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IN THIS ISSUE

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Editor's Notes

We are proud to present the inaugural issue of our multidisciplinary journal for 2025, a curated volume of research that reflects the evolving landscape of scholarly inquiry across the sciences, humanities, and applied fields.

We begin with Hamzah Abdurraheem's critical stylistic analysis of Esiaba Irobi's Nwokedi, which unpacks the rhetoric of violence embedded in language, ideology, and cultural discontent. Using systemic functional linguistics, the study lays bare how linguistic choices can serve both as artistic strategy and social commentary, foregrounding the authorial voice in a narrative of political unrest.

The social sciences are strongly represented in Ivan Kaye F. Bantigue and Augusto V. de Viana's historical sociological study of gang formation in Tondo, Manila. Their work provides a nuanced look at how geography, migration, and marginalization coalesce to shape survival strategies and social identities in one of the country's most complex urban settings.

In the field of health sciences, Beatriz P. Merquita, Mary Clarence P. Malinao, Lily Ann D. Bautista, Maria Mirjana M. Calunod, Jevenus M. Malicay, Sunday Marie M. Cabarrubias, Paul Michael Partosa, and Johnniel S. Evangelista offer an evidence-based comparison of muscle energy technique, dynamic stretching, and a combination of both for alleviating cervical pain. This quasi-experimental study not only adds to the growing literature on physiotherapeutic modalities but also highlights the importance of accessible and non-invasive interventions in community health settings.

From the vantage point of environmental and agricultural sciences, Michaelito A. Naldo explores the pivotal role of nutritionists in reshaping the animal feed industry toward greater sustainability. By advocating for informed choices in feed formulation and the use of alternative raw materials, this paper underscores how technical expertise can drive environmentally responsible practices in the agri-food chain.

Rounding out the issue is a fascinating inquiry. Kim G. Sarong, Dinah Belle P. Abong, Esther Ann Nacita, Marc Daniel Nisperos, Daniel Sarte, Queenie Fritzie Sarte, and Pretty Vilar investigate the antibacterial properties of epidermal mucus in Scarus fish species. Their findings not only contribute to our understanding of aquatic immune defenses but also hold promise for the development of natural antibacterial agents in the fight against pathogenic microbes.

The art cover is by Negros Oriental visual artist and fashion designer, Dan Ryan Duran. It is a vintage Igorot photo printed on scrap fabric.

Warlito S. Caturay Jr. , PhD

Rhetoric of Violence: A Critical Stylistic Study of Esiaba Irobi's Nwokedi

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Abstract

Violence ruptures peaceful co-existence and communal harmony. However, some literary writers advocate violence as a panacea to addressing socio-economic inequality and leadership failure. This paper deployed critical stylistic tools of nominal groups, processes, equivalence, and contrast to explore the depth of violence in Esiaba Irobi's *Nwokedi*. Data were drawn from the play, and the analysis was based on Systemic Functional Linguistics. Findings revealed that the choice of material processes bespeaks the violent ideological orientation of the youths, while the mental processes convey the mental agony suffered by the victims of violence. In addition, the use of noun modifications and equivalence provides negative descriptions and invectives that further deepen the macabre tone of violence, which gravitates towards the gruesome murder of the political leaders in the play. In conclusion, the paper explicated the functional significance of the linguistic choices that foreground the playwright's authorial style, thematic focus, and ideological orientations.

Keywords: Stylistics, critical stylistics, processes, naming, equivalence, violence, and ideology

Introduction

African literature has long served as a powerful medium that challenges colonial subjugation, socio-political discontent, harrowing poverty, economic inequality, and youth neglect induced by post-colonial dysfunctional leadership and authoritarian regimes. To address these problems, African literary critics have deployed diverse literary and linguistic canons to engage the writers' thematic preoccupation, authorial styles, and ideological orientations to foster social change in the garb of revolutionary ethos. It has been observed that there is a limited application of Jeffries's critical stylistic tool in African literary studies. For instance, Adekunle and Oke (2021), Onoja (2023),), Iyakwari et al. (2024), and

Hamzah (2025) have applied critical stylistic tools to interrogate political disillusionment, revolutionary agenda, and ideological perspective in Femi Osofian's *Morountodun*, Chika Unigwe's *Night Dancer*, Kaine Agary's *Yellow-Yellow,* and Chimamanda Ngozi Adichie's *Purple Hibiscus,* respectively. To date, critical studies employing the tools of Critical Stylistics to analyze Esiaba Irobi's revolutionary plays, particularly *Nwokedi*, are conspicuously absent from the scholarly literature. This research, therefore, aims to address this significant gap.

Of all Esiaba Irobis' plays, *Nwokedi* is widely read and critiqued. This is because it mirrors contemporary Nigeria's socio-economic and political experience. Due to galloping youth unemployment, Nigerian youths have become restless and restive, challenging the present crop of Nigerian leadership. The EndSars demonstration that began in October 2020, with Lagos as a major epicenter, was sparked by police brutality, youth unemployment, social injustice, poor governance, and widespread corruption. Thus, the choice of *Nwokedi*, among other things, is to sensitize the ruling class to address the myriad socio-economic issues bedeviling Nigeria in particular, and Africa in general, before youths deploy rhetoric of violence as espoused by Esiaba Irobi in *Nwokedi* to resolve their grievances. The play, therefore, demonstrates how language functions as a site for ideological struggle in a post-colonial African setting where youths subvert established political hegemony and resist social sufferings and economic backwardness through violent disposition.

Deploying the methodological tools of Critical Stylistics to investigate Esiaba Irobi's *Nwokedi* would contribute to the growing number of works in postcolonial studies. Given the advocacy for violence as the ideological drive of the play, socio-political discourse may tilt towards violence in Africa, if the present social inequality and social injustice continue unabated, as some African countries are now under military rule. The Arab Spring of 2011 still resonates in global politics. This study's findings are expected to catalyze a heightened awareness among Nigerian and African leaders, advocating for policies prioritizing rapid and sustainable development for their populations. This research also encourages further scholarly inquiry into Esiaba Irobi's remaining plays, employing Critical Stylistics as an analytical framework.

Critical Stylistics is an approach to textual analysis and interpretation that uncovers ideologies in texts. Lesley Jeffries (2010) developed Critical Stylistics as a discrete sub-branch of stylistics, a sub-field of applied linguistics that examines formal patterns that constitute the fabric of texts, spoken or written, literary or non-literary. She drew her inspirations from a

harvest of insights and principles from Fairclough (1989), Fowler (1991), and Simpson (1993, 2004). This suggests that Critical Stylistics is heavily indebted to Critical Linguistics and Critical Discourse Analysis. Norgard et al. (2010) further explain that Critical Stylistics is also concerned about the relationship between language and power and how language can communicate hidden ideologies and intentions in texts and talks.

According to Jeffries (2014), Critical Stylistics emerged as a reaction against Critical Discourse Analysis due to the inability of its practitioners to provide what she describes as 'a reasonable broad range of tools.' While asserting a sharp distinction between Critical Stylistics and Critical Discourse Analysis, she introduces the concept of 'textual-conceptual functions' to the field of stylistics. This linguistic tool interrogates language's power dynamics and uncovers ideological concerns within texts. Textual-conception functions combine textual features (triggers) and the ideation function. Many have a prototypical form that always carries the conceptual effect…' (Jeffries, 2014, p. 412).

This form-function textual construction meaning is anchored on Halliday (1994) and Halliday and Matthiessen's (2004, 2014) notion of the three metafunctions of language (ideational, interpersonal, and textual) model of generating linguistic meaning. Jeffries (2010, p.15) mentions these textual-conception tools, and they are listed below:

- Naming and Describing
- Representing Actions/Events/States
- Equating and Contrasting
- Exemplifying and Enumerating
- Prioritizing
- Assuming and Implying
- Negating
- Hypothesizing
- Presenting the Speech and Thoughts of Other Participants
- Representing Time, Space, and Society

Not all the tools are discussed in this paper for space considerations. Only those selected for the analysis of Nwokedi were briefly explained to understand the concepts adopted for analysis. Three out of the ten tools were adopted for this analysis. The three tools are Naming and Description, Representing Actions/ Events/States, and Equating and Contrasting.

Naming and Description are the potential participants the nominal group revolves around. The Naming and Description constituent, or the nominal group's constituents, has three grammatical units: *Pre-modification*,

which can be a determiner and adjectives; and the Headword, the semantic core, is the nucleus of the nominal group. It comprises a common noun, a proper noun, or a personal pronoun without modification. Post-modification follows the Headword and has a function called Qualifier, which can be a prepositional phrase or a clause. Pre-modification says something about the Head and is functionally subdivided into several parts: Deictic, Numerative, Classifier, and Epithet (Halliday & Matthiessen, 2014). According to Jefferies (2010), the nominal group contains a great deal of information that can be used to explore the dominant ideology of a text through the choice of nouns, noun phrases, and their modifiers and nominalizations. For example, within the Nigerian context, the choice between "An unemployed young man" and "A jobless young man" has some ideological mapping, for the latter connotes a derogatory remark.

Representing Actions/Events/States refers to 'clause as representation' and captures the transitivity system. The transitivity system construes the world of experience into process types. "Transitivity," writes Halliday and Matthiessen (2004), "is a system of clause, affecting not only the verb serving as process but also Participant and Circumstance" (p.181). Processes relate to the theory of experience and account for most of the clauses in a text. Jefferies (2010) identifies four process types: material, mental, relational, and verbal. Material processes describe what is happening or being done in the external world, which she further categorizes into three subtypes: Material Action Intention (MAI) denotes intentional actions carried out by a conscious human being (e.g., The woman slapped the man); Material Action Supervention (MAS), where the verb or the action performed is beyond the Actor's control (e.g., The man slumped); and Material Action Event (MAE), where the verb refers to an inanimate Actor (e.g., The tree fell on the road). The two dominant participants in a material clause are the Actor and the Goal.

Mental process describes the state of the mind in psychological events (Bloor & Bloor, 2004). It represents something or a process that goes on in the internal world of the mind. While Halliday and Matthiessen (2004) sub-categorize mental processes into four, namely, cognition, perception, emotion, and desideration, Jefferies gives three sub-categories of the mental processes as cognition, perception, and emotion. The two functional elements of the mental clause are the Senser/Experiencer and the Phenomenon. For this paper, Jeffries's three sub-categories of mental process were adopted for analysis.

The relational processes are realized by the verb be or some verb of the same class (known as copular verbs). Halliday and Matthiessen (2014)

explain that relational clause shapes the outer experience of the material world (material clauses) and the inner world of our consciousness (mental clauses) as experience of 'being' rather than 'doing' or 'sensing'. Being in relational clauses has two parts: "something is said to be something." The English system operates with three main types of relation: intensive, possessive, and circumstantial. In addition, each of the three main types of relation has two distinct modes of being: 'attributive' and 'identifying.' The two functional elements of attributive relational clauses are Carrier and Attribute, as in 'Life is good' and 'The man seems crazy.'

In comparison, the two functional elements of identifying relational clauses are the Identifier and the Identified, as in 'Dr. Ibrahim is the team leader.' The verbal process describes the verbs of 'saying.' It intermediates between material and mental processes and involves "saying something is a physical action that reflects mental operation" (Thompson, 2004, p. 100). The two functional labels of verbal clauses are Verbiage/Sayer and Target.

Equating and Contrasting: Equating, within the context of Critical Stylistics, refers to the creation of equivalence. Equivalence suggests synonymy. Two words are synonymous when they are closely related in meaning. In other words, it deals with sameness in meaning (though not complete sameness) or similarity or nearest in meaning that words contract in sentences. Text producers explore the rich landscape of synonyms in English to express related or connected ideas. Equating is the relationship of equivalence, and writers employ it to create ideological structures. According to Jeffries (2010), syntactic triggers to construct equivalence include noun phrase apposition, parallelism, relational intensive transitivity, metaphors, and simile with the SPC structures.

Apart from the creation of equivalence, contrast, also known as an antonym, is another textual means of creating ideology in texts. Contrast expresses oppositeness in meaning. It is a very complex and natural feature of language. Two words are opposite when they share all but one of their semantic properties. The semantic property that the words do not share is present in one but absent in the other. In semantics literature, scholars have discussed kinds of antonyms: gradable and non-gradable antonyms, which trigger ideological structures. In addition to gradable and non-gradable (complementarity, converses, directional) antonyms, Jeffries avers that negated opposition, transitional opposition, comparative opposition, replacive opposition, concessive opposition, explicit opposition, parallelism, and contrastives are common syntactic elements that trigger contrast in texts (Jeffries, 2010).

This paper deployed the analytical tools of Critical Stylistics to

uncover radical ideology driven by violence in Esiaba Irobi's *Nwokedi.* This study employed three core analytical tools of Critical Stylistics—Naming and Description, Representing Actions/Events/States, and Equating and Contrasting—to interrogate how lexicogrammatical choices signpost the play's thematic concerns and unpack its ideological orientations.

Literature Review

Esiaba Irobi belonged to the third generation of Nigerian playwrights. These playwrights wrote from the late eighties to the twilight of the nineties (Roy-Omoni, 2022, p. 14). Before his untimely demise in 2010, Irobi published six plays: *Colour of Rusting Gold* (1989); *Hangmen Also Die* (1989); *Nwokedi* (1991); *The Other Side of the Mask* (1999); *The Fronded Circle* (1999); and *Cemetery Road* (2009). *Hangmen Also Die* (1989) and *Nwokedi* (1991) have received more critical appraisal than the other four plays. As this paper's chosen text for analysis, this review focuses on *Nwokedi.*

Scholars and critics such as Osu (2011), Akingbe (2013), Ignatius and Udoka (2014), Ebekue (2018), Okoye (2019), Inegbe and Bassey (2020), Amiriheobu, Eleberi and George (2020), Eze and Salifu (2021), and Shittu (2022) have critically studied and appraised *Nwokedi.* These scholars examine the play's thematic focus, cultural perspective, revolutionary bent, and linguistic choices. Osu (2011) sees *Nwokedi* as a play that mirrors the Igbo traditions as rituals and myths characterise it. To him, *Nwokedi* is "a reliable source of inspiration for literary expressions, which enacted as a struggle to overthrow the greedy politicians who have ruptured the future of the youths that bear the brunt of inept leadership" (p. 151). Like Osu, Shittu (2022) equally observes that *Nwokedi* is situated within the cultural realm of Igbo oral tradition because it is a play that hinges on ritual cleansing for community renewal and continuity. This cleansing, Shittu argues, constitutes an antidote for "political debauchery and social imbalance" (p. 64) that characterize both military and civilian administration and governance. According to Shittu (2022), inept leadership, bad governance, mindless plundering, and siphoning of the people's resources provide the catalyst for violence and revolt, which envelop the setting of the play.

Violence, Shittu (2022) maintains, reflects Esiaba's renunciation of spineless political gladiators, social inequality, and pervasion of justice, which, Osu (2011) argues, constitute the reason why *Nwokedi*, the leader of the Ekemeku, a revolutionary cult, employs violent revolutionary tendencies to deal with the politicians. This revolutionary terror, anchored on Marxist

revolutionary aesthetics, is directed at politicians perceived as the architects of the social malaise threatening the socio-economic survival of the youth. Thus, violence that rocks the fabric of the text is ignited by radical social change aimed at eliminating all corrupt politicians.

Radical social change premised on the altar of violence and terror is also the thrust of Ebekue's (2018) work. Ebekue examines the yawning gap between 'the haves' and 'the have-nots' in Esiaba Irobi's *Cemetery Road* and *Nwokedi* as a study that interrogates the power, relevance, and frosty relationship between the two opposing social classes in the play. He contends that the flash of tension and oppression that overwhelms the play arises from the social violence and friction characterizing revolutionary struggles. According to Ebekue (2018), "material gratification and personal aggrandizement" (p. 77) serve as the fulcrum that perpetuates social inequality. An attempt to denounce modern capitalist hegemony of controlling the reins of power and factors of production by the corrupt political class precipitates an atmosphere of violent responses and counterattacks. Like Osu, Ebekue applies Dialectical Materialism as the theoretical framework to analyse the class struggle that dominates Irobi's plays. Through this Marxist-driven dialectical materialism, Ebekue envisions, in the plays of Esiaba Irobi, a radical change. This revolutionary change is the metaphor for sustainable social revolution that would usher in robust social and sustainable development.

Violence and destruction as a means of seeking socio-political and economic redress is the focus of Eze and Salifu's (2021) study. The duo conducts a comparative study by examining the psychic and social paralysis of a rising generation in John Osborne's *Look Back in Anger* and Esiaba Irobi's *Nwokedi*. In their paper, particularly in Nwokedi, Eze and Salifu (2021) contend that socio-economic and political factors paralyze the youths and alienate them from the mainstream scheme of day-to-day social life; therefore, they resort to a howling revolt to uproot the social system that has perpetually impoverished them and rent their future into shreds. The authors contend that unemployment, corruption, and political exclusion significantly constrain the youths, prompting them to direct their anger and resentment toward the ruling class. This accumulated frustration, fueled by pervasive corruption, financial mismanagement, the pilfering of public funds, widespread unemployment, and crushing poverty, escalates into violent eruptions. These outbursts, in turn, breed social dislocation, exacerbate social stratification, and lead to extensive bloodshed in *Nwokedi.*

The above-reviewed works focus on literary criticisms based on thematic explorations and analyses grounded in Marxist revolutionary

aesthetics (Osu, 2011; Ebekwu, 2018). However, Okoye (2019), Inegbe and Bassey (2020), and Amiriheobu et al. (2020), like the present study, are language inclined. Okoye (2019) carries out a linguistic stylistic analysis of Esiaba Irobi's three plays, namely, *Hangmen Also Die, Cemetery Road,* and *Nwokedi,* by examining the foregrounding features in the play to identify how the playwright adroitly manipulates his linguistic choices to convey meaning effectively. Stylistically foregrounding features of deviation and parallelism examined in the selected texts reveal that the works have revolutionary undertones and fervor that escalate into violence and revolt.

Similarly, Inegbe and Bassey (2020) explore the polemics of language in Esiaba Irobi's *Cemetery Road* and segment the analysis of language in the chosen text along the following parameters: language of wit, mockery and sarcasm, macabre language, language of violence, persuasive language, proverbial language, language of abuse and insensitivity, language of despair and imagery. Although Inegbe and Bassey claim to deploy linguistic tools to analyze their chosen text, based on the title of their work, they succeeded in drawing lexical and sentential examples appropriate to the parameters listed above. The methodology and analysis employed in the study do not reflect a linguistic analysis of a literary text.

The foregoing paragraphs have shown that though the works of Irobi have enjoyed critical attention, research studies, to the best of the authors' knowledge, have not focused attention on a linguistic study on *Nwokedi* which deploys the tools of Critical Stylistics that relate linguistic options in the text to thematic exploration and ideological orientation of the author, using the framework of Systemic Functional Linguistics. In other words, previous studies have not examined the linguistic features through which Esiaba Irobi communicates and espouses his radical ideological vision. This current study intends to fill the gap.

Methodology

This paper deployed three out of the ten analytical tools of Critical Stylistics as described by Jefferies (2010): Naming and Description, Representing Actions/Events/ States, and Equating and Contrasting. The paper adopted qualitative research techniques, using the framework of Systemic Functional Linguistics. Data for analysis were drawn from the three cycles that constitute the setting of the play, namely, Osisioma, Bakalori, and Osisioma. The choice of nouns and noun modifications was analyzed for Naming and Description. For Representing Actions/Events/States, material, mental, and relational processes were analyzed. In analyzing Equating and

Contrasting, the paper focused on syntactic triggers like simile, metaphor, and antonym.

Synopsis of the play *Nwokedi*

Nwokedi is a play woven around the annual Epke festival celebrated on the 31st December to renew the earth's strength and atone for the sins committed. A goat is to be slaughtered and its blood spilled to cleanse the land for societal rebirth and communal regeneration. The Ekumeku, *Nwokedi's* age group, oversees the festival. In the distant past, human beings were sacrificed to purge the land of its sins. Thus, members of Ekumeku, headed by Nwokedi, are determined to use human beings for this year's Epke festival. They settle for the serving politicians, Nwokedi's father and Senator Arikpo, who, they believe, have desecrated the land through their failed promises, inordinate selfish ambition, and personal material acquisition that have created galloping unemployment and crushing poverty. So, *Nwokedi* is a violent response to the philistine political leadership characterizing Nigeria's governance.

