containment is strongly correlated with the behavior of infected individuals (Correia, Luck, & Verner, 2020). Hence, the rise of the infected individuals stimulate government to tighten up the rules of containment. However, the intensify containment measures make consumption much costly, so individuals lower their consumption and work. Causing severe recession (Eichenbaum, Rebelo, & Trabandt, 2020).

To reduce the impact of COVID-19 the Algerian government applied many actions starting by closing schools and universities (12/03/2020), releasing half of the government workers (17/03/2020) not much later the government declared total confinement. This Procedure was followed by social transfers to workers, unemployed and retired people. However, this financial support was only given to the registered workers in the official statistics excluding the workers in the informal economy that suffered the same or more damage from the containment measures.

On 14\06\2020 the Algerian government took the decision to begin reducing the containment policy. However, based on the optimal containment policy results it is too early for such a decision because in this period the optimal containment policy was not optimal and still increasing. As a result of this decision the number of infected individuals started to increase again reaching 441 new cases on 05\07\2020 after knowing a significant lessening from 26\05\2020 to 14\06\2020. Another important factor for this significant rise in cases is non-compliance to the confinement rules by individuals and continuing practicing their activities informally decreasing the efficiency of confinement policy adopted by the Algerian government.

The current study has some empirical limitations due to the uncertainty covering the COVID-19 pandemic, and the adopted empirical methodology.

The main limitation of the empirical result is the infection percentages adopted in the study. Due to cultural and geographical differences between countries these percentages can change leading to a certain uncertainty in the results. In addition to the incapability to distinguish between the individuals that were infected in the formal from those who were infected in the informal economy.

The study did not consider the scenario where the vaccine of COVID-19 is discovered. This can change the progress of the pandemic in all over the world.

Due to the limitations of the SIR models the current analysis does not enable us to determine the impact of the negative oil shock on the Algerian economy. Especially that our economy is sensitive to such shocks.

Appendix D: The Structured Interview

This interview is designed to be conducted with the authors of the articles under investigation. We would like to question you about the use of Interactional Metadiscourse Markers in the Results and Discussion Sections of your Scientific Research Articles. We would be grateful if you could share your true opinion with us in order to reach new academic knowledge.

Thank you very much for your time

Q1. Have your teachers taught you how to write the Results and Discussion sections of your research papers?

If yes, how?

Q2. Have your teachers taught you or trained you how to use Interactional Metadiscourse Markers in the Results and Discussion section of your research papers?

Q3. Do you use Interactional Metadiscourse Markers while writing your Results and Discussion section?

Q4. Among the five categories of the Interactional Metadiscourse Markers, which one do you use the most in the Results and Discussion section of your research?

Justify your answer?

Q5. How often do you use each one of the five categories of Interactional Metadiscourse Markers?

Q6. Do you think that the use of boosters increases the credibility of the Results and Discussion sections in particular and in the Scientific Research Articles in general?

Q7. According to you, what categories of Interactional Metadiscourse Markers should be used the most in the Results and Discussion sections of Scientific Research Articles? Why?