Results and Discussion

Nouns and noun modifications are employed in the play to provide some ideological information. Arikpo names the youths that waylay him as 'nonentities', 'louts' (p. 3), and 'hooligans' (p. 4) to register the numerical strength and preference for their violent disposition. Similarly, Mrs Nwokedi tells Aripko that the Unemployed Youths Association of Osisioma is called Ekumeku, which means 'hurricane' and 'whirlwind'. This choice of nouns denotes violence and implies that youths are pursuing a violent agenda and radical ideology to remove all spineless politicians who have ruined their future forcefully.

The employment of noun modification or nominal group signposts the ideological divide that runs through the thread of the play. Nominal groups that denote naming and description punctuate the conflict that drives the play and emphasize the confrontational posturing and the widening ideological gulf between the youths and the politicians. After he narrowly escaped being burnt by the Unemployed Youths Association of Ugep, Arikpo narrates his ordeal to Mrs. Nwokedi and describes these violent youths in pejorative and derogatory names which have far-reaching ideological effects:

Devil's Own Brigade
a miserable mob of jobless young men and women
a menace of unemployed chimpanzees
a harvest of political illiterates. *Nwokedi,* (p. 3)

The functional significance of the choice of noun modification reinforces the deep-seated feelings of hatred Arikpo nurses have against the youths who have reduced him to dust and his residence to ashes. He says they are 'dangerous,' 'murderous,' and that "violence roils in their veins like viruses" (p. 8). These linguistic choices are 'unique identifiers' (Jeffries, 2010, p. 19) contributing to how Aripko frames the Unemployed Youths Association of Ugep.

Similarly, the unemployed youths who bear the brunt of political and rudderless leadership pour verbal venom on the political institution that has fractured their future and vision on the altar of greed, selfishness, and aggrandizement. In his re-election campaign activities to return to the Senate, Nwokedi Sr., the biological father of Nwokedi Jr., the protagonist of the play, approaches the electorate, among them the Ekumeku, to canvass for their support and votes. At the campaign ground, Nwokedi Jr. exhibits his violent revolutionary posturing as he campaigns against his father and even nominates Ozomena, a member of Ekumeku, to represent them at the Parliament. He piles up a cluster of noun modification laced with harsh and horrible descriptions that are loaded with huge ideological content to condemn, disparage, and demean his father:

m h
'distinguished rogue',
m h
'political obscenity'
m h
'resourceful liar'
m h
'high-degree thief'
m m h
'a confidence trickster'
m m h
a carapaced tortoise *Nwokedi* (p. 11)

The filial confrontation between father and son sets the tone of socialist ideology, violent radicalism, and revolution, imprinted on the

pages of *Nwokedi*. The ideological divide anchored on different political persuasions creates an atmosphere of seething anger and violence that overwhelms the play. Note the semantic heightening in the choice of the negative and derogatory nouns: 'rogue,' 'liar,' 'thief,' 'trickster,' and 'tortoise' that aptly describe politicians (Nigerian politicians in particular) as cunning and deceitful personalities, corrupt and ghoulish individuals. These descriptions 'package up' ideas about the traits of Nigerian politicians and underscore the revolutionary bent of Nwokedi, who refuses to be carried away by filial relationships (Jeffries, 2010, p. 19). Nwokedi demonstrates a towering figure who rises above primordial feelings or sentiments by standing as a stumbling block against his father's senatorial ambition.

The choice of Action/Events/States in the text equally signals the ideology of violence, the employment of Material Action Intention (MAI), which denotes that the Actor (s) of the material processes intentionally carry out the actions. Arikpo tells Mrs Nwokedi how his new house in Ugep is reduced to cinders and stones and dust:

> Arikpo: My people, (bitterly) They burnt my car, burnt my life. They have butchered me like a sacrificial animal. They have torn my flesh limb from limb…. The only job they could find was to shatter my house into fragments. (p. 3)

> Arikpo: They planted a bomb in the parlour and blew into pieces. In law, they razed it to ground, to the very foundations. (p. 40

The choice of the material verbs: 'burnt,' 'butchered,' 'turned,' 'planted,' 'blew,' 'razed,' 'shatter,' from the excerpt above, indicates violent activities, which underline the ideological orientation of the youths. This ideology thrives on destroying, maiming, annihilating, and killing elected political office holders and voluptuous politicians who murder their dreams and rupture their future. The material verbs in the excerpts above are foregrounded as they serve as co-text (Jeffries, 2010; Iyakwari et al, 2024) that reinforce the semantic import of 'burnt' and 'planted' respectively. Similarly, due to corruption, greed, and non-performance leveled against Senator Arikpo, the Unemployed Youths Association of Ugep wrote him not to contest in the coming elections. He ignores their threat and goes on to campaign, seeking re-election to the Senate. He relays his ordeal to Mrs Nwokedi:

Arikpo: In-law, when I saw the debris of my labour, I wept. Crippled in body and spirit I crawled into the car to drive to the police station but somewhere near the Ugep Township Cemetery, the hooligans waylaid me. They smashed my windscreen with a thousand stones. Dragged me out and dealt me these cuts with pieces of broken glass. Some used daggers. Other machetes. This wound (points to his head) was carved with an axe. (p. 4)

Again, 'waylaid,' 'smashed,' 'dragged,' and 'dealt' me these cuts with pieces of broken bottles' are Material Action Intention (MAI), which are collocates of violent activities and intense reactions and activities occasioned by mental frustration, social hardship, and harrowing conditions. These Material Action Intention process verbs frame the youths as a band of violent radical individuals who are determined to uproot all forces of retrogression and political backwardness. Thus, the Material Action Intention verbs, as identified in the drama text, explicitly connotes violence, where 'smashed,' 'dragged,' 'carved' function as co-text to 'waylaid' and provide crucial linguistic and interpretative functions (Jeffries, 2007) to stress the violent ideological orientation ingrained in the mind of the youths.

Similarly, in Bakalori, where Nwokedi is observing his one-year mandatory National Youth Service Corps, he exhibits his socialist ideology premised on brutally dislodging any political leadership that constitutes a clog in the wheel of social progress, economic development, and political advancement. He instills a fire of revolt and revolution into the minds of other corps members:

'….we must gather our strength and energy into the demands of a revolution'. (p. 28)
'We must revolt against revolt against those disembodied godheads….' (p. 28)
'Our roots are in the future. We must revolt.'(p. 28)
' A man must dare.' (p. 29)
'We must seize the reins of power in this nation.' (p. 30)
'We must spill his blood this evening.' p. 71

Nwokedi's brute call to a violent revolution at the orientation camp demonstrates his iron-willed determination to change the status quo forcefully. It is also a vehement denunciation of the repressive and oppressive military oligarchy that has suppressed the will and siphoned the commonwealth of the people. Nevertheless, his fellow corps members turn their backs against him and remind him of the failed Biafran Revolution.

Since he believes that 'A man must dare,' he single-handedly challenges the established order and fights two soldiers. Thus, 'we must gather our strength', 'we must revolt', 'we must seize the reins of power', 'we must spill his blood' are Material Action Intention verbs skewed in obligations and inclinations of high modulation 'must' and 'will' (Halliday & Matthiessen, 2014) and are 'performed by a conscious being' (Jeffries, 2010, p. 40). Of course, Nwokedi, a conscious revolutionary figure, will perform and execute the repeated obligations. Thus, these obligations are lexicogrammatical indicators of a revolution anchored on collective engagements that involve killing all perceived politicians who have shriveled the future of the youths. The identified action-packed material process verbs define the ideological struggle in the play.

Still on processes, the harrowing mental experience that racks the nerves of Mrs Nwokedi as a result of the filial face-off between her husband and son dictates the use of Mental Cognition process verbs to condemn politics utterly. She enthuses: "I hate politics. I detest it. It is a useless game. Very dangerous and violent" (p. 15). Through the choice of the verbs 'hate and 'detest', the reader could observe the speaker's inner world, represented by the pronoun 'I', who is the Senser. Her inner feelings, denoted by 'hate' and detest', emphasize the mental agony rending her heart as a result of the political ideology that erects a wall of separation and mutual hostility between father and son. The father, Mr. Nwokedi Snr, is equally a victim of mental grief as he recounts his humiliating defeat at Parliament to Arikpo, who advises him to control his raging emotions. In an outburst of anger, Nwokedi Senior explodes:

> 'How can I? Why Should I? How can I control myself when I have lost my seat at
> Parliament? Lost my case at the Court of Appeal. Lost my deposit. Lost my name and my face. How can I when I have lost everything that gives meaning to my life.' (p. 66)

This outburst is rhetorically appealing and stylistically foregrounded. One, the Mental Cognition process verb 'lost' is repeated five (5) times to convey his debilitating shock and sense of dispossession, having lost at the Parliament. Two, the parallel structures in "I have lost my seat …. (I have) lost my case … (I have) lost my deposit ….'etc. reveal the gripping grief knifing through the landscape of the inner world of his heart, making him mentally unstable to manage and control his actions and feelings. In other words, his inability to control (Mental Reaction process verb) the tension gnawing at the terrain of his mind engenders mutual hostility between him

and his son on one hand, and between him and his wife on the other hand. Encircled in these wild emotions, he resorts to name-calling, describing Nwokedi Junior as 'a prodigal son, 'a renegade,' and 'a mercenary' (p. 66).

This mutual hostility, dictated by ideological divide, further sharpens the tension and violence that rocks Mrs Nwokedi's matrimonial home. In one tumultuous encounter, Nwokedi fiercely confronts his father and says: "Father, I hate you, I hate your roguish generation…. Father, you are the object of my hatred. You and your squandering generation. I hate you" (p. 77). Thus, Nwokedi's deep-seated hatred of and simmering anger for his father are summed in the choice of the Mental Cognition process verb 'I hate you', which aptly explains why he publicly ridicules and condemns his father. According to Jeffries (2010) and Halliday & Matthiessen (2014), verbs in the mental cognition process construe and reveal the speaker's stream of consciousness, which may be traumatic, as in the above example. The tense and volatile atmosphere created by the physical violence in the play further provokes the use of mental process verbs that underline the emotional violence and turbulent eruption in the internal world of Arikpo. As a victim of physical and mental assault, his conversation with Mrs Nwokedi is laced with the choice of mental processes that mirror the troubled landscape of his mind. In the third cycle, when the Epke festive mood gathers momentum and the sound of the drums becomes macabre and murderous, fear rumbles in his mind and he tells Mrs Nwokedi: "I have a strong premonition that if I stay here much longer I may live in a coffin…. I feel harassed. I feel like a ram bleating at the shrine—a helpless animal surrounded by a thousand glinting knives" (p. 51).

The entire utterance punctuates the wild and tumultuous wave of emotions running through his veins. His repetition of the Mental Reaction process verb 'feel', known as the mental clause of perception (Jeffries, 2007, 2010; Halliday & Matthiessen, 2014), paints a clear picture of a freezing and fidgeting figure wobbling and waggling on the crest of death. His grim mental imbalance is further punctuated by the conceptual metaphor 'a helpless animal surrounded by a thousand glinting knives.' A similar mental process verb that reflects mental and psychological violence is further gleaned from the text. As the Epke festival reaches its crescendo and the drums grow madder, Aripko and Mrs. Nwokedi see death, violent death, lurking in the festive air that beclouds Osisioma. First, it is Aripko, who, in a clear and simple choice of Mental Perception process verb, discloses the ferocious fear gnawing at his troubled heart: 'The drums I hear are the drums of death' (p. 85). Notice the Mental Perception process verb 'hear', which collocates with drums, to express certainty that death, violent death,

looms on the horizon.

Next, it is Mrs. Nwokedi who confirms Arikpo's fear and worry as she divulges the sombre musings rocking the internal world of her mind. She prophesies: "I perceive the smell of blood. And the stench of graves. In my inner mind, I see fresh mounds of earth. (mystically) Senior, the scent of death is thick in the festive air" (p. 86). Here, Mrs. Nwokedi employs two Mental Perception process verbs, 'perceive' and 'see,' to communicate her unstable and fractured emotions that gravitate towards death. Consider the strong collocations: 'blood', 'grave', and 'mounds' explicitly heralding the 'scent of death'. Also, the verb 'see' is instructive because she can probe through the inner recesses of her mind into the shrouded velvet of the future. Though her emotions may be macabre, murderous, and violent, her prophecy, colored by mental agony, comes to pass as Nwokedi beheads his father and Senator Aripko to purge the land and atone for their sins to pave the way for a revolutionary change, a new vanguard of leadership symbolized in the youth-dominant Ekumeku. These properties of mental clauses, as analyzed in the preceding paragraphs, evoke the inner turmoil and somber mood that have enveloped the characters.

Furthermore, Relational Intensive processes are employed in the text to add to the violent ideological bent. Such relational processes complement the material and mental processes' activity-packed verbs and emotion-driven clauses. Few examples are stated thus:

> I am Nwokedi….There is magic in my name
> Our roots are in the future. We must revolt.
> *Nwokedi* (p. 28)

In the above excerpt, the Relative Intensive process 'I am Nwokedi' is driven by protest, violence, and radicalism. It connotes audacity and temerity that challenge any established constituted authority. Amazed by Nwokedi's effrontery, one of the most senior army officers in the Orientation Camp at Bakalori, addresses Nwokedi thus:

> Adjutant: You look like a subversive element
> Nwokedi: I am not a subversive element, Bokassa
> Adjutant: What are you?
> Nwokedi: I am a rebel.
> Adjutant: A rebel? What is "a rebel?"
> Nwokedi: A rebel is the man who says "no". The man who says "it is enough!" (p. 31)

Nwokedi's brisk and thorny responses mirror his revolutionary ethos and raging abhorrence for the system that has instituted social inequality, abject poverty, and galloping unemployment. This system, Nwokedi describes as "a stinking, rancid and swampy system" (p.78). Right in front of the military officer that would tear him to shreds, he boldly proclaims himself 'a rebel,' an Attribute (Jeffries, 2007, 2010; Halliday & Matthiessen, 2014), suggesting a violent outburst and open challenge to the political order that has truncated the dreams and aspirations of the youths, that has created joblessness and hunger and that has pushed the unemployed to the abyss of disillusionment and disenchantment. Thus, the Relational Intensive process of being "I am rebel" aptly captures the thematic focus and ideological orientation of Nwokedi.

Completely possessed by the murderous anger of the old, corrupt, and deceitful politicians, symbolized in the personality of Aripko and his father, Nwokedi, pointing a knife fixedly in their faces, says: "Both of you are criminals!" (p.79). It is a succinct and serrating Relational Intensive process that reverberates the thundering anger brewing in his mind against all leaders who have floundered the hopes of the youths. It is a punchy and weighty clause that defines Nwokedi's harsh and harrowing assessment of his father and Nigerian politicians.

However, the first relative clause, "I am a rebel," and the second clause, "Both of you are criminals!" have far-reaching ideological implications. While the Attribute of the first clause, 'a rebel,' may suggest a freedom fighter, a revolutionary ideologue that champions social change, the second clause, 'criminals,' connotes a niche of negativity and a pack of crooks. This seemingly differing ideological orientation, couched in the rhetoric of violence, is expressed in the text through another Critical Stylistic tool known as equating or equivalence and contrast.

One of the features of equating or equivalence that is widely used in the text is simile, which denotes violence and radicalism. At the beginning of the play, Aripko likens the Unemployed Youths Association of Ugep to viruses. In other words, the Youth Association is synonymous with viruses. He says: "Violence roils in their veins like viruses" (p. 8). The simile implies that just like viruses spread and attack every pore of a healthy body, the mayhem perpetrated by the Unemployed Youths Association and *Ekumeku*

has an overwhelming grip on the society.

In addition, due to the thunderous drums of the Ekpe and their sinister messages, Aripko conveys his premonition and weird feelings. He compares himself to a bleating ram: "I feel like a ram bleating at the shrine. A helpless animal surrounded by a thousand glinting knives" (p. 51). The image in the two similes (the second simile being 'I feel like a helpless animal surrounded ….) depicts doom awaiting a ram bleating in the shrine and an animal surrounded by a sharpened thousand knives, as both are already shrouded by gruesome death. Nwokedi equally confirms this murderous feeling of gruesome death that seizes Arikpo's mind as he tells Arikpo: "You look like a ram to me… a sacrificial ram… I mean that a constipated destiny is staring you in the face" (p. 71).

Apart from simile, metaphors are also used to structure violence and convey anarchy that aptly reveals the ideology that runs through the play's thread. Due to the closeness between Nwokedi and Ezinna, her sister, Mrs. Nwokedi discloses to Arikpo that "when they were children, people used to call them sword and scabbard" (p. 52). The phrase "sword and scabbard" is a conceptual metaphor. They are 'sword and scabbard,' meaning that Nwokedi and Ezinna are identical regarding intimate siblings who are stubborn and strong-headed, confrontational and violent. Senator Arikpo, Ezinna's husband, describes her (Ezinna) as "a very stubborn girl" (p. 62). This metaphor type is what Jeffries (2010) refers to as 'conceptual equivalence' (p. 54).

Metaphor as 'conceptual equivalence' is implied in Lakoff and Turner's (1980) view of metaphor as a conceptual system that largely structures and conveys daily realities and reflects our thinking, action, and perception of social occurrences. Thus, Nwokedi Sr, relating how he lost his seat at Parliament to Arikpo, structures his experience to imply and implicate that Mrs. Nwokedi insidiously worked against his bid to return to Parliament, using a cluster of animal metaphors: "This is the female spider who cuts off the head of the male spider after they have made love ….She weaves the web but hides behind. She lent the rabbit the iron trap with which it caught the tiger" (p. 66).

"This is the female spider …" generates the conceptual metaphor Mrs. Nwokedi is the female spider, following the SPC structure. The tenor of the excerpt is replete with animal imageries (metaphor) that conveys conflict and violence, particularly as the female spider kills the male spider after making love, weaves the web to catch its assailant, and lends the rabbit the iron trap to kill the tiger. The material process verbs 'cut off,' 'weaves,' 'lent,' and 'caught' provide concrete and illustrative animal metaphors that

foreground the domestic tension and humiliating electoral defeat which mark the twilight of Mr. Nwokedi's political career.

Still on metaphors, the martial music which heralds the military takeover at the end of the play, finally shatters the heart of Senator Arikpo. He breaks the news of the coup to Nwokedi Sr., employing metaphors (and simile) that convey chaos and violence: "In-law, these soldiers will rupture what is left of the future like a virgin's hymen. They will perforate it with bayonets and plant bullets within that womb" (p. 89). Material verbs 'rupture,' 'perforate,' and 'plant' collocate with the weapons of war like 'bayonets' and 'bullets' to produce collocations of conflict, instability, and violence. The tenor of the metaphor is the effect of the coup on the politicians which is likened to the forceful destruction of a virgin's hymen through a violent rape that often leaves an indelible psychological scar on the mental state of the victim of rape. Furthermore, that psychological scar is aptly communicated by Mwokedi Sr.: "The meaning of this life we live eludes me" (p. 90).

Senator Arikpo mostly receives the overwhelming crushing effects of the coup. He is psychologically mangled, socially ostracized, and economically bankrupt. So, the coup's news breaks his fragile frame and lacerates his somber mood. He piles up dozens of elliptical conceptual/ animal metaphors to describe the military: "Hyenas! Vandal!, Jackals!, Animals!, Cannibals!, Carnivores!, Kosokos!, Wolves …. Civet cats!, Vermins! Uniformed rams! You will all die! (p.90). The metaphors employed in the play are mostly, as rightly observed by Jeffries (2010), interpreted and understood through 'cognitive strategies' (p. 54) that underline our everyday experience. Applying these strategies would reveal that the metaphors resonate with physical destruction and mental devastation.

In addition to equivalence, contrast as a Critical Stylistic tool to denote a violent ideological perspective runs through the fabric of the text. The conflict in the play is the differing ideological orientation between the jobless, restless youths and the greedy, inept political leaders in the corridors of power. Nwokedi and his Ekumeku group regard the politicians, symbolized in Mr. Nwokedi Sr. and Arikpo, as a pack of 'excuthieves' (Osundare, 1984) and 'nonentities.' Nwokedi describes his father and Arikpo as 'distinguished rogue,' 'a political obscenity,' 'a resourceful liar' … 'a high degree thief,' 'a confidence trickster,' 'a carapaced tortoise,' 'marauding monsters and bleating beast' (p. 11). In contrast, Arikpo holds the youth in high contempt, representing their turbulent activities and reactions to socio-political issues as dangerous and violent. He depicts them as 'Devil's Brigade'(p 8), 'a disco-going, hemp-smoking, beer-guzzling generation,' 'louts,' 'jobless

vagabonds,' 'an irresponsible generation,' 'a brigade of unemployed youths' (p. 15), and 'peasants' (p. 19). These noun phrases contrast sharply with the naming and descriptions Nwokedi employs to describe his father. Contrast generates the differing and simmering ideological twist (Jeffries, 2010, p. 56) that defines the content of the play.

In an encounter between Nwokedi and his father, contrast drives the philosophical and ideological differences between the opposing, antagonistic camps. Nwokedi describes his father and Arikpo as a 'squandering generation,' 'irresponsible generation,' roguish generation,' 'confused generation,' 'Trousered Apes,' 'Night's acrobats,' 'Culture Vultures' (p. 77), 'vampire bats' (p. 78), 'tyrants' and 'criminals' (p. 79). Vultures, bats, tyrants, and criminals produce an image of prey, scavenging and swooping on the lesser animals. In contrast, however, Arikpo describes Nwokedi Junior as 'idealistic' (p. 78), often terrorizing people (p. 80) and 'blinded by daydreams' (p. 81). Ideological conflicts create cracks and 'exploits... subdivisions' (Jeffries, 2010, p. 56), violence, and anarchy.

Findings

The foregoing discussions reveal that the noun modification or the nominal group is employed to name and describe the youths and the politicians who constitute the two opposing classes in the play. While Arikpo uses derogatory and pejorative labels 'hooligans,' 'a miserable mob of jobless young men and women,' 'a harvest of political illiterates' to describe the violent, restless and restive youths, Nwokedi equally piles up a cluster of noun modifications couched in biting invectives and loaded in ideological content such as 'high degree thief,' 'a confidence trickster,' to describe the greedy and selfless and spineless political leaders.

The choice of material processes such as 'burnt,' 'butcher,' 'shatter,' 'smashed,' 'dragged,' ' seize,' and 'spill' are Material Action Intention verbs, which depict the wild revolt and intense violence of the youths to demonstrate their revolutionary candor towards change. The mental process verbs such as 'lost,' ' hate,' and 'feel' foreground the intense emotional pain and agony suffered by the different characters in the play as a result of the ideological divide that creates simmering seeds of discord between father and son on one hand, and between husband and wife on the other hand.

The use of relational intensive clauses such as ' I am Nwokedi' and 'I am a rebel' stresses the violent radicalism of the hero of the play. It establishes his radical ideological belief, which is grounded in the language of violence and revolt as the only instrument to entrench change, equality,

progress, and development.

The use of similes such as 'I feel like a ram bleating at the shrine' and 'You look like a ram to me' connotes the gruesome death that looms on the horizon of the play and confirms the murderous and macabre tone that resonates in each line of the play. Similarly, one-word conceptual metaphors like 'Animals', 'Cannibals', Carnivores', 'Wolves' reveal the overwhelming debilitating effects on the coup on Arikpo, which finally wrecks a morbid and violent impact on his mental frame of mind. The choice of contrast linguistically polarizes the characters in the play into two opposing camps: the youths and politicians. The contrast also punctuates their ideological divide, creating tension, revolt, and violence that runs through the fabric of Nwokedi.

Thus, the study confirms previous studies such as Okoye (2018), Inegbe and Bassey (2020), Eze and Salifu (2021), and Shittu (2022) that Esiaba Irobi's Nwokedi advocates violent revolutionary tendencies as political ideology to address leadership failure, sordid social conditions, and economic backwardness. The present study differs sharply from the previous ones as it identifies Noun modification/nominal groups, processes like material, mental, and relational, and equivalent and contrast couched in simile and metaphors as the lexicogrammatical options through which Esiaba Irobi communicates and espouses his Marxist revolutionary aesthetics, which he believes will establish radical social change.

Conclusion

Class Violence, as typified in *Nwokedi*, is a recurring ideological vision that runs through the fabric of Esiaba Irobi's plays. In *Hangman also Die,* the narcissist Marxist ideologue Ogbansiegbe is killed by the Suicide Squad, the revolutionary vanguard force, in order to pave the way for a more communalist and masses-oriented Marxist ideology (Osu, 2011), and in *Cemetery Road*, a government official and Lawani are brutally murdered in the play. Even Mazeli, the firebrand revolutionary hero in the play, is killed. This penchant for a violent form of revolutionary change underscores Okiche's (2016) assessment of Esiaba Irobi as a Marxist revolutionary who 'sought a method to violently revolt against oppression and intimidation to achieve political rebirth. . . ' (p. 73)

Thus, the proclivity towards violent radical change to address post-colonial ineptitude of political governance and the general putrescence in the society (Agho, 2016) marks Irobi as a critical realist in the mode of the first and second generations of African writers who are Marxist ideologues

such as Ngugi wa Thiong'O, Alex La Laguma, Ebrahim Hussein, Festus Iyayi, etc. These writers, like Esiaba Irobi, are advocates of organized revolts and forceful removal of the corrupt, selfish, and greedy ruling class by the oppressed class. Ngugi wa Thiongo (1972) asserts that 'violence to change an intolerable, unjust social order is not savage: it purifies men' (p. 28).

As long as economic hardship, social injustice, and political misrule pervade human societies, people would orchestrate violent revolt, after all forms of possible non-violent outlets have been exhausted. Some ethnic militias and resurgences across Africa and other parts of the world are products of social revolutionary change geared towards addressing bad governance and injustice. Unless African political leadership implements programs that would stimulate social justice, economic growth, and sustainable development, African revolutionary writers of a Marxist strain would continue to advance violent change and organized revolt to address socio-economic and political disenchantment.

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The Emergence of Hardiness: The Hoodlums and Gangs in Tondo, Manila from 1960 to 1980

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Abstract

The geographical conditions of Tondo and the social network coverage demonstrated by the gangs would understandably influence behavior. Much has been written about the emerging problems accompanying rapid economic growth and the spread of poverty, criminality, financial stability, and the worsening condition of society and humankind; however, there have been relatively few studies about the cause of deviance and the unsavory reputation attached to the Tondoeños.

This study examines the intricate interplay among migration patterns, gang proliferation, and the urban development of Tondo. To provide context, the discussion of sub-topics like geography is presented to elucidate the concentration of settlers in Tondo's streets and establish its connection to the emergence of concentrated groups of hoodlums and the formation of gang communities. Moreover, society is a type of association that enables individual members to cooperate to achieve objectives as a collective, which cannot be achieved by independent individual action. In the context of Manila's Tondo district, this theory helps us understand how societal conditions have shaped the development of events, situations, and phenomena, particularly about the survival strategies of its inhabitants vis-à-vis understanding the locale of Tondo as a slum and a marginalized area. This study argues that gangs are integrated into the social fabric of the community, a presence frequently characterized by fear (local term: nakakatakot) stemming from their activities in various parts of Tondo. This social behavior is typically connected to economic activity and the concentration of settlers in the community. The significance of the 1960s, the post-war market, is that social and human activity changed.

Keywords: Tondo, Manila, Gangs, Population, Crimes

Introduction

The district of Tondo is an old and vital place in Manila. Long before the Hispanization in 1571, it was one of the earliest settlements clustered around Manila Bay and the Pasig River. Settlements initially began in marshes and later expanded into the dry land that arose from the banks of bodies of water; these migrants are from the Albay, Bicol, and La Union provinces. When railroads were constructed during the early 20th century, entry points to other parts of Luzon and Bicol made it possible for migrants from Albay, Bicol, and La Union to settle there. These migrants took advantage of the North Harbor piers adjacent to Tondo, which became a hub for the probinsiyano Visayas and Mindanao, facilitating trade and migration. The pivotal role of Tondo in the region's trade and migration history as a hub for the probinsiyano from Visayas and Mindanao is a testament to its importance and influence.

The urban landscape of Tondo is marked by several interconnected challenges, including emerging social problems accompanying rapid economic growth, the proliferation of gangs, financial stability, deteriorating social conditions, underlying causes of deviance, and the pervasive unsavory reputation attached to the people of Tondo. Labels such as nakakatakot have become a stigma among the Tondoeños and yet organizations. Contrary to the analysis and passive recipients of Tondo Manila, several investors, businesspeople, academicians, and supporting nongovernment organizations have actively engaged in improving the urban development and environment to provide intervention and improve the current situation.

This study is an interplay between migration patterns, gang proliferation, and the urban development of Tondo. The discussion of sub-topics, such as geography, is explored to understand the concentration of settlers on the streets in Tondo and relate this to the concentration of gang or gang communities. Another category aligned with geography is labor and employment, which can be considered as a factor for migration but also a distinction among the gang members with the usual mentality that these groups are unemployed vis-à-vis understanding the locale of Tundo as a slum and marginalized. This study aims to discuss how gangs are part of the social behavior of the community, which is usually marked as nakakatakot because of their existence in film and literature. This social behavior is typically connected to economic activity and the concentration of settlers in the community.

Conceptual Framework

Herbert Spencer is known as a philosopher and social theorist in the nineteenth century; Spencer's critical contribution was developing the concept of social Darwinism and coined the term "survival of the fittest" from Charles Darwin. The societal change in the 19th century, including the Industrial Revolution, rapid industrialization, and the rapid expansion of colonial empires, led to increased urbanization and the spread of capitalism. These transformations significantly influenced Spencer's development of Social Darwinism, as they highlighted the competitive nature of society and the importance of adaptation for survival.

This study is concerned with the geographical influence on Tondo's social and political development during the post-war period, as well as the social factors that contributed to the social image of Tondo, Manila. Herbert Spencer contended that social organization, in its various forms, is fundamental to understanding human society and its dynamics. Given humanity's inherently social nature, he posited that significant social structures are essential for explaining both general social phenomena and specific conflicts among individuals and groups. Moreover, Spencer viewed society as a form of association that enables its members to cooperate in achieving collective objectives unattainable through independent individual action. This is evident in humanity's capacity for resource utilization to adapt to challenging environments, pursue shared goals, and collectively define individual roles and behaviors within the social order.

Drawing on Spencer's argument that society is an association enabling collective action to achieve goals beyond individual reach, this study highlights the intricate link between Tondo's distinctive geographical and social conditions and the proliferation of gangs. This analysis further connects gang emergence to prevailing patterns of crime and violence observed from the post-war period through to the contemporary era. Employing this method of Social Darwinism would lead to the understanding and interpretation of the development of events, situations, and a medium and short-term period. The phenomena of the historical time trace the geographical location of Manila and Tondo vis-à-vis the movement of man in the community for economic and personal purposes, which later created the policy that utilizes man concerning the use of allocated space in the community.

Methodology

The choice of sources, data, and methodology is often used to understand and explain the perpetrators and perpetration of crimes. Qualitative research usually provides a rich, in-depth picture of the complexities that conform to reality and circumstances. On the other hand, a quantitative study designed, implemented, and interpreted relies on testable constructs, concepts, and hypotheses and provides generalization and reasonable results.

Data collection will be conducted in two phases: qualitative and quantitative. The qualitative phase: Interviews from the Tondoeños will not be undertaken because of data privacy concerns; however, descriptive and analytical methods will be employed to interpret the data. The quantitative phase: Data from the police station will be used to track the criminal and non-criminal records of gang members, as well as their livelihood, gang group, and gang proliferation in Tondo over the period. Data on Tondo residences from the National Census and Statistics Office and the Philippine Statistics Authority covers demographics, population density, and employment. Using maps of Manila from Manila City Hall to identify the districts in Tondo and to ensure the concentration of settlers and gang groups in Tondo will represent the different socio-economic strata in Tondo.

To enhance the validity of the findings, methodological triangulation will be employed, comparing qualitative and quantitative data to ensure a comprehensive understanding of the research phenomenon. Using a mixed-methods approach, this study aims to provide a robust analysis of the complex interplay between migration, gang proliferation, and urban development in Tondo, thereby contributing valuable insights into the resilience of its residents.

Results and Discussions

The Geography: Manila and Tondo

Several large rivers cover the island of Luzon and are navigable by ships of greater tonnage, such as the Pasig; it can carry even a hundred tons, impeded only by a bridge. The port is located there, near the towns; even the most significant ships are docked and repaired at minimal cost; the river is considered more profound compared to other bay water tributaries, and if it were not for the bridge of Manila, the ships could proceed even further. At the same time, the smallest can extend to Malacañang and even to Pateros of

Pasig Bay, making Tondo easily accessible and a hub of trade and commerce.

The presence of the river had profound social and political implications. It served as a vital transportation route, facilitating the arrival of goods and people in Manila from the neighboring parts of the island, such as Luzon province. Thousands of canoes, dinghies, and paraos would arrive and be leased from the lake to the city or the Bay of Manila, contributing to the city's economic and cultural diversity. This influx of goods and people from various parts of the island enriched the city's cultural fabric and stimulated its economic growth. Manila, the capital of the Philippines Islands, was not only a political center but also a hub of trade and commerce. The Philippines' most important cities and towns, such as Cavite and Zamboanga, were fortified, indicating their strategic importance in the region (Mallat, 2021, p.2).

Manila took a long time to make (Joaquin, 1990, p. 1). What is now its ground used to be the sea; through hundreds and hundreds of years, this foreshore began to fill up until a triangle of ground appeared. This started the site of the City of Manila; a triangle can be imagined as it handled the Pasig Town, the rim arc of Pasay, and North Harbor.

Manila, the capital of the Philippines, is on Manila Bay, on the banks of the Pasig River, a tidal estuary that connects Laguna de Bay to Manila Bay. The bay is 120 miles in circumference and accommodates navies around the world. Manila was the best commercial center on the globe as a significant part of Manila is located in what used to be swamps and marshes, as well as Manila Bay, which has a coastline of 190km and stretches from Cavite to Metro Manila, all the way to Bulacan, Pampanga, and Bataan. Seven cities bound the city: Navotas and Caloocan on the North, Quezon on the Northeast, San Juan and Mandaluyong on the East, Makati on the Southeast, and Pasay on the South.

The geography and location of Manila were the first elements that made Manila a significant trading port. A port had to be developed. In the age of the galleon trade, goods were either unloaded in Cavite or landed at the Contra Costa on the eastern side of Luzon to be brought overland to the Laguna Lake area and on to Manila via the Pasig River.

Goods for New Spain, especially Chinese goods, landed in Manila before being loaded on a ship bound for Acapulco. During the galleon trade, Manila replaced India as a trading city in Asia. In 1832, the town was officially opened to world trade, but even before that, foreign ships, though formally banned by the Spanish crown, traded with Manila. The city's opening to international trade recognized the potential of trade with the colony's most significant city.

The second element that made Manila a maritime trading city was the urge to trade and its potential profit. The ground was formed in the mouth of the river, called a delta, and occupied by the City of Manila. The site of Manila was reclaimed from the sea; perhaps the first to inhabit the delta isles were the barangay folk who began to arrive in the Philippines around the tenth century. The Philippines' geographical location is an outlier among some Southeast Asian islands, which have adapted major cultural influences in the entire region.

The lands in Manila are primarily filled with different urban areas. In the beginning, the slums were used for housing and informal commerce. These areas, classified as unfavorable to the available space needed for human settlement, later received support from specific political and economic forces using administrative gaps. Currently, Manila has a computed land area of 42.34km$_2$ consisting of six districts, 17 administrative districts, 100 zones, and 896 barangays (Philippine Statistics Office, 2024).

The City of Manila is the country's historical, cultural, political, economic, and educational center. History and culture can be observed in the city's physical character. The opening of the port, railroads, bus companies, and labor opportunities provided a privilege in Manila, especially in the provincial locations; the railway equipment was from Britain throughout Manila. The sailing vessels were often based on the regional ports, local crew, and captain, and railway operations were concentrated.

The geographical location made Tondo a distinguished venue from the pre-Hispanic era's local, national, and global perspectives. It started a rustic foreshore community in the Manila Bay Area and evolved into a trading post. Manila was confined within the walls of the city, known as Intramuros. Initially, the walled city of Manila was enclosed with walls known as the Intramuros. In the sixteenth century, the jurisdiction was under Manila, which later became the province of Tondo. It became an ideal entrepot where merchants delivered goods to China, Japan, Sima, and the Malay Peninsula. The port of Manila's geographical location provides excellent wealth to the Philippine economy. The pattern of development in the port of Manila was identified from the biographical location of the port that lies in the bodies of the Pasig River, which leads to local and international trade opportunities, highlighting the Philippine products from raw to processed.

The geographical location of Tondo, Manila, leads to various interpretations of the origin of Tondo as a place name. It was called Tundoc, a banana species with violet skin, though the fruit is yellow and sweet (Bonifacio, 1977, p. 52). Tondo, also once called *Tundo*, is a Tagalog word for baiting or catching fish; hence, *Tundaan* was a small boat often attached

to a much larger fishing boat. Tondo was borrowed from *Tandu*, a Malayan or Indonesian word commonly used in place names. Lastly, *Tundo* comes from the word *Tuldok* since it was founded on a rocky formation that appears like a small island (Camagay, 2010, p.4).

Some of the streets in Tondo have meaning and significance as old as the country; some also praise and honor the memories of Filipino and Spanish personalities. There are names based on individuals who lived in Tondo (History and Cultural Life of Manila, n.d.): (a) Baltazar, named after Francisco Baltazar, who became the first Juan de Sementara of Tondo; (b) Lakandula as an honor to the king of Tondo who welcomed Miguel Lopez de Legazpi in Manila; (c) Pilapil, Rev. Mariano, teacher of the great Francisco Baltazar, "Prince of Tagalog Poetry"; Father Pilapil was a notable educator among the Filipino Clergy; (d) Pacheco, Enrique is the secretary of Finance in the Supreme Council of Katipunan; (e) Yangco, Teodoro, Filipino philanthropist and former Philippine Resident Commissioner to the United States; (f) Magat Salamat, the son of Lakandula who conceived an emery plot to regain the "freedom" and lordship with their fore-fathers, (g) Soliman – the last king of Manila who offered resistance to Miguel Lopez de Legazpi and perished at the naval battle at Bangkusay channel on June 3, 1571; (h) Dandan- Father Pedro Danda, one of the fighting Filipino priests, a noted musician and preacher who joined the troops of Riego de Dios in 1896 (Garcia & Resurreccion, 1971, pp. 254-471).

The country's historical, cultural, political, economic, and educational center is in Manila. History and culture can be observed in the city's physical character among the districts. Tondo is considered the epicenter of migration from various parts of the Philippines for the following reasons:

Firstly, its proximity to the Port of Manila provided direct access to maritime trade. Moreover, it was a critical railway terminal throughout the late 19th and early 20th centuries. Tondo functioned as the central nexus for Luzon's railway system, initiating lines northward to Dagupan (Pangasinan) and southward to the Bicol region, with Manila as the focal point (Ortega, 2016, pp. 35-50). This extensive network, coupled with the Manila North Harbor in the Tondo foreshore area, facilitated the migration of numerous individuals from the Central and Southern Philippines via inter-island ships.

Second, Manila was the home of two major ports – North Harbor was a domestic port where migrants would come in and out of Manila, and South Harbor was for foreign providers. The sheltered features of the bay open an opportunity to other islands of Luzon and are navigable by ships of greater tonnage, such as the Pasig, a broad and deep river that comes in seven branches from the lake of the bay. It can carry even a hundred tons,

which are impeded only by a bridge. The port is strategically located along docking and cost-effective repair of even large ships. This river is considered more profound than other bay water tributaries, and if it were not for the Manila bridge, the ships could proceed even further. At the same time, the smallest can extend to Malacañang and even to Pateros of Pasig Bay (Annual Report of the Manila Railroad Company, 1906).

Third, motorized vehicles were the most dominant species in the urban transport jungles of early-twentieth-century Manila and Singapore by the late 1920s and the 1930s. Their dominance over non-motorized modes was not surprising, given the technological sophistication of the former. Motorized vehicles were faster, more durable, and capable of carrying more passengers. Furthermore, these modes could compete in terms of passenger fares.

Establishing bus terminals in Manila indicated that Manila is continuously growing based on its status quo (Annual Report of the Manila Railroad Company, 1906). It is one of the essential general points of destination and an advantage in making a bus terminal. Furthermore, it is impractical for any bus operator to ascertain the ultimate destination of most passengers. No matter where a bus finally stops, most passengers will proceed beyond the terminal stop. Consequently, whether the terminal plan is implemented, secondary means of transportation, such as walking or other local vehicles, are indispensable.

Plans for establishing new bus terminals had been conceptualized to address traffic congestion in Manila. The Philippine Chamber of Commerce formally proposed this initiative. The city officials did not show enthusiasm until July 1949, when the city council finally passed an ordinance to establish, operate, and manage provincial buses (Tunay, 1951, p.6):

> (a) For buses coming from and going to the north:
> (1) Azcarraga Street from Juan Luna Street to the extension of Dewey Boulevard in the north and its immediate vicinity.
> (2) Aurora Boulevard from Andrada Street to M. Natividad Street and its immediate vicinity.
> (b) For buses coming from and going to the east and northeast: Sta. Mesa Boulevard Extension from Santol Street Eastward to the city limits (Lambingan Bridge) and its immediate vicinity.

A primary concern was that the proposed bus terminal would become the dumping ground for political opportunists, thereby jeopardizing the grandiose plan to remedy traffic congestion.

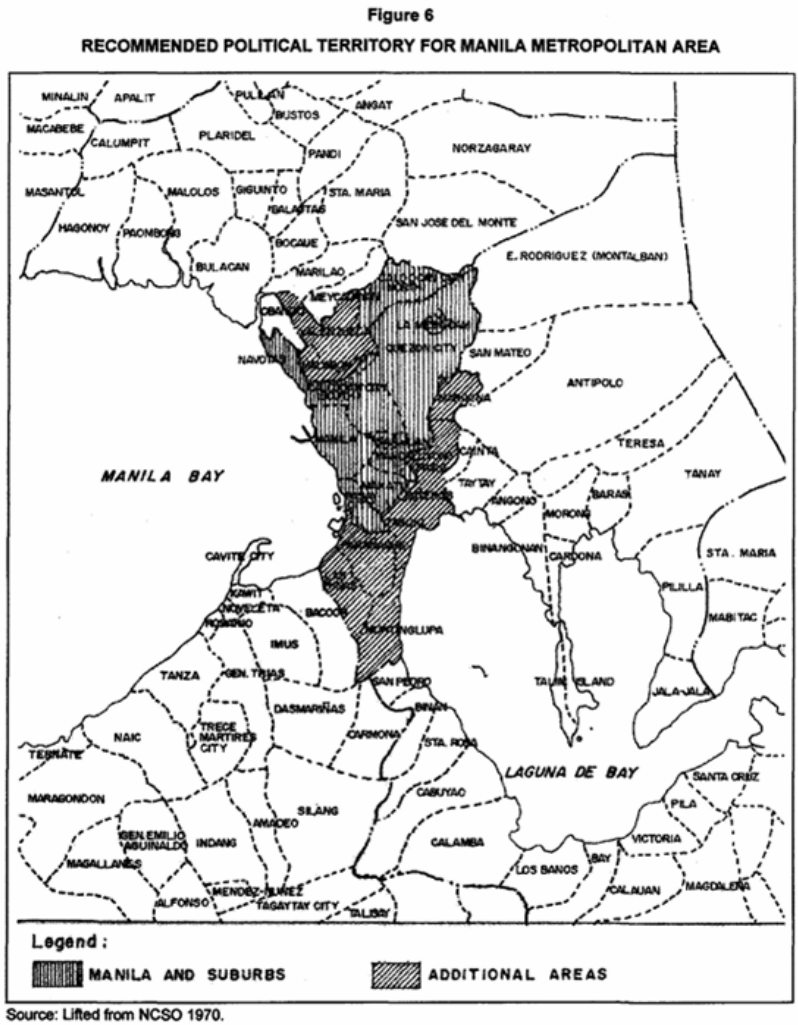
Lastly, the geographical contribution of Tondo opens livelihood opportunities. Fishing sectors along Manila Bay included fishing villages like Bangkusay, Navotas, and Baclaran. Towns like Malate, Tambobong (Malabon), Las Pinas, and Paranaque had extensive salt beds. Tondo was an entrepot where merchants delivered goods from China, Japan, Borneo, Siam, and the Malay Peninsula and distributed the products throughout the islands. Later, foreign traders settled in Tondo, Manila Bay, the leading trade route for the spice-producing peninsula, especially in the south (Mallat, 2021, pp. 120-121).

The public market is also one of Manila's most significant historical sights. The Divisoria Market near the Calle Azcarraga is the city's wholesale produce center. Together with the neighboring market of Yangco Market, there is a retail shopping center and a textile trade center located in Tondo, Manila. Tondo, Manila, has also become home to several significant industrial establishments. These include La Tondeña Distilleries (situated along Estero de Vitas), Alhambra Cigar and Cigarette Company (on Juan Luna Street), La Fortuna Distilleries (in Gagalangin), La Filipina Uy Gongco, and Philippine Foremost Milling Corporation.

In the 1950s and 1960s, rapid and uncontrollable population growth, resulting from a high rate of natural increase and significant internal migration, contributed to the economic growth of Manila but brought problems in the process. Given the evolving infrastructural development, financial sectors, market division, and structural rigidities created in the 1970s, the economy did not adjust well based on market restrictions, trade restrictions, and price controls on the agricultural and capital industries (Solon & Floro, 1995, p.1) It includes poverty and housing shortage, which are exemplified by the problems in society. In the immediate post-war period, urban development radiated from Manila, the administrative, economic, educational, and social center since the colonial period, northwards to Caloocan City and southwards to Pasay City. Government housing projects in Quezon City and the private sector development of Makati as a financial, commercial, and residential center in the late 1950s and the 1960s completed the filling up the inner code between Manila Bay and EDSA (Manasan, 1999, p. 6). Industrial and residential development intensified in Navotas, Malabon, and Valenzuela in the late 1960s and Marikina, Pasig, Paranaque, Las Pinas, and Muntinlupa in the 1960s and the 1970s (Manasan, 1999, p. 10).

Figure 1

Recommended Political Territory for Manila Metropolitan Area (Reyes, 1998, p.14)



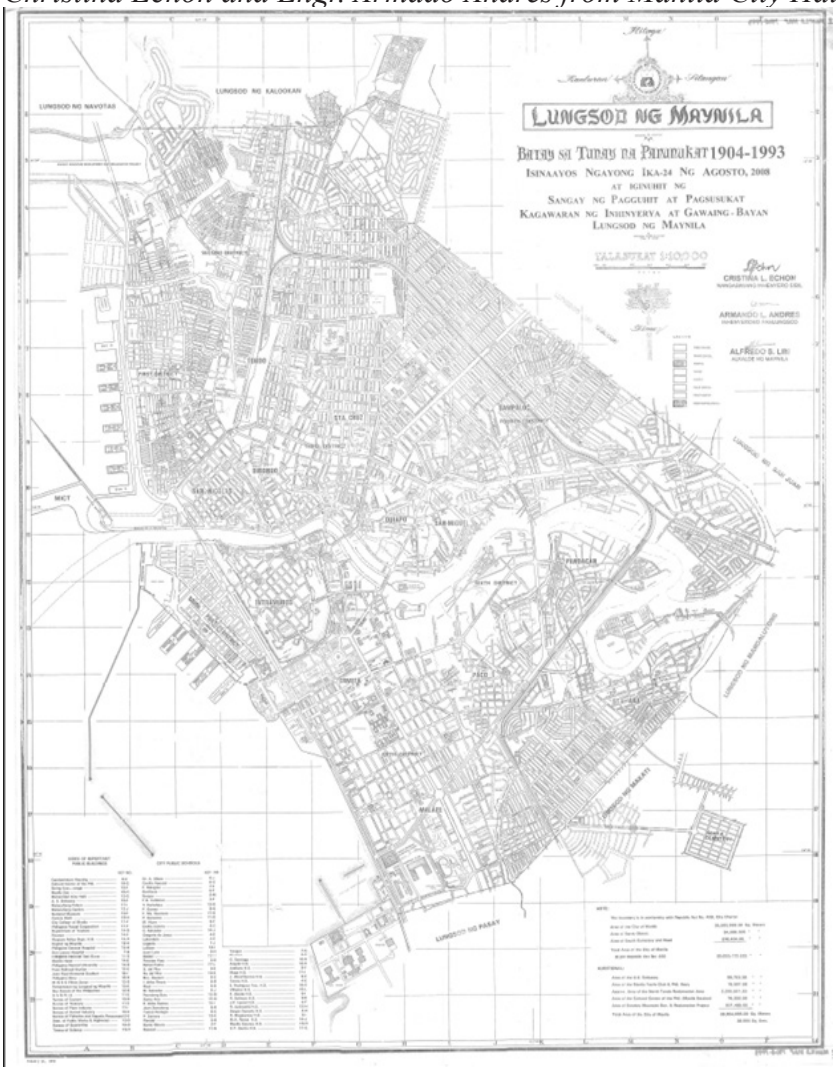
Source: Lifted from NCSO 1970.

The boundaries of Manila and its districts also changed over the period. Due to government policies, the districts in Manila also changed. Among the fourteen districts, Port Area and Sampaloc have a larger mass due to the concentration of settlers- the Tondo, as a hub of settlement from the city proper and provincial cities linking through the maritime network, provides a connection between provinces and Manila, which transports human and commodities that is showcased to Divisoria Market, Azcaraga Market up to extend of Agora Market in Navotas through jeepney and Sampaloc, wherein the bus terminal such as Florida Bus and Victory Liner that travels in Northern Part of Luzon apart from the numerous universities

such as the University of Santo Tomas, while in Morayta and Recto are the printing press, cinema houses, LRT station, and universities such as Far Eastern University and University of the East.

Figure 2

Map of Manila with Its Districts and Land Areas (Prepared by Engr. Christina Echon and Engr. Armado Andres from Manila City Hall)



These locations, including Divisoria, Intramuros, Santa Cruz, and Morayta, exhibit extensive accessibility to other key areas within Manila. They host a plethora of establishments encompassing diverse sectors such as

business, commercial, institutional, and residential. Furthermore, the remaining districts of Manila also maintain substantial access to various Metro Manila locations. Throughout this period, Manila's household population experienced drastic growth, driven by a significant influx of individuals seeking residential and employment opportunities. Consequently, certain districts, particularly within Tondo, were recognized as among the most popular urban centers.

Democratic Trends

"Manila" is no longer just Manila. The original city of Manila has vastly outgrown its limits. Population data from various censuses show that the city of Manila has proliferated since the first part of the twentieth century, reaching very high levels of population density, and that its growth has essentially stopped since most of the demographic increase is now taking place in outlying cities.

Migration to the Tondo dates back to the immediate post-war times. Families rendered homeless by the war could settle in Tondo, Manila. Settlers from Visayas transferred to Manila after the Second War, finding refuge in Tondo and becoming true Tondoeños. As Tondo continues to expand its population, most of the settlers are from portions of Tagalogs, Ilocanos, Pampangos, Visayans, and Bicolanos. Other foreigners that settled were the most significant number of Americans and Chinese, who were active merchants and laborers. The remaining residents were Spaniards, Englishmen, Japanese, and citizens of various foreign countries (Census of the Philippine Islands, 1918, p.141).

After the Pacific War in 1945 and throughout 1950, the population grew, and the provincial folks moved to the Capital City hoping for greener pastures. Rural poverty in the provinces of Visayas and worsening peace and order in Central and Southern Luzon and Mindanao are reasons the capital city has increased its population. The advantage of harbors and railways is that they are the primary means of transportation in various provinces, so people can arrive and live in the city (Connoughton, 1996, p. 50).

Migrants from the Southern Philippines arrived via inter-island ships, disembarking at the North Harbor piers in Tondo's foreshore areas. Concurrently, those originating from Luzon traveled through the Philippine National Railway (PNR). Specifically, these PNR lines terminated at Tondo's Tutuban Station, serving routes from San Fernando and La Union, while the Paco-Plaza Dilao Station in Manila accommodated routes from Legazpi, Albay (Camagay, 1953, pp. 98-100).

As a result, the homeless provincials picked up jobs with low salaries in the pier area. They erected houses with light materials or barong-barong (a colloquial word used by people to discuss the housing material) in nearby vacant lots amid these difficulties experienced by the migrants and those who are natives of Tondo. These new settlers were challenged to survive and increase, and the promise of Manila's better life inspired people in the province (Ty, 1948, p.10). .

Substantial internal migration is most severely observed in the Metropolitan Manila area, where the population is more than compared to the effects before the war. In the succeeding years, the wave of migrants found its place in the metropolis, if not in Tondo, which is considered the largest number of settled communities in the fringes and outskirts of the district. By the early 1980s, Manila had experienced congestion because of the economic growth in the 1960s and 1970s, due to the growing sectors, services, and manufacturing concentrated in the central region. Rapid population increases strain the metropolitan area's infrastructure, and when the rapid population increases strain the metro area's infrastructure. An increase in water demand has resulted in the government investing a lot in water diversion projects. The adequate sewage often clogged up, resulting in flash flooding during heavy rains, which closed some waterways in the metropolitan areas. In addition to the urban residents, workers who used public transportation in Manila from the nearby provinces also led to heavy traffic on roads, especially on weekdays.

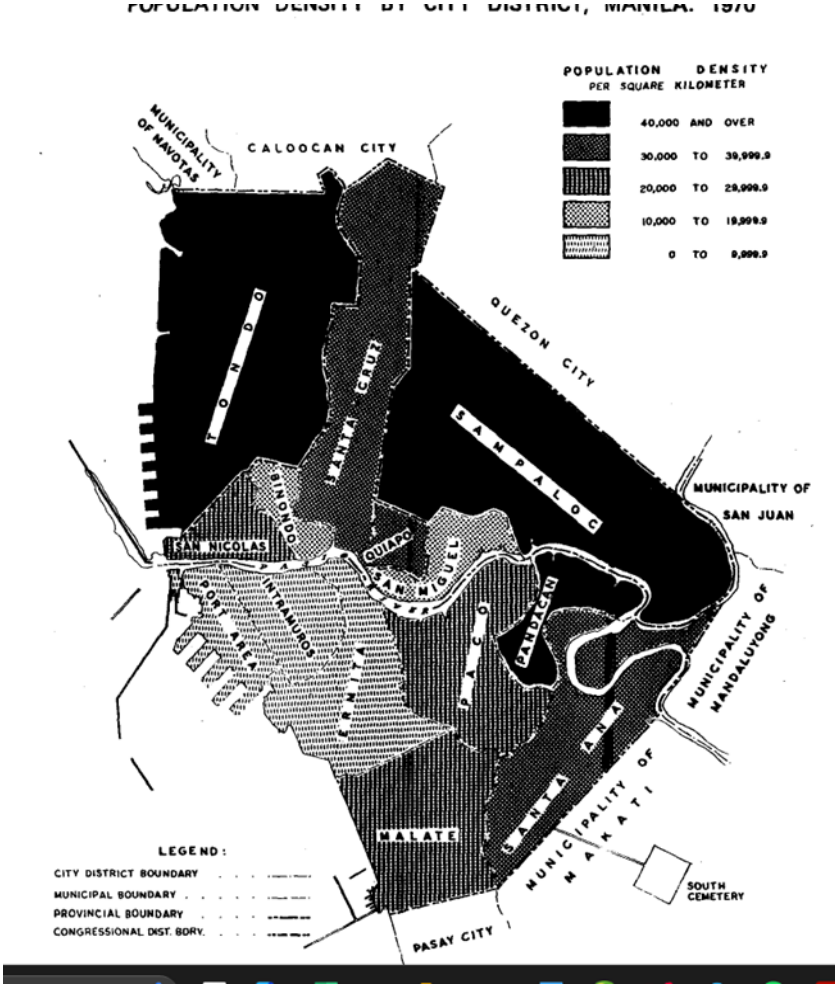
The tremendous growth of Metro Manila after 1960 is the most significant urban phenomenon in the country. The metropolitan region has become the center of the country's economic, social, political, cultural, and educational life. The growth of the Philippine metropolitan area results from rural to urban migration. Between 1960 and 1970, Metropolitan Manila had an annual growth rate of 4.79 percent, with some sections of the growth rate over 11 percent, which led to the perception of a drastic increase in population from 56.0 in 1948 to 1960 and 61.7 from 1960 to 1970 (Laquian, 1972). The concentration in the primate city continues as the trend towards suburbanization in Manila. Manila had a net migration loss of 932,940 between 1960 and 1970, while the metropolitan area grew.

Meanwhile, Tondo owned the largest concentration of settlers and the most considerable sprawl of squatter colonies. The slum dwellers cover 40 percent of the population – 395,752 in number (Caoli, 1988, p. 5). Concentrations are not only in the 154 barangays, but also in Smokey Mountain and the Tondo Foreshore lands. The image of Tondo has become more opposing, especially in the presence of media and literature. In the 80s,

Tondo became the subject of pook maralita, a hub of squatters, problems in space, and sanitation: fearsome community, uneducated men, rude, criminalities, and gangsters (Jocano, 1975, p. 33). Specific locales become a hub of public violence and the existence of gangs such as Isla Puting Bato, Parola, Angustia, Velasquez, Bangkusay, and Baryo Magdaragat or Tambakan later known as Smokey Mountain. The concentration of slum communities is in Tondo Foreshoreland, Parola, Kagitingan, Luzviminda, Isla Puting Bato, Baryo Magsaysay, Bagkusay, and Port Area.

Figure 3

Population Density by City District of Manila in 1970 (Census of Population and Housing, 1970)



The migration of more than a million people by 1960 was largely spontaneous and had little government support, but it was surprisingly well

organized. This particular migratory movement, however, did not generate the socio-economic dynamism often associated with mass migration. Instead, migrants broadly utilized established family and village networks. For instance, individuals from Cebu and Bohol provinces in Central Visayas and some Kapampangans from Central Luzon steadily relocated to Northern and Eastern Mindanao. Similarly, migrants from Northern Luzon settled in Western Mindanao, while those from Western Visayas established communities in the Southern province of Cotabato (Stinner & Montilla, 1981, p. 13). Migration resulted in more complex political networks reaching across geographical areas. The migration of communities of huk-influenced regions such as Pampanga and Bulacan indirectly aided political and economic development (Stinner & Montilla, 1981, p. 14).

> Provincial folks are lured to Manila even though life is increasingly challenging. The unemployment situation in the city is becoming more accurate every day. There is a good demand for skilled workers, but the man who knows no particular job efficiently might as well stay home instead of wasting time attending to the office.
>
> Coming to Manila just for a brief visit, it is all right. However, if your purpose is to find work to support a family or finish your studies, someone had a better look twice before leaping into the opportunity. Someone might be completely disillusioned as thousands of once dreamy-eyed provincials in Manila are painfully disillusioned (Ty, 1948, pp. 4-5).
>
> Some women seen on board (to Manila) are maids and widows, but most are young girls aged sixteen to twenty-five. These women are recruited from Bacolod, Iloilo City, Igharas, Pavia, Calinog, Antique, and all parts of the Visayas, all lured from home by good, great jobs promising them happiness and confidence.
>
> To young Visayan girls, I give you this sound advice: Never be fooled by the promises of any man or woman who guarantees you a good and easy job in Manila.
>
> In Manila, those girls who are unattractive and old become cooks, Lavandera, and maids. They are sent to applicants through an agency in Manila legally and morally, as any can ask for, but not

> the young and beautiful. They are usually sold to the highest bidder. Beauty, youth, and a shapely body make Manila more money (Inday do not go to Manila, 1947, p. 20).

The image of Tondo has become increasingly opposing, especially as shaped by media and literature. During the 1980s, Tondo was the subject of discourse concerning pook maralita, characterized by a concentration of informal settlers and extensive slum proliferation. This portrayal highlighted pervasive challenges, including spatial organization and sanitation issues, an inadequate public transport system, chronic traffic congestion, and deteriorating health and sanitation conditions due to insufficient potable water and unsanitary waste disposal. Furthermore, Tondo was depicted as a fearsome community, associated with uneducated, rude individuals, high rates of criminality, and the presence of organized gangs.

The increase in urbanization has resulted in a typical range of problems, and a strategy for urban development is also considered a problem. Throughout the period, problems in space and sanitation arose, leading middle-class residents to vacate the area. The situation made way for societal issues such as criminality, pollution, and population increase, leading to deviance in media, literature, and film.

The Hoodlums and Gangs

The stringent government controls on trade give rise to smuggling syndicates, which insinuate themselves into the fabric of business and politics. Numerous gambling lords and operators of illicit gambling networks exploit the plight of the impoverished, becoming crucial in perpetuating the patronage systems that sustain local power. These hired gunmen, often fugitives from the justice system, seek protection from the very politicians who maintain their power and prestige.

In the late 1940s, Manila resembled a wild town; several businesspeople liberally brought guns as a form of protection and security from the fields, usually ruled by the local toughies, especially in the municipalities of Tondo and Sampaloc. These criminal gangs used to organize raids on warehouses, hijacked cargo trucks, and took control of a wide range of operations, from gambling to prostitution. The light settlers started moving out of Manila and rebuilding their homes in the suburbs of San Juan, Makati, and Mandaluyong. Through these changes in Manila, immigrants from the provinces flowed into Manila in search of opportunities.

Urban gangsterism once became a model in Manila, Nicasio Salonga,

known in famous scenes as Asyong Salonga, a Filipino gangster. His popularity became known during postwar Manila, in the chaos of the city's disastrous retaking by the Americans. Considering the harsh and wily, his specialties were robbery, extortion, and murder. The existence of the Angustia gang led by Salonga became the most potent underworld group in Manila after the rival gang pledged its allegiance to Salonga (The Local Scene, 1946, p.15; End of a Bloody Trail, 1946, p. 11, 17).

Aside from the stated gang, the number of gangs in Paco, Sta. Ana, Sampaloc (The Criminal's Friend, 1947, pp. 2-3), and Tondo (Manila Crime Chieftain Killed, 1951, p. 10), in these murderous clashes, gang members drew blended weapons, fired homemade darts and arrows, bombarded the enemy's territory with homemade "pillboxes," and used high-caliber firearms left during the war.

Though this, the district of Tondo in Manila is perhaps a location for criminality, the home ground of notorious gangs, a relentless ground for confrontations among the community members, and a scene of murderers, wicked and innocent. Through the given scenario, inhabitants, especially in the depressed areas, question the presence of the law. As unusual as it may seem, Tondoños, daily killings, stealing, and other disturbing events are part of the way of life.

The problems of Tondo from the entangled observation are more than just the perspective based on facets of media. The difficulty in identifying and eventually solving the Tondo problems leads to an uncontrolled settlement and stems from the frame-of-reference distortion. Moreover, the point of recognition of unidimensional approaches that address the inter-relation of merely convenient problems implies their separability in the realities of life.

This problem of increasing crime and conflict is symptomatic of more profound social ills. Conflict behavior is much more visible and often involves loss of life and considerable property damage. Compared to delinquency, conflict behaviors attract public attention, a general term that includes several forms of behavior that are not easily recognized as delinquent.

The Notorious Hoodlums

In the post-war period, the growth rate dropped, and poor growth performance in Manila and the provinces led to struggles among the social classes in political and economic interests. This resulted in the creation of gambling lords and operations that capitalized on people experiencing poverty and were indispensable for fueling the patronage of local political

Manila became a widely known city in 1950; it was once a location searching for opportunity and a seat of Filipino culture. A famous individual who was considered a model of an urban gangster was Nicasio Salonga, known as Asiong Salonga, who was considered a notorious model in postwar Manila (Magno, 1998, p.61). His challenging behavior was known for robbery, extortion, and murder, which started when he was 15 years old. Aside from his activity, he is also popular in leading a gang named the Angustia gang, which was popular in Manila and pledged its loyalty to Asyong Salonga. Despite this behavior, the politicians and police have given him protection and leeway; in return, he serves these individuals. In October 1951, Salonga was killed by a bullet shot in his head while drinking with a fellow in a store in Tondo (Manila Crime Chieftain Killed, 1951, p. 10). The gunman was Ernesto Reyes, a member of a rival gang, Salonga, who immediately surrendered to the police. In this societal avenue, individuals became popularly known to the community, and a film was dedicated to him in 1961 that became widely known to society (Manila Crime Chieftain Killed, 1951, p. 10).

The suburb town of Malabon once became a for the prominent individual whose name shattered the authorities and settlers in 1981-Benjamin Garcia alias Ben Tumbling was shot dead by Malabon authorities, and the people of Malabon wept openly for days during his wake; the mourner's sheer number of impassable streets around his coffin and it was available for public viewing (Cagahastan, 1985).

Hoodlums are situated not only in Manila but also in the suburban outskirts; in Leonardo Manecio's case, alias Nardong Putik, is a prominent, influential figure in Cavite; his active leadership and criminal activity in Cavite, especially in kidnapping, murder, robbery in the band, and illegal possession of firearms. His intimate connection with people of power would be well-loved by the people of several towns he considered territory compared to Nicasio Salonga, who is popularly known as Robin Hood because he supports the Tondo community; Manecio is a man who restored peace and order to the community which he controlled, which the local police units must take care of.

Note that from 1950 to 1960, Cavite experienced economic dependency due to a large extent of smuggling, carjacking, and marijuana growing. Compared to Manila, which played a crucial role in economic development, the mainstream of businesses and politicians, gambling lords, operators of illegal gambling, and prostitution were experienced.

Far from Manila and the media, Isabelo "Beloy" Montemayor often built local sensations into several icons, such as the Nardong Putik of Cavite

(Magno, 1998, p.61) A migrant from Bohol moved to Cebu City as a seller of fish and shells in the Carbon Market in the central retail district of Cebu. Years later, in 1950, Montemayor ran a small tailoring shop, earned the alias "Palong," and used disguises for the rest of his life, including wigs and women's clothes. Eventually, the creation of an extensive brotherhood of ex-convicts and gangsters who would eventually become involved in organized crime, from smuggling to illegal gambling operations, especially in Cebu City (Bloody end for 'Putik', 1971, p. 1, 28).

Far from Luzon and Visayas, migration to Mindanao was also widely popular in 1950 and was actively encountered. The migration dramatically altered the Huk rebellion in the early 1950s . Moreover, these Christian migrants were settled in central Mindanao, where most of the leaders were against the government; hence, the Armed Muslim and Lumad gangs or Barracudas (Magno, 1998, p.65)

In the 1960s, Manila's newspapers were filled with accounts of atrocities committed by the warring communal gangs in Mindanao. The famous leader was Kumander Toothpick, who organized a gang named Ilaga, whose members were some Christian settler community threatened by Muslim and Lumad marauders. Aside from the religious and social differences, the group was once used during the martial law period; its members were recruited into the Civilian Home Defense Forces (CHDF) . The notorious Kumander Toothpick was overshadowed in 1985 by his son-in-law, Norberto Manero Jr., alias Kumander Bucay, and his brothers Edilberto, alias Kumander Baliling, and Elpidio. It has a known story of cannibalism about the Manero brothers, especially the belief in early customs of protection against danger and evil spirits.

In 1963, another individual who became popular among the local newspapers was Arturo Porcuna, famous for his pen name "Boy Golden (Porcuna, 2 Aides Shot Dead by Foes, 1963, p.1). The conflict happened when Porcuna was riding a jeepney along Dewey Boulevard when three men from Tundo shot him. Brigadier General Eduardo Quintos from the Manila Police District urgently assigned police members from the station to search for the gunmen to prevent further conflict and unrest activity in Manila.

According to the members of the Manila Police District, the conflict was rooted in the extortion of money for protection from Porcuna and the company. Another reason is the alleged halal or lewd to a 16-year-old cashier named Edith Bailey at Green Lantern Cocktail Lounge (Laban sa Kabig ni Boy Golden, 1963, p.1).

Another event followed the assassination of Porcuna in December

of 1963, where Porcuna was involved in the assassination of Antonio Razon at Nancy Luncheonette. Based on the statement of Razon that, aside from Porcuna, together with him are Guido Dimapilis and an alias 'Ando' who assassinated him at the said location ('Positibo,' si Porcuna sa pulbura, 1963, p.1).

However, the life of this notorious gangster of the early 60s in the streets of Manila ended on December 24, 1963, when he was shot to death by a member of his rival gang. Killed with Porcuna were two new members of his gang known as "Jojo" and "Bert." According to Jaime San Miguel, Porcuna's henchman, who rented the three-room apartment, told the police that the gun wielders were Eddie Luz, Baby Soriano, Antonio Razon, Rene Sebastian, and three others who were not able to be identified. Based on the police investigation, Porcuna and the Razon group's rivalry stemmed from a quarrel over a woman. Their rocket was "protection" for hostesses in Manila and Pasay nightclubs.

Hoodlums in Manila present a complex interplay of advantages and disadvantages that impact the community. In this part of society, organization and involvement became a prominent feature of the community, especially in the slums of Tondo; in fact, it is the fulcrum of the entire society. Supporting exclusively the male members of the organizations that establish common grounds for functioning as distinct, and the purpose shall focus on the undesirable pursuits in life. On the other hand, some might argue that the presence of hoodlums can foster a sense of camaraderie as these individuals band together for protection and mutual support in the face of adversity. Moreover, the disadvantages are significantly more pronounced, as the hoodlums and their activities are often associated with crimes, violence, and a general sense of insecurity in the neighborhood. Furthermore, the involvement of hoodlums in illegal activity will result in the perpetuation of cycles of poverty and crime, making it difficult for the communities to break free from the detrimental patterns. Thus, while some may have perceived the benefits regarding social cohesion, the overarching consequences of the hoodlums in Manila and even in Tondo were negative.

The Emergence of Gangs in Tondo, Manila

The gangs may be said to represent the inner dimension of slum experiences. These gangs are a prominent feature of slum life, and it is not only the males who are likely to be linked to gangs, but also females, who are often described as "deviants", if only for the fact that the residents have described the activities they pursue as undesirable and unconventional.

Before the advent of the Pacific War, Tondo was a hub for settlers from the nearby provinces. Because of Tondo Manila's geographical location close to the railway and post area, people will continue to migrate, and the primary needs like food and shelter are now limited in access and production. Some migrants from the Visayas and southern Philippines moved to Tondo, Manila, due to the worsening situation in Central and Southern Luzon. The legion of migrants from the Southern Philippines was disgorged by the inter-island ships at the piers of North Harbor, located in the foreshores of Tondo. As a result, the number of reported violent and non-violent crimes has increased due to survival.

After the Pacific War in 1945 and throughout the 1950s, the population grew, and those in the province started to migrate to Manila. Greener pastures are attractive, especially to those living in farming and agriculture, the jobless and inadequately employed, and the dreamers of Manila. This period also shifted to the problem of social security in Manila; several criminals were released from prison and the Manila City Jail and formed gangs, establishing territorial grounds and concentrating on criminal activities in Manila.

The gang is used restrictively to mean a group of young people who have banded together in some ways for several purposes. They may be considered as forming a peer group, although the age may vary from fifteen to thirty-five. Other than the physical attributes, it is likewise used loosely and refers to associations of people. Thus, the phrase "peer group" similarly refers to the associations of people of approximately the same age and within the same range (Jocano, 2002, p.11). Historically, gangs are composed of male participants; however, an emerging group of members in society can be different from their male counterparts in terms of engagement. The reason female gang members reported familial and peer influence as reasons for joining was that they needed protection.

Moreover, male gang members are more involved in criminal activity, and the types of offenses committed by males are classified under the judicial system. As such, it is difficult to determine the variations in joining gangs based on gender. However, females and males may share common risk factors and motivations for joining a gang.

Filipino gangs are not only concentrated in Manila but also in other countries, such as the USA. Filipino gangs were concentrated in California in the 1960s as they were identified by tattoos of gang names in graffiti style. Compared to the Philippines, the tattoos of gang members are placed on the body, specifically on the neck, arm, and legs, while a designed tattoo is known as talk on a specific part of the body. Examples are the Oxos, tattooed

on the right side of the body between the waist and the armpit. At the same time, tattoos are mostly found on the buttocks in the Sigue-Sigue Sputniks. Even women are marked. Accordingly, it was placed in the vagina, the pubic hair having been shaved off below the belly, where the words "no trespassing- private property (Jocano, 2002, p.121).

In Manila, the central street gangs are frequently reflected in the Manila Times' headlines because of their violent and socially destructive activities. These gangs are the Sigue-Sigue Commando, the OXO, and the Bahala Na. Initially, the two main gangs were the Sigue-Sigue and the Bahala Na. In 1964, some members of Sigue-Sigue joined forces with the Commando and became the Sigue-Sigue Commando. Others affiliated with the Sputniks and called themselves the Sigue-Sigue Sputniks.

Within the context of human activity, the ideological makeup of Tondo Manila is considered. In the 1950s, individuals, particularly those in Bagkusay and Velasquez streets, engaged in actions that destroyed the social milieu of security and livelihood. These deviant individuals were variously labeled within the society such as “tagapamayapa,” “tagapamagitan”, “protector mula sa mga krimianl at mapamagsalantala,” and “namumuno’ (Jocano, 2002, p.113).

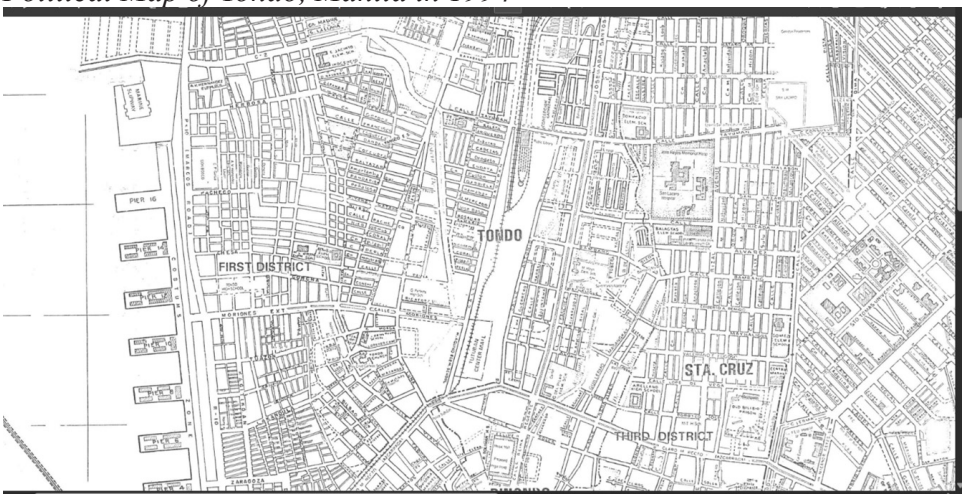
While gang members frequently assert themselves as community defenders and protectors of their "brothers" against external threats, this claim is contradicted by their widespread victimization of local citizens. Such victimization manifests through robbery, rape, burglary, and a general pattern of terrorizing the very communities they purport to defend. Streets, namely Bangkusay, Velasquez, “Pitong Gatang,” Angustua, Herbosa, Zaragosa, Padre Rada, Moriones, Perla/Sande, and Antonio Rivera, are the center of violence from the 1950s to the 1980s. Labels such as “mamatay-tao,” “halang ang kaluluwa,” “mabalasik” at “magaspang ang pag-uugali” were known based on the narratives of settlers (Jocano, 2002, p.113).

In the 1960s, the Sigue Sigue Sputnik Gang emerged as a notable and highly organized conflict gang within the Manila City Jail. Its formidable reputation was encapsulated by its motto: "He who comes to destroy us will himself be destroyed." This is a direct reference to the "Province Mates," such as the Visayan OXO group, where the Sputniks observed an increasing number in Manila. There was a definite consensus among the Sputniks regarding the origin and meaning of the gang's name. The name comes from the Russian orbital satellite of the same name and is significant because of its "spying” or "all-knowing" capabilities. The Sputniks pride themselves on their knowledge of what is always going on both inside and outside of the jail - "among friends, enemies, and the police, in which the claim was

made that the Sputnik organization was not confined to the Manila area alone but was well-known throughout the Philippines."

Figure 4

Political Map of Tondo, Manila in 1994



The other large conflict gang in confinement was the OXO gang, which was formed in the National Penitentiary at Muntinlupa in 1956 (Castillo, 2012) in response to "maltreatment by the Tagalogs." It was among the OXOs that a bitter rivalry along dialect and cultural lines emerged, which the Visayans had to organize to "protect themselves from maltreatment." No specific requirements for joining the gang were stipulated; instead, it was consistently emphasized that individuals joined voluntarily, free from coercion. The bond of loyalty is sealed when the new member takes the OXO TATAK in the form of a tattoo, usually placed on the right side of the torso, between the armpit and the waist. When asked about leadership in the gang, the OXO members replied that no single one of them was better than any other member, and each TATAK has the letter "L" as part of the design as a reminder of the "all are equal" principle. The "Visayan blood" seems to be an additional binding factor. Although others (including an occasional Tagalog) may join, the "outsider" is usually subjected to a particular test of loyalty designated by the leader (Ashburn, n.d., p.134).

The origin and meaning of the term "OXO" are questionable, for there seems to be little agreement or consensus among members. Some say it symbolizes the skull and crossbones, which means "death to the enemy." Another claim is that it came from the Tagalog term meaning "yes, yes" with an "X" in the center signifying that they, the Visayans, were opposed to anything to which

the Tagalogs said "yes." Still, other members seemed to have no idea about the origin and meaning of the term "OXO." All OXO members interviewed stressed that the members have "decent jobs" and are hard workers (Ashburn, n.d., p.136).

The literal translation of the Bahala na Gang ("Heorne what may") indicates its orientation. The Bahala Na seemed to have the smallest organization of the four gangs and was bound by the fewest rules other than loyalty. Almost "psychopathic" in orientation, these gang members constantly referred to "thrill killings" or raiding "rival gangs just for the hell of it." Gang-related conflict in this context extended beyond inter-gang rivalries, leading to violence that could be indiscriminately inflicted upon any bystander. This conduct was primarily explained by a pervasive sentiment that "life was hopeless," a fatalistic outlook suggesting that individual actions held no significance if one's "fate" was predetermined to be unfavorable (Ashburn, n.d., p. 137).

This investigation determined that most Sigue Sigue Commando members originate from Pampanga Province. This region has experienced significant Police Constabulary (P.C.) and Hukbalahap activity since the late 1940s and early 1950s, a context that likely acclimates the Commandos to a conflict-ridden environment. When they come to Manila, they meet head-on on the solid front known as the "Manila Boys"- the same situation presented to the Visayan OXOs - and again, the battle lines are drawn. Thus, the OXOs and the Commandos are often friends against the common urban enemy, the Sigue Sigue Sputniks, even though they speak different tongues. This was the situation in the Manila City Jail at the time of this study. Tagalog-speaking Commandos and Visayan OXOs had a "peace treaty" and joined forces against the "Sputniks"(Ashburn, n.d., p.138).

The Commando insignia of the "wildcat" was taken directly from the P.C. Ranger's official emblem. At the same time, the whole concept of the gang was derived from the motion picture entitled "The Commandos." The members interviewed virtually agreed on this point, representing a relatively clear-cut example of mass media's influence on a conflict gang's activities. The main regulation of the group, "One for one and one for all," emphasizes loyalty and implies hospitality in the face of insecurity. The other regulations were not in formal written form, and there were no special requirements for membership except loyalty.

Apart from the stated gang group, the concentration is in Tondo and several areas in Manila and provinces. The Tres Cantos Gang and Red Apache are prominent gang groups in Tondo, specifically in the streets of Herbosa-Bangkusay-Velasquez. The group and members are popular

with the Manila Police Department and Detective Bureau. According to Emmanuel A. Tejada's 1960 article published in Taliba, the challenges posed by Tondo's criminal elements were starkly evident. Tejada reported: "Hinamon ng mga maton ng Tundo na hindi pa nadarakip ang pulisya ng Maynila na dakpin sila sa kani-kanilang mga pinagtataguan" (The thugs of Tondo who had not yet been caught challenged the Manila police to arrest them in their respective hideouts). He further elaborated on the persistent conflict, stating: "habang nagsisikap ang pulisya sa Maynila sa pangangalaga sa katiwasayan ng mga naninirahan sa purok ng Tondo ay patuloy naman ang mga kapaslangan labanan ng mga maton" (while the Manila police strive to maintain the peace of the residents in the district of Tondo, the destructive fights of the thugs continue) (Tejada, 1960, as cited in Camagay, 1953, pp. 98-100.

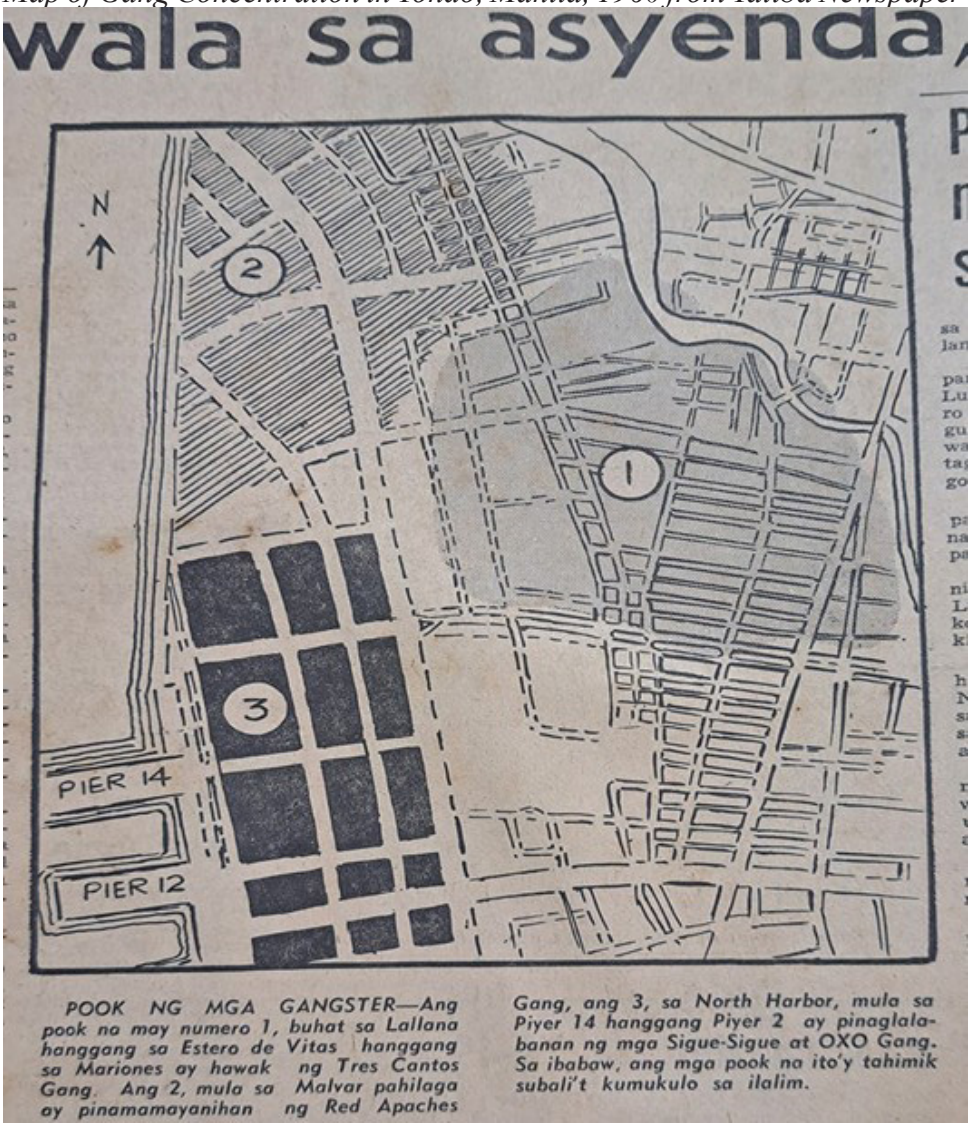
Isang aksidente ang naitala kung saan isang mamamayang naglalakad at estudyante na nagnganga;ang Lucrecio Urdansa, 20, na nakatira sa 183 10th Avenue Grace Park, Kalookan, Rizal ang napagkamalan at pinatay. Magiika-7 na ng gabi ng maidala sa Mary Johnston Hospital sa Tundo. Ang nagging hinala ng pulisya na ang labanan ng Sigue-Sigue at OXO, dalawang pangkat ng preso sa Muntinlupa na nagpatayan sa loob ng bilanguan, ay umabot hanggang sa kamag-anak sa Tundo (Patuloy ang Krimen sa Tundo, 1960, p.1).

The gangs discussed in this chapter persist and expand within Tondo's streets. Primary groups such as OXO, Sigue-Sigue Sputnik, Sigue-Sigue Commando, and Batang City Jail continue perpetrating criminal activities in specific Tondo streets. These activities encompass petty crimes, targeting trucks from the provinces, robbery, and armed holdups. Furthermore, these gangs are inherently territorial and serve to provide mutual protection to their members in times of adversity.

In a news article published on November 1, 1960 (Patuloy ang mga krimen sa Tondo, 1960, p.1), the selected areas in Tondo were identified as Pook ng mga Gangster in the areas adjacent to the port of Manila. These areas are also segmented under the jurisdiction of specific gang groups. For instance, the Tres Cantos gang controls the section of streets labeled "1," extending from Lallana to Estero de Vitas and further to Moriones. Conversely, the territory labeled "2," stretching from Malvar northward to Tondo's northern reaches, falls under the authority of the Red Apache Gang. Additionally, the area encompassing North Harbor up to Pier 15 of Manila North Harbor is contested by rival groups, namely the Sigue-Sigue and OXO gangs.

Figure 5

Map of Gang Concentration in Tondo, Manila, 1960 from Taliba Newspaper



As time changes, this criminality continues on different streets in Tondo. Compared to the 1970s and 80s, specific streets adjacent to the port of Manila were the recorded hub of criminality involving gang members, specifically the Tres Cantos Gang, Red Apaches Gang, Sigue-Sigue, and OXO Gang. For instance, one notable case involved an incident on August 6, 1979, at Batangas Street, which was addressed in The People of the Philippines vs. Juanityo Bautista y Aquino, Leonardo Macapagal y Ruiz, and Rolando Rebutar y Gonzales(1979). Another documented instance of conflict among these rival gangs resulted in fatalities stemming from severe injuries.

Another case from the members of OXO, Sigue-Sigue, and the Bahala Na Gang (The People of the Philippines vs. Ramon Narciso y Contreras and Rufino Pena y Guevarra, 1968), and conflict was rooted in Tondo Manila that even continued in the Bilibid Prison. The statement of Bernardo Villalon testified that the given organization has conflict within the prison cell and its quarters in Tondo, Manila. Some members also continued their membership even within the Bilibid Prison. According to the given case, the intention to kill the detained gang members resulted not only in a conflict in Bilibid Prison but also led to the death of some of its members. Hence, this crime of murder also resulted in the death penalty for the named suspects.

Likewise, other gang groups in Tondo are not predominantly centered on newspapers. In 1958, a murder incident happened on Bangkusay Street, involving the two-gang group- Canary Brothers and Tondo Grease Gang (The People of the Philippines vs. Soriano Alcaraz y Licuanan alias Ano, et al., 1958). The shooting incident was considered a planned killing because of the existing disagreement within the gang family. Another murder case in 1974 that involved a gang war between the members of Kalaspac group and the Dagupan Hunters group happened in G. Perfecto St., Tondo, Manila on September 28, 1963 (The People of the Philippines vs. Sominador Mejia a.k.a Domingo, 1974). Based on the narratives, two weeks before the death of Victoriano dela Cruz from Kalaspac Group, he had taken a potshot or a shot aimed unexpectedly from Ricardo Garcia, a member of the Dagupan Hunters' group that led a war against respected families.

Through this perception in Tondo, Manila, many gang-related crimes were documented in Manila City Jail in 1964. The gang population of Sigue Sigue Sputnik and the OXO was a significant gang conflict in jail. While the OXO had a steady increase in number during this period, another gang group, the Sigue Sigue Commando, also increased, but on a smaller scale. With 4,954 inmates in 1964, 1,908 are part of the significant gangs, namely Sigue Sigue Sputnik, OXO, Bahala Na, and Sigue Sigue Commando. Among the three, Sigue Sigue Sputnik has 731 inmates, followed by OXO with 727 inmates, while the Sigue Sigue Commando has 239 inmates, and Bahala Na has 211 inmates. These gang members are committed to participating in violent and non-violent crimes. Of the recorded gang members in Manila City Jail, there is a total of 35 violent offenses; Murder is the highest crime committed, while the least is Assault with Slight Physical Injuries. Other crimes such as Frustrated Murder, Robbery with Frustrated Murder or Homicide, and Frustrated Homicide. The non-violent crimes are lower in number; however, there is a recorded crime: robbery-snatching is the highest, followed by theft, vagrancy, deadly weapons, drunkness, and esstafa (Ashburn, n.d., p.132)

Conclusion

Gangs, as social networks of individuals who come together in time and space, engaging in community activities and producing collective identity, played a significant role in the social structure of Tondo. The geographical conditions of Tondo and the social network coverage demonstrated by the gangs would understandably influence behavior. Known for its resilient and hardy inhabitants, Tondo has often been portrayed in newspapers and movies. These portrayals, which usually focus on the community's ability to overcome adversity and a strong sense of community, have significantly shaped the public's perception of Tondo and its people. This paper narrates the evolution of Tondo based on Spencer's theory of Social Darwinism.

Through Spencer's theoretical framework, the behavior of the Tondoeños was predominantly understood as survival-driven, with their actions profoundly embodying a communal identity. This collective orientation underscores the remarkable hardiness of Tondo's residents. The emergence of opportunity in Tondo is based on the advantage of its geography for livelihood, transportation, and well-being. These advantages lead to disadvantages- one needs to survive among the competition in space, opportunity, and identity.

These gangs are not only a product of oneness and delinquency but also a product of behavior in the community that contributes to social history, which should be acknowledged because it leads to a broader perspective in arts, media, literature, and even politics.

Contrary to the analysis and passive recipients of Tondo Manila, several investors, businesspeople, academicians, and supporting nongovernment organizations have actively engaged in improving the urban development and environment to provide intervention and improve the current situation. Through this label depicted by society, the idea continued throughout the period, and this also neglects the idea that other neighborhoods have, perhaps, the same or much more than Tondo.

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A Comparison of Muscle Energy Technique (MET), Dynamic Stretching, and a Combination of Both on Cervical Pain and Range of Motion Amongst Residents of Negros Oriental: A Quasi-Experimental Study

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Abstract

Neck pain is one of the most common complaints among individuals, arising from various etiologies. Numerous techniques, such as muscle energy techniques (MET) and Dynamic Stretching (DS), have been utilized to manage neck symptoms. This quasi-experimental study compared MET, DS, and a combination of both in treating non-specific neck pain. Thirty participants from Negros Oriental were divided into three groups (MET, DS, and a combination) based on age and sex. VAS was used to measure pain, while goniometry was utilized to determine cervical lateral flexion. Results revealed that all three techniques are effective in decreasing pain and increasing lateral flexion ROM in terms of effect size after every session, but the progress every session is not enough to be considered effective according to the Minimal Detectable Change (MDC) and Minimal Clinically Important Difference (MCID). All three groups showed efficacy in treating neck pain and improving neck lateral flexion, except for VAS in the DS group, as shown by improved VAS scores and neck lateral flexion ROM measurements when pre- and post-test scores were compared. No intervention applied amongst the three groups is superior to the other.

Keywords: neck pain, muscle energy technique (MET), dynamic stretching (DS), range of motion (ROM)

Introduction

Neck pain, with concomitant neck tension, can result from poor or prolonged postures. The prevalence is 27 per 1000 people, and it has become a common ailment in office work, student life, and even in everyday activities such as texting with the frequent use of mobile devices (Kolahi et al., 2022). Cohen (2015) explained that with an annual prevalence rate that exceeds 30%, neck pain is the fourth leading cause of disability in the United States. In most cases, it resolves on its own, but around 50% experience a recurrence or persistent pain, primarily amongst females and the middle-aged.

The most common type of neck pain usually develops after being in a static position for several hours. Short-duration pain can be relieved with rest or self-stretching. They may, however, persist for a long time if contributing factors such as bad habits or poor work ergonomics are not corrected. Self-care measures become ineffective, leading to the need for a more formal medical intervention, which can be costly and difficult for many people.

As a multifactorial disease, several modifiable and non-modifiable risk factors contribute to neck pain, causing disability and economic burden (Hoy, et al., 2010). Kazeminasab et al. (2022) showed that these factors include age, female sex, low social support, prior history of neck or low back pain, sedentary lifestyle, duration of computer use, and perceived stress, which suggests a broad prevalence among different populations. Hunter, (2019) delineates how the modern lifestyle may increase neck pain complaints. The work environment contributes considerably since workers often lack proper postures or ergonomics. Stress and psychological factors also influence pain perception, heightening their complaints even more. These workers are also unaware of appropriate interventions and often develop chronic neck pain.

Cervical pain affects the overall functional performance. Restriction of neck mobility is one of the leading factors contributing to disability or limitation of physical functioning, highlighting the effect of the postural musculature of the neck, such as the upper trapezius. These muscles are frequently overused to compensate for neck pain. As a result of compensation for pain, people exhibit tenderness and/or tightness around this area. Brandt et al. (2014) discussed the association between neck pain and trapezius muscle tenderness among office workers. Their study shows a strong correlation between perceived neck pain intensity and trapezius muscle tenderness, which confirms that most neck pain is due to myalgia,

or muscle pain and tenderness.

There are a variety of approaches in which neck pain may be managed, some of which involve stretching and other physical therapy techniques in which cervical joint mobility may be improved, thus addressing perceived pain. Although people refer to the internet for self-management, one must be careful, as some techniques require more advanced training for proper application. This study investigated and explored the effects of two common forms of manual therapy, which have been proven effective in relieving neck pain. The study compared the effects of dynamic stretching and muscle energy techniques on individuals with cervical neck pain. These techniques are low-cost, easily administered, and teachable to the general population so that people can independently address their neck condition.

Babault and Opplert (2018) explained that stretching has been commonly used to increase joint mobility and has significantly affected neuromuscular control. Studies showed that stretching can also manage cervical pain, increase range of motion, and improve people's function and quality of life (Tunwattanapong et al., 2016; Chang, 2020). There is insufficient literature proving that dynamic stretching can improve neck pain, as it is commonly used primarily to increase flexibility. This type of stretching involves actively contracting and stretching the muscles as the joints are moved through their complete range of motion. These movements improve muscle temperature and reduce stiffness (Bramble, 2021).

According to Coons et. al (2017), dynamic stretching has been a popular choice over static stretching due to the improvements it has shown with performance parameters such as endurance, strength, power, and anaerobic. This form of stretching often improves agility, speed, and acceleration. It involves actively tightening the muscles while moving the joints to their full range of motion with sport-specific motions throughout the stretch. Concerning this, Bramble (2021) indicated that these movements allow muscle temperature to increase and muscle stiffness to decrease. A study by Park and Park (2019) found that static and dynamic stretching effectively increased neck ROM and decreased cervical disability; dynamic stretching also improved cervical rotational movements. This study consisted of 24 participants divided into two groups, treated three times a week for four weeks.

Muscle energy technique is another intervention of interest. Sbardella et al. (2021) defined Muscle Energy Technique (MET) as a “hands-on” therapy that induces muscle stretching, strengthening, and relaxation. This technique does not require the physiotherapist to control the corrective force. The users themselves perform voluntary contraction . MET has

improved pain, joint mobility, muscular weakness and contractures, localized edema, and blood flow (Bedekar et al., 2016). Additionally, Sbardella et al. (2021) reported that MET has been known to alleviate pain and reduce sympathetic tone using fascial stimulation and vasodilation in a localized manner.

No study was found on dynamic stretching and its effects on the neck musculature, specifically the upper trapezius. There is limited information on the combined impact of METs and dynamic stretching in the intervention of cervical pain and improvement of cervical ROM.

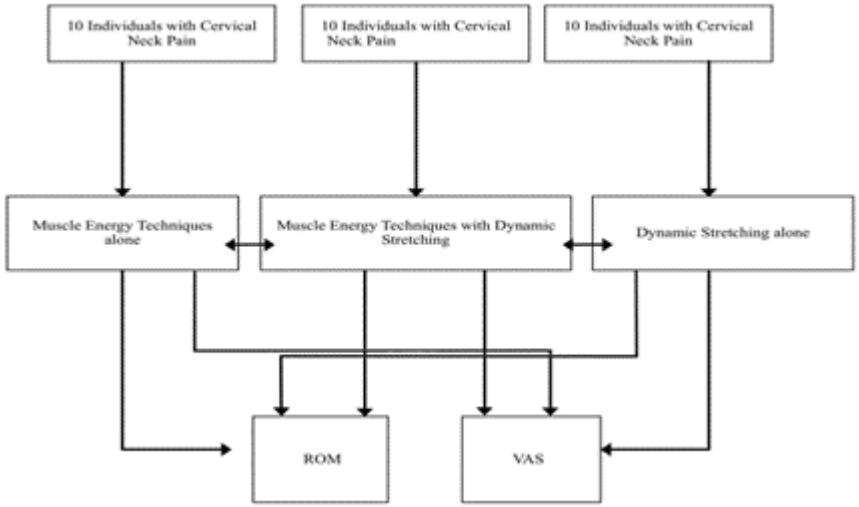
This study intended to compare the efficacy of MET and dynamic stretching on the upper trapezius muscle to address cervical pain and limitation of motion (LOM). Specifically, this study aimed to determine the following: (1) whether there is significant difference in cervical pain and ROM after every intervention session using MET only, dynamic stretching only or a combination of both (2) whether there is a significant difference between pre and post intervention following the use of muscle energy techniques alone, dynamic stretching alone, or a combination of MET and dynamic stretching on cervical neck pain scores and lateral flexion ROM (3) whether a combination of MET and dynamic stretching are superior to MET or dynamic stretching alone for pain management and increasing ROM in participants ages 18 years old and above with non-specific cervical pain.

Conceptual Framework

As a quasi-experimental study, this research focused on three non-randomized groups of participants with cervical neck pain who was evaluated based on the pre- and post-tests using the Visual Analogue Scale (VAS) for pain and goniometry for lateral flexion ROM changes to demonstrate the effects of the three interventions: MET alone, MET with dynamic stretching, and dynamic stretching alone. Evaluation improvements were compared based on significant differences after administering the interventions. This model outlined the possible interventions to treat neck pain (Figure 1).

Figure 1

Conceptual Framework of the Study



Methodology

This chapter presents the research design, sample of the population, sampling techniques, instrument for data collection, methods of data collection, and method of data analysis used for the study.

Research Setting

This research was conducted at the Silliman University Institute of Rehabilitative Sciences Free PT Clinic and the New Academic Building (NAB) for the individuals' organized collection, gathering, and intervention. Silliman University is located in the progressive town of Dumaguete, Negros Oriental.

Research Design

This study utilized a quasi-experimental, pre-test and post-test design to compare both results. Fetters et. al (2012) demonstrated that a quasi-experimental study is appropriate in testing causal relations with causal factors that may or may not be controlled or eliminated for a participant. The causal factors in this study were the METs and the Dynamic Stretching variables. As per DePoy, et. al. (2011), since randomization is absent in a quasi-experimental design, the researchers may make causal claims while

acknowledging the alternative explanations for these design limitations and avoid making causal inferences when they are unjustified by the design. The researchers focused on comparing pain severity changes using the Visual Analogue Scale (VAS) and range of motion improvements using a universal goniometer. The results from the VAS and goniometric measurements were administered before and after each intervention session. The intervention was applied for six sessions as guided by the study of Gillani et al. (2020), who surveyed the effects of METs and static stretching. The study had two groups of twenty participants each and was treated with a frequency of two sessions each for 3 weeks, having a total of 6 sessions to achieve the desired results.

Participants and Sampling Procedure

The purposive sampling technique was used to compare the pretest and posttest. A study by Akhilesh Ganti (2022) has supported the claims that sample sizes equal to or greater than 30 are often considered sufficient for the CLT (Central Limit Theorem) to hold, which supports the total number of participants in this study.

The central limit theorem (CLT) states that, regardless of how the data are distributed, the mean of a sample of data will get closer to the mean of the relevant population as the sample size grows. In other words, the data is accurate, regardless of whether the distribution is normal or aberrant. The CLT is typically thought to hold for sample sizes of 30 to 50, indicating that the sample means are roughly normally distributed. This means the graphed results follow a normal distribution as more samples are used. In statistics, a sample size of 30 is quite typical. A sample size of 30 frequently widens the population data set's confidence interval to the point where comments contradicting your findings are justified. The likelihood that the sample will represent the population increases with increasing sample size. Thirty (30) participants with non-specific cervical pain were recruited for this study. Participants were divided into the MET only, dynamic stretching only, and MET and dynamic stretching groups. Ten participants were assigned to each group. Residents of Negros Oriental who are 18 years old or above were recruited. The dependent variables were measured once per session before and after the intervention.

Potential participants were screened with a history taken through a basic subjective interview by the researchers and neck lateral flexion ROM measurement. Eligibility was determined using an inclusion and exclusion criterion. They were also asked to sign a consent form before participation.

The researchers assigned the participants' gender, age, and pain scale level. The participants were assigned to ensure characteristics were homogenous, primarily taking into consideration gender, age, and baseline pain rating.

Participants were recruited using the following inclusion criteria: (1) Age 18 years old or older with non-specific neck pain of any duration, which should be localized at the C1-C7 segments and/or the upper trapezius, with or without headaches (2) A Visual Analogue Scale (VAS) score of at least 3/10. (3) with the presence of limitations of motion of the neck in side bending, (4) consented to participate in the study.

Participants were excluded if they presented with (1) contraindication(s) to MET and dynamic stretching, (2) conditions such as acute cervical fracture, severe osteoporosis, neoplastic disorders involving the head and neck, or open wounds at the head and neck regions, (3) presence of comorbidities except for hypertension and diabetes, (4) symptoms of pain beyond the head, cervical, and upper trapezius regions, (5) active histories or diagnoses of visceral conditions that refer to the cervical spine such as acute coronary syndrome or colonoscopy-induced splenic injury, (6) vestibular problems, (7) currently receiving physical therapy, (6) illiteracy in the English, Filipino, or Cebuano languages, (8) lack of commitment and consent to participate in the full protocol of the study, (9) inability to participate in face-to-face sessions.

The exclusion criteria were based on a randomized control trial by Phadke et al. (2016) comparing METs and static stretching on pain and functional disability in participants suffering from mechanical neck pain. The excluded items are factors that may result in non-mechanical neck pain, which may affect the outcomes of the study.

Research Instrument / Procedure for Data Collection

Upon data collection, the following instruments were utilized to measure the changes observed in the progression of the study.

1. Psychometric Scale: The Visual Analogue Scale (VAS) was used to assess the pain complaints of the sample population. The VAS is a self-reported measure of pain utilizing a 10-cm line, the 0-cm line representing no pain at all and the 10-cm line representing the worst pain (Delgado et al., 2018). The user marks along the line their level of pain. The examiner then measures the level of pain with the use of a ruler or tape measure. This scale was used to assess the pain severity experienced by the participants throughout the study. This allowed comparisons of how the management affected the

participants' pain experience. Changes in pain complaints were monitored throughout the three weeks when the study was conducted. The minimally clinically important difference (MCID) of VAS, according to McDonald et al. (2019), ranging from 1.8 to 5.2 points, was noted and observed.

2. Goniometry measures joint angles or shows position angles using a goniometer (Norkin & White, 2009). It can measure the cervical side bending motion angle in the front plane in the anteroposterior axis. A recent study by Apti et al. (2023) shows that the normal cervical lateral flexion ROM is at 42.1+/-7.9 deg. The researchers tested only neck side bending of both left and right sides to assess the effects of improved muscular flexibility manifested by improved upper trapezius range of motion. This was done starting in the neutral neck position and then having the participant side bend the neck actively. The degree value is taken at the end range of the active movement from the neutral position. The shoulder girdle and chest were stabilized. The fulcrum of the goniometer was placed over the spinous process of the C7 vertebra. The proximal arm was aligned with the spinous process of the thoracic vertebra so that the proximal arm is perpendicular to the ground. The distal arm is aligned with the dorsal midline of the head, with the occipital protuberance as the reference point. The minimal detectable change (MDC) of neck side bending, according to Kuo et al. (2020), is at 5.9 to 9.1 degrees. Range of motion findings for side bending were compared to these values.

Data Gathering Procedure

The experiment was initiated once the proposal was approved and ethics clearance was received. The researchers then gathered participants in Dumaguete City. A Google form questionnaire or one-on-one interview was performed to determine eligibility for participation. The participants were informed that the intervention they received was free, and the intention was for research purposes.

Documents for consent, confidentiality, demographics, and baseline information were gathered. Baseline measures were collected. The research intervention and data gathering protocol were followed for three weeks. The Visual Analogue Scale (VAS) and goniometry were outcome measures. VAS and lateral flexion ROM were assessed every session. Participants were met face-to-face in the Institute of Rehabilitative Sciences Free Clinic (IRSFC).

One researcher supervised each MET intervention, another researcher supervised each Dynamic Stretching intervention, and these two researchers supervised the combination of both interventions. Furthermore, one researcher was assigned to take all goniometric measurements for range of motion to minimize intertester reliability issues.

All sessions started with taking vital signs (BP, PR, Temperature, Oxygen Saturation), then questioning VAS and measuring neck side bending ROM. The intervention for each group (as detailed below) was performed after the first two steps.

1. MET Group: Participants in this group were instructed to perform self-METs using reciprocal inhibition on the antagonistic upper trapezius muscle. The participant was in a sitting position. The head was positioned in mid-range ipsilateral side bending. The participant provided a counterforce or resistance against the opposite side of the head, contracting towards the contralateral side, bending (Siddiqui et al., 2022). The participant was instructed to provide more than 20% strength but less than 35%, with resistance counteracting the force equally. The isometric contraction was held for 5-7 seconds, followed by a "release and relax" instruction by inhalation and exhalation, with further rest as the head was taken to an increased range of contralateral side bending. The procedure was repeated 5 times until an increased stretched range was achieved (Chaitow & Franke, 2013).
2. Dynamic Stretching Group: The participants were asked to perform dynamic stretching exercises. The participant was in a sitting position with the head in neutral. The participant then actively performed contralateral side bending of the head with both shoulders and trunk maintained in neutral position. The participant was instructed not to hold the position any higher than 3 seconds. The stretch was released by allowing the head to return to a neutral position. The procedure was repeated 10 times, in 2 sets (Blahnik, 2011).
3. MET and Dynamic Stretching Group: With the abovementioned procedures, the participant was asked to perform the two interventions in one session. The participant performed the METs first in 3 repetitions with the procedure stated in the MET group, followed by performing dynamic stretching with 10 repetitions of 1 set with the same procedure stated in the Dynamic Stretching Group. The parameters were given as such to ensure that the interventions

provided were similar in duration and/or repetitions. After performing the procedure/s, VAS questioning and neck side bending ROM measurement were reassessed. The session concluded after the re-taking of the vital signs. Intervention application and data gathering were performed for three (3) weeks, for two (2) sessions per week, having a total of six (6) sessions.

Method of Data Analysis

The researchers outsourced a qualified data analyst to assess clinical effects between the pre-test and post-test (2-4 weeks after the start of interventions). The time interval and three intervention groups (METs alone, METs with Dynamic Stretching, and Dynamic Stretching alone) were considered fixed effects. The data analysis would be consistent with the treatment principle so that all participants would be included in the analysis of intervention outcomes. The VAS scores and lateral flexion ROM angles were taken every visit; therefore, information was available up to the visit before the drop out (Armijo-Olivo et al., 2009).

The paired T-test with a confidence interval of 95% was utilized for the mean difference computation, and the one-sample and two-sample t-test for the statistical hypothesis test. The Ryan-Joiner Normality Test was used to calculate the normal distributions between the data gathered, and One-Way Analysis of Variance (ANOVA) to compare the findings between each group. To represent the distribution of values under the descriptive analysis, histograms and dot plots were used to visualize the data distribution. Interval plots were used to illustrate the comparison of means between each group. Effect size and means were also calculated.

Ethical Considerations

The study was conducted with ethical considerations for the participants' information, identity, and consent. The individuals' responses were kept confidential, and the University Research Ethics Committee of Silliman University approved the study. The participants were fully informed of the procedure before starting the study. The entire process was explained in detail with the corresponding rationale for full transparency. Information gathered by the researchers was stored in a Google Drive and was only accessible to the researchers, the research advisor, and the statistician. All information will be deleted within 5 years. Participation of the participants was voluntary, and they were free to withdraw anytime when there was a

need or a will to do so. Although there was no monetary remuneration, participants gained the chance to learn self-management techniques for their neck pain.

Results and Discussion

This chapter presents the results of the study and the relevant data taken from the experimental procedure that were analyzed using various statistical tools.

The participants were grouped according to age and sex among all three groups. For the MET group, there were six females and four males with a mean age of 31.8. The DS group had eight female and two male participants with a mean age of 27.2. The combination groups had three female and seven male participants with a mean age of 22.4. Although an attempt was made to distribute the participants equally based on sex and age, this was impossible as the participants who voluntarily agreed to participate had varying ages and sexes. Most participants in all three groups were females in their early 20s (see Figure 2). Four of the 34 participants who were gathered did not return for their intervention despite follow-ups. These dropouts were excluded from the statistical analysis. Only one participant out of the 30 finished the six (6) sessions to achieve total relief of pain. The other 29 participants did not return for intervention because of reports of pain relief. They verbally reported on the phone that there was no more pain felt when contacted before the day of their session and during missed sessions. A follow-up call was done a week after data gathering to check for the recurrence of pain, and the participants reported that the pain did not return. There was one participant who reported the recurrence of pain due to return to work reasons, but the pain level was not as high as before the intervention. The average number of sessions completed in all three groups tested is four. The 30 participants achieved the maximal benefits despite not finishing six (6) sessions, as evidenced by a 0 score in the VAS during the last encounter.

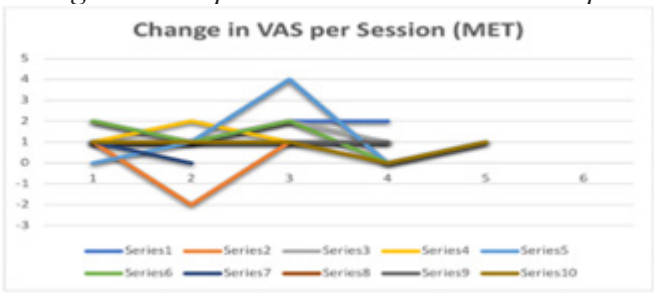
Results were analyzed, and comparisons with hypothetical predictions were made based on the analysis and interpretation of the results. Said predictions were based on whether a combination of MET and dynamic stretching is superior to MET or dynamic stretching alone for pain management and increasing ROM in participants aged 18 years and above with non-specific cervical pain.

Difference in Cervical Pain and ROM after Every Intervention session Using Muscle Energy Techniques

The trends for the change in VAS after every intervention session in the MET group were analyzed descriptively through line graphs. The different colors showed the results for each participant. The values in the y-axis showed the difference in pain level taken from that session, subtracting the post-intervention pain level from the pre-intervention pain level. At the same time, the x-axis represented each intervention session. The graph trend showed similar changes after every intervention session in the VAS MET group, which was further explained in the statistical analysis in Figure 2.

Figure 2

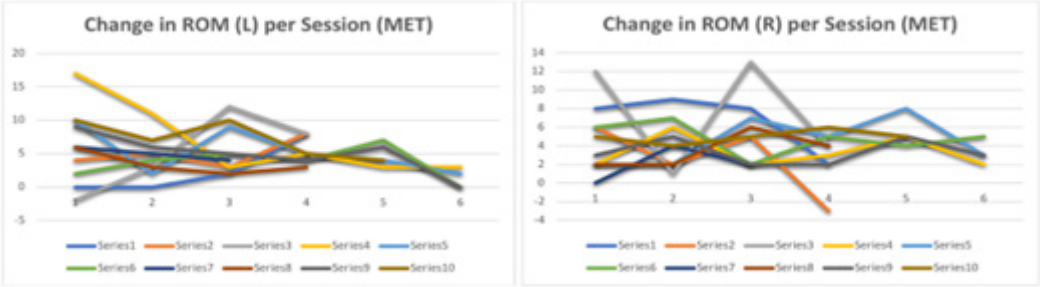
Changes in VAS per Session in the MET Group



In the ROM group for both the right and left sides, the trends showed a similar level of decrease for each session. The y-axis represented the degrees of change, while the x-axis represented the number of sessions. The differences per session on the right side were more than on the left when looking at the graph. This was further statistically analyzed below (Figure 3).

Figure 3

Changes in lateral flexion ROM in the MET Group



The changes in cervical pain using the VAS and lateral flexion ROM after every intervention session were statistically analyzed using the mean and effect size. The effect size was calculated to determine if there was a significant difference. The effect size determined the relationship between variables and whether the group was significant. Statistically, the effect size is the mean divided by the standard deviation. A number greater than one (1) indicates that the intervention was effective. The bigger the number is above 1, the higher the effect. There is no maximum value for effect size. The MCID was checked based on the mean change after every intervention session.

The VAS scores gathered were analyzed for effect size and compared to the MCID of 1.8-5.2 points to determine a significant difference in cervical pain (McDonald et al., 2019). The effect size determined a significant change in lateral flexion ROM and was cross-checked with the minimal detectable change. According to Kuo et al. (2020), the MDC of neck side bending is 5.9 to 9.1 degrees. Any value going lower than this range would mean the change was insignificant. Cervical pain was measured using the VAS before and after every intervention session. For the MET group, the mean decrease in pain after every intervention session was 1.070. The effect size for this group was 2.93. The effect size was larger than the mean since it was a determinant of how significant the effect of the intervention was, considering its standard deviation. Any number higher than one (1) indicated a significant difference. The bigger the number, the bigger the change. The mean was the average of all the differences taken at the end of each intervention session.

The range of motion values were taken for neck side bending on the left and right sides. Active range of motion measurements were used to focus on functionality. After every session in the MET group, the ROM values in both left and right-side bending increased to an average of 5.362 (right) to 6.84 (left) degrees. There are some cases where the ROM decreased on both the left and the right after intervention, but this increased again in the following intervention session. The cause for the decrease in ROM after the intervention may be extrapolated to be related to the activities done before the intervention session. However, the actual reasoning for this was not assessed since this was not part of the study. The effect size is 1.91 on the left and 4.12 on the right. The MET group in right-side bending showed the highest effect size among all the other intervention groups. This was also consistent with the dot plot on the number of sessions. The right-side bending had a larger effect size than the left-side bending. The reason for this must be further analyzed by knowing the hand dominance of the

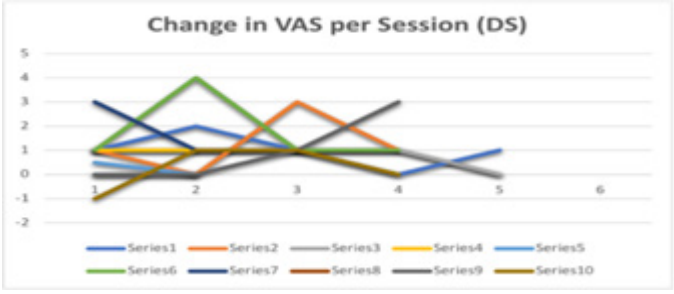
participants regarding neck pain.

Using Dynamic Stretching

A line plot was created to determine the trends in the changes in the DS group after every intervention session. The line graph showed a higher difference in pain reduction in some participants than in others, with some participants having a stagnant decrease in pain. This was further analyzed statistically (Figure 4).

Figure 4

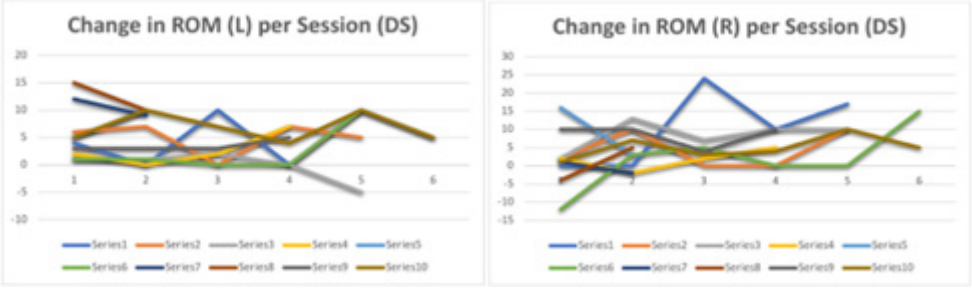
Changes in VAS per session in the DS Group



The lateral flexion ROM for the DS group was also descriptively analyzed in a line graph. Based on this data, the differences in the lateral flexion ROM after every intervention session were closely similar (Figure 5). The statistical analysis showed a more detailed explanation of the differences for each session.

Figure 5

Changes in lateral flexion ROM per session in the DS Group



The exact process was used to gather the VAS in the MET group. The mean reduction of pain after every intervention session in this group

was 0.90. The effect size was 1.40. This showed that DS was effective in reducing pain after every intervention session.

A similar trend in the lateral flexion ROM values of the MET group was seen in the DS group. After every session for this group, the mean increase in lateral flexion ROM was 5.88 degrees on the left and 5.15 degrees on the right. The effect size on the left was 1.55 and the right was 1.31 (Table 6). This has proven that DS effectively increased side-bending ROM after every intervention session.

The mean and the effect size were independent of each other. The effect size greater than one (1) indicates that the intervention was effective, while the mean indicates the average improvement the participants felt per session.

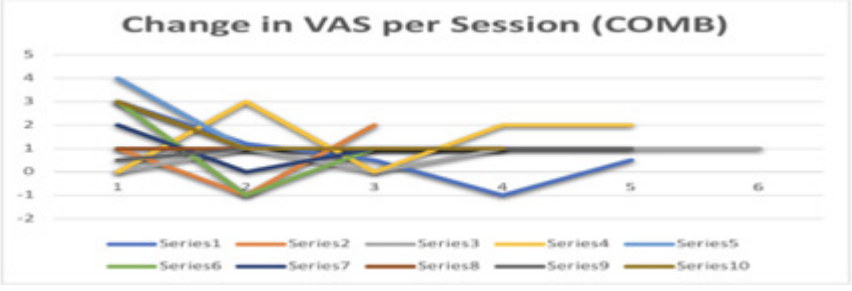
The p-value was taken for the DS group for the VAS (.005) and lateral flexion ROM (.002) to prove further that there was a significant change after every intervention session, independent of the MCID, MDC, and effect size. For the DS group, the p-values showed a significant positive change after every intervention session in decreasing cervical pain and increasing lateral flexion ROM.

Using Both MET and Dynamic Stretching

Using both MET and dynamic stretching fell under the combination group. The exact process in the previous groups was used to get the VAS values. A line graph was created to show VAS's differences in the combination group. The graph showed a varying difference in the decreasing pain and cases where the pain increased at the end of the session (Figure 6). This was further statistically analyzed.

Figure 6

Changes in VAS per session in the Combination Group

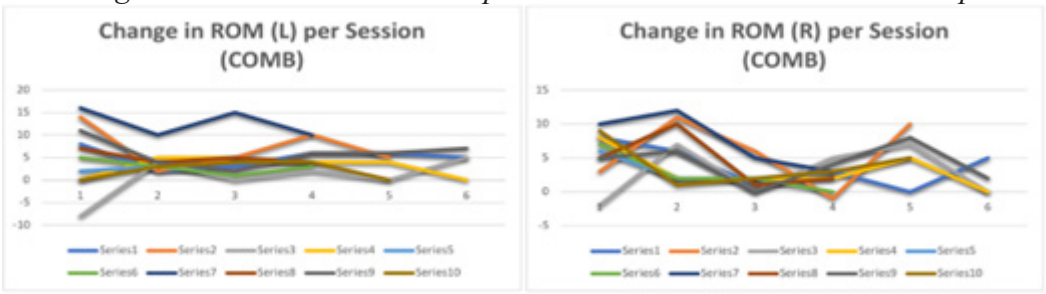


The lateral flexion ROM for the combination group was plotted in a

line graph to show the trends in the increase in lateral flexion ROM after every intervention session. It showed a similar increase for both sides (Figure 7). This was further statistically analyzed.

Figure 7

Changes in Lateral Flexion ROM per Session in the Combination Group



The lateral flexion ROM for the combination group was plotted in a line graph to show the trends in the decrease of pain after every intervention session. It showed that the right ROM had gradual improvements in mobility, as evident in large ROM changes, then plateaus later on by the 3rd to 4th sessions. Greater improvements were seen at the last sessions, where most participants had increased ROM for right neck side bending.

The mean difference in pain was 1.147 in this group, with the effect size at 2.093, which is considered a significant difference.

A similar trend is seen in MET and DS in the increase of the lateral flexion ROM after each intervention session. After every session for this group, the mean increase in lateral flexion ROM was 5.96 degrees on the left and 5.215 degrees on the right. With the effect size as the basis, both have significant changes, with 1.19 on the left and 2.04 on the right.

Similar to the intervention of the values in the MET and DS group, the combination group were also analyzed for their p-values (.009 for VAS, .000 for R ROM and .005 for L ROM) to determine if there was a positive effect of a combination of MET and DS in decreasing cervical pain and increasing side-bending ROM after every intervention session independent of the MCID, MCD, and effect size. The results showed p-values less than 0.05, proving that the combination group was also effective (Table 10).

Based on the results and discussion, H01 was rejected since there was a significant change for the VAS and lateral flexion ROM after every intervention session, as proven by the effect size greater than 1 and the p-values less than 0.05 in all three groups. However, the mean values show no significant difference from the MCID for VAS and MDC for lateral flexion ROM. There was an exception in the left side bending of the combination

group since the value surpassed the MDC. These results were expected since decreasing pain and increasing ROM require multiple sessions before seeing significant results. Formal comparison was not statistically acceptable between the different groups as they were independent of one another's MCIDs and MDCs, which did not show significant change.

Difference between Pre and Post-test VAS Scores and Lateral Flexion ROM Following the Intervention of Muscle Energy Techniques Alone, Dynamic Stretching Alone, or a Combination of MET

Pre-test and post-test, following six (6) sessions of two (2) times per week for three (3) weeks, VAS for pain, and both left and right lateral flexion ROM scores were gathered for this study. According to the editorial by Stratton (2019), comparing the pre- and post-test scores will determine whether the intervention was successful for the participants.

All post-test VAS results yielded zero scores in all participants. Still, they varied only by the total number of intervention sessions needed to reduce the pain to zero, or no pain was present in the next session. Under the MET group, the pre-test mean score was 4.6, 4.3 under the dynamic stretching group, and 4.8 under the combination of the MET and dynamic stretching groups. All groups have a post-test score of zero. Although changes in VAS in the DS group were not significant according to the p-value, it did reach the VAS MCID, suggesting a possible positive effect in decreasing pain (Table 1). Please refer to Appendix C7-C8 for the supporting data.

To determine which technique performed better in reducing pain and increasing lateral flexion ROM, one-way ANOVA with a confidence interval of 95% was used to determine the relationship between the means of all three groups. The means of the VAS and lateral flexion ROM in the MET, dynamic stretching, and the combination groups were compared (Appendix C4, C5, and C6).

The difference between baseline and post-intervention was recorded and analyzed. For the VAS in the MET group, the mean is 3.90. This p-value is 0.002, indicating a significant change since it is less than 0.05. The p-value was 0.078, making no significant change in VAS in the DS group from pre to post all intervention sessions. The combination group had a p-value of 0.019, implying a significant change (Table 1).

Table 1

Summary of Means from Pre- and Post-test and p-values from MET, Dynamic Stretching, and Combination of Interventions on VAS and Neck Side bending ROM.

	Pre-Test Mean Scores	Post-Test Mean Scores	VAS MCID / ROM MDC	P-value	Remarks
VAS					
MET	4.6	0	1.8 - 5.2	0.002	Significant
Dynamic Stretching	4.3	0	1.8 - 5.2	0.078	Non-significant
Combination of both MET and dynamic stretching	4.8	0	1.8 - 5.2	0.019	Significant
Right Neck Side Bending ROM					
MET	28.9	50	5.9 - 9.1	0.000	Significant
Dynamic Stretching	34.5	50.5	5.9 - 9.1	0.000	Significant
Combination of both MET and dynamic stretching	31.1	47.7	5.9 - 9.1	0.000	Significant
Left Neck Side Bending ROM					
MET	27.5	50.6	5.9 - 9.1	0.000	Significant
Dynamic Stretching	29.8	49.7	5.9 - 9.1	0.006	Significant
Combination of both MET and dynamic stretching	28.1	51	5.9 - 9.1	0.000	Significant

According to Kuok et. al. (2020), the MDC for neck side bending is at 5.9 to 9.1 degrees as mentioned above. All participants had increased neck-side bending ROM in either of the three interventions provided. For ROM, the MET group's pre- and post-test mean scores were 28.9 to 50 (right) and 27.5 to 50.6 (left). Under the dynamic stretching group, the pre-

and post-test mean scores are 34.5 to 50.5 (right) and 29.8 to 49.7 (left). For the combination of MET and dynamic stretching group, the pre- and post-test mean scores are 31.1 to 47.7 (right) and 28.1 to 51 (left). Based on the MDC, all three groups significantly improved lateral flexion ROM based on the pre- and post-test scores (Appendix C8).

It was statistically proven that all three groups positively reduced pain and increased lateral flexion ROM for the participants with cervical neck pain.

Although all interventions showed a decrease in mean VAS scores when compared during pre- and post-intervention, the dynamic stretching group did not yield a statistically significant difference. When the baseline to post-intervention values of the VAS in the DS group are analyzed based on the MCID, the value falls under the MCID, which means that it effectively reduces pain as per the MCID. Further studies regarding this matter may be conducted to determine the minimal effects of DS on cervical pain.

Based on the statistical results, muscle energy techniques alone, dynamic stretching alone, or a combination of MET and dynamic stretching have an equal effect on improving cervical neck pain and neck side bending ROM.

In terms of the length of intervention, all three interventions varied in the number of sessions needed before a 0/10 pain was achieved. For the MET group regarding VAS scores, 1 participant achieved absence of pain after the first session, another participant experienced absence after three intervention sessions, 5 participants had no pain after four intervention sessions, and 3 participants no longer experienced pain after five sessions. Under the dynamic stretching group, 3 participants had no neck pain after two intervention sessions, 3 participants no longer had pain after four intervention sessions, and 4 participants achieved the absence of pain after five intervention sessions. For the combination of both MET and dynamic stretching group, two participants had 0/10 VAS scores after two intervention sessions, 2 participants required only three intervention sessions, 2 participants after four intervention sessions, 2 participants after five intervention sessions, and 1 participant after six intervention sessions, all of whom had no pain. The smallest number of intervention sessions with the greatest number of participants in each group was used to determine which intervention had the shortest time needed to achieve a 0/10 VAS pain reduction. MET, having achieved no pain after four intervention sessions for 5 out of 10 participants, has the shortest pain reduction time among all three groups. This is followed by the dynamic stretching group, with 4 out of 10 participants having 0/10 VAS after five intervention sessions, and 2 out of 10

participants achieving no pain after the 2nd, 3rd, and 4th intervention sessions for the combination of MET and dynamic stretching group.

The research study proved that MET, DS, and a combination of MET and DS are independently effective in decreasing cervical pain and increasing neck side bending ROM. There are no studies available that show the effects of a combination of MET and DS in reducing pain and increasing ROM in other parts of the body aside from the neck. The researchers hypothesized that combining two effective techniques would result in faster pain reduction and increased ROM. This study, however, showed that the combination group had the most gradual decrease in pain among the three groups. In a study made by Phadke et al. (2016) that aims to compare the effect of MET with passive stretching on pain and functional disability in people with mechanical neck pain, VAS and NDI scores have shown a significant improvement in both MET and stretching groups on the sixth day post-intervention. However, both VAS and NDI scores improved better in the MET group than in the stretching group. This study showed better returns from individual intervention than the combination of MET and dynamic stretching.

Superiority of the Combination MET and Dynamic Stretching Intervention as Compared to MET Alone or Dynamic Stretch Alone in Decreasing Pain and Increasing Lateral Flexion ROM

The Two-Sample T-test and Confidence Interval (CI= 95%) were used to analyze the data comparing the combination of MET and dynamic stretching versus MET alone, and the data comparing the combination of MET and dynamic stretching versus dynamic stretching alone. This type of statistical test was used since the means of the two comparisons were assessed (Table 2).

The T-test p-values (significant <0.05) were all considered insignificant when differences in mean VAS were compared in both the combination group versus the MET group (p-value 0.358). The means were taken to take the average effects of the participants per intervention group for all sessions within 3 weeks. VAS of the combination group and dynamic stretching group rendered similar differences in mean with a p-value of 0.183. Regarding lateral flexion ROM, the analysis method was the same. Differences in the mean in the combination and MET groups regarding Right and Left ROM were insignificant (Right ROM p-value=0.563, Left ROM p-value=0.672). Insignificant differences were also seen with the combination and dynamic stretching groups in both Left and Right ROM

p-values (Right ROM p-value 0.483, Left ROM p-value 0.485).

The paired t-test showed the p-values of the VAS and lateral flexion ROM in all three groups. A p-value less than 0.05 rejected the null hypothesis, stating that there was a significant change between the values without considering the MCID and MDC. The p-value in the MET group was found to be 0.000, which suggested that MET alone effectively decreased pain and increased ROM.

Table 2

Two-Sample T-test p-values of Combination versus MET and Dynamic Stretching from VAS and Lateral Flexion ROM Mean

	Mean change after every intervention	P- values
VAS: Combination versus MET		
VAS Combination	1.147	0.358
VAS MET	1.070	
VAS: Combination versus Dynamic Stretching		
VAS Combination	1.147	0.183
VAS Dynamic Stretching	0.900	
Right Neck Side Bending ROM: Combination versus MET		
Right ROM Combination	5.21	0.563
Right ROM MET	5.36	
Right Neck Side Bending ROM: Combination versus Dynamic Stretching		
Right ROM Combination	5.21	0.563
Right ROM Dynamic Stretching	5.15	
Left Neck Side Bending ROM: Combination versus MET		
Left ROM Combination	5.96	0.672
Left ROM MET	6.84	
Left Neck Side Bending ROM: Combination versus Dynamic Stretching		
Left ROM Combination	5.96	0.485
Left ROM Dynamic Stretching	5.88	

Although it was already evident in the previous results that all three interventions had similar effects in improving pain and mobility, analysis

was further done to test Null Hypothesis 3 (H03) and find out whether the combination of techniques, MET and dynamic stretching, was better than either of the two interventions by themselves. Differences in post-tests from pre-tests from all sessions of VAS and lateral flexion ROM were compared based on their mean average using the thresholds of VAS MCID (1.8 to 5.2) and lateral flexion ROM MDC (5.9 to 9.1 degrees) in all three intervention groups. The difference in means per intervention group was also compared and analyzed through the Two-Sample T-test (Table 10).

Based on the results, data suggested acceptance of H03, showing no superiority in combining muscle energy techniques and dynamic stretching based on VAS and lateral flexion ROM mean differences compared to MET or dynamic stretching alone.

Additionally, it is worth noting that after the fifth session, all participants of both the MET and DS groups no longer had pain. The dot plot on the number of sessions needed to reduce the pain to 0 showed that the MET group had 7 participants reporting 0 pain levels at the end of the fourth session. In comparison, the other two groups only had 6 participants who had 0 pain at the end of the fourth session (Appendix C9). The combination group had 1 participant reach session 6 before the actual relief of pain. The researchers initially believed combining MET and DS would be the most effective and efficient in reducing pain since it combined two effective techniques. This was not the case in this study since the combination group was the last to achieve complete pain relief. This study suggested that MET or dynamic stretching alone will improve pain and ROM.

The mean number of sessions for the MET group to achieve 0 pain was 3.9. There were 3.8 sessions for the DS group and 4.1 for the combination group. This showed that an average of 4 sessions among all three groups were needed before relief of non-specific cervical pain following the application of MET alone, DS alone, or a combination of both.

When comparing the effect size of the three groups with the dot plot on the number of sessions, there was a consistency in the highest effect size of the MET group with the number of sessions needed to reduce pain. The dot plot (see Figure 2) showed that the MET group is the fastest mode of intervention to relieve pain, which was consistent with the effect size since the MET group had the highest effect size among all three groups.

Conclusion

The study revealed a significant difference in cervical pain and ROM

after every intervention session using MET, dynamic stretching, or a combination of both. The effect sizes for every intervention show values greater than one for the VAS and lateral flexion ROM. Furthermore, the paired T-Test of the VAS and lateral flexion ROM groups had p-values less than 0.05, which states that after every intervention session, there is a reduction in pain and an increase in ROM in all three techniques.

Secondly, the research showed a significant difference in pre- and post-intervention VAS scores and lateral flexion ROM measurements following MET alone and combination treatment. A significant difference was only found following dynamic stretching in improving the lateral flexion range of motion. There was no difference found in VAS scores.

The combination of MET and dynamic stretching did not yield superior results to MET or dynamic stretching for pain management and increasing ROM in participants aged 18 years and above with non-specific cervical.

In comparing the effectiveness of the three techniques, MET, dynamic stretching, and the combination of both in managing cervical pain and range of motion show that all are effective in reducing cervical pain and increasing active lateral flexion ROM after every session, according to effect size. However, there is no one group superior among all three groups. Although generally found to be statistically significant in terms of effect, it should be noted that the values presented did not meet the acceptable MDC and MCID. Either of these three techniques can be used to manage cervical pain effectively. Increasing lateral flexion ROM requires more studies with a bigger sample size for improved statistical power.

Recommendations

The researchers recommend using either technique: MET alone, dynamic stretching alone, or a combination of both. However, since the combination did not yield superior results, it may be prudent to suggest using a single intervention to save time and effort for the patient.

To obtain more precise MDC and MCID values for changes after each intervention session, it would be best to include participants with a pain scale rating greater than 5/10, as this could show a greater potential for pain reduction. A limitation of motion of at least 40% of the normal range is also recommended to increase the measurable change in degrees after each session. Additionally, a wider age range among participants would help reveal trends in neck pain and limitations of motion (LOM) across age groups. Due to time constraints and the availability of qualified participants

each group included only 10 people, resulting in 30 participants. Increasing the number of participants to 30 per group is highly recommended to improve the study's statistical power. Furthermore, a longer intervention and observation period could help examine the long-term effects of each intervention.

Further research on the effectiveness of MET, dynamic stretching, and their combination as a home exercise program for non-specific cervical neck pain would provide valuable insight into the utility of these techniques. These non-contact interventions, which do not require special equipment, make them practical in a home exercise program.

Declaration of Originality and Competing Interests

The authors declare that the paper is an original research investigation and contains no materials previously published or written by another author that have not been appropriately cited or include falsified or fabricated data from the data-gathering procedure.

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Appendix A: MET on the Upper Trapezius Muscles

The following procedure explains how Self-MET was performed on the left upper trapezius muscle using the reciprocal inhibition approach:

a. In a sitting position, the participant positioned their head in mid-range left neck side bending.

b. The participant applied resistance against right neck side bending using the right upper extremity with hand placement on the right side of the head.

c. The participant exerted only >20% of force but <35% with resistance equally given.

d. The contraction was held for 5-7 seconds. A relaxation phase of inhalation and exhalation was given after resistance was released, followed by an increased range towards right-side bending.

e. Self-MET was performed on the left upper trapezius following steps a to d, with a newly stretched position achieved after every repetition. The same procedure was executed for applying self-MET on the right upper trapezius with literalities interchanged upon performance.

At the end- range of right side- bending, resist the motion by placing one hand on the right side of the head for 5-7 seconds while contracting the right upper trapezius. Inhale and exhale after resistance is applied.

Stretch the left upper trapezius by going into right side- bending. Place the left arm behind the back to increase the stretch.

Stretch the left upper trapezius into the new range. Repeat these steps for 5 repetitions. Repeat all these steps on the opposite side to for the right upper trapezius.

At the new range, resist right side bending again. Perform inhalation and exhalation after the resistance.

f.Each position with intervention resistance was repeated 5 times or until the increased stretched range was achieved.

Appendix B: Dynamic Stretching on Both Upper Trapezius Muscles

The following procedure of dynamic stretching was performed on both upper trapezius muscles:

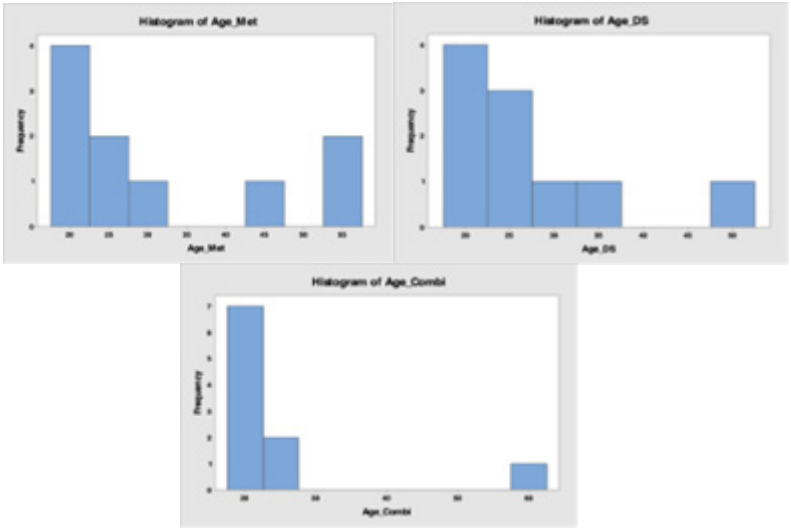
a. The participant was in a sitting position with the head in neutral.
b. The participant side flexed the head contralaterally until a stretch was felt on the ipsilateral side (left upper trapezius of the participant) while keeping the shoulders and trunk in neutral.

c. The position was not held for more than 3 seconds. The participant returned the head to neutral position and repeated the dynamic stretch 10 times in 2 sets (Blahnik, 2011).
d. The same procedure from steps a to c was repeated towards the left neck side, bending to target the right upper trapezius.

Appendix C: List of Figures

Appendix C1

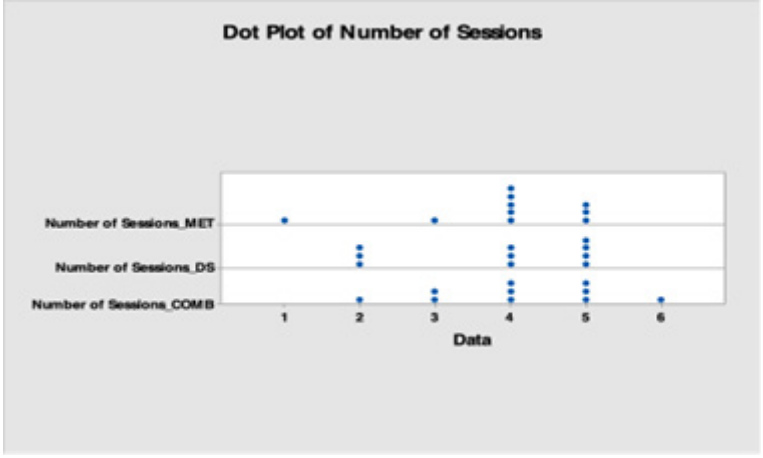
Histogram of Age in the Three Groups



Appendix C1 shows the distribution of the participants based on age in the three groups. The x-axis shows the age of the participants, while the y-axis shows the frequency or the number of participants under that age group. The participants are mostly in their 20s and are among the three groups.

Appendix C2

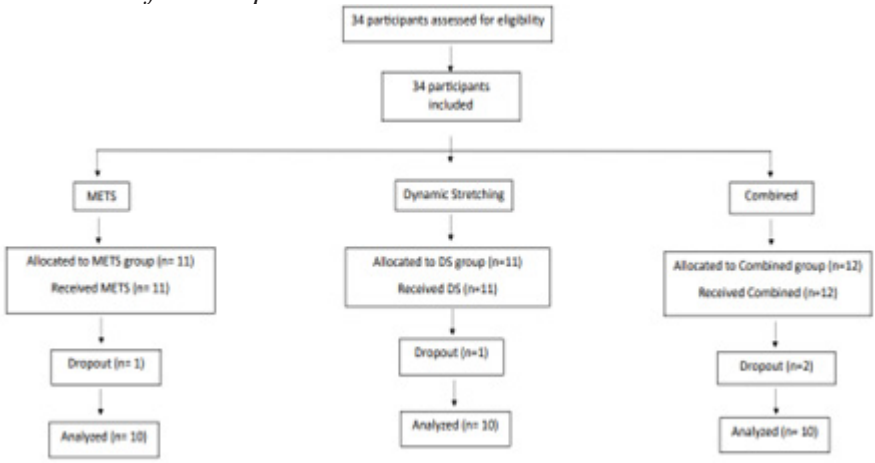
Dot Plot on the Number of Sessions needed by the participants before reporting 0 pain levels



The individual plots show the number of sessions required to treat the participants before the pain was reduced to 0.

Appendix C3

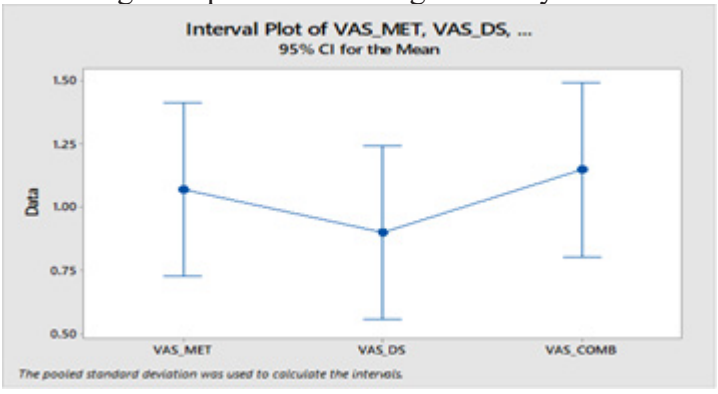
Flowchart of Participants



participants shows that 34 participants were initially included in the study. Four dropouts were incurred, 1 in the MET group, 1 in the DS group, and 2 in the combination group. There are 10 participants in each group. Thirty participants were statistically analyzed in total.

Appendix C4

Interval Plot of the Mean Differences in pre- and post-test scores of MET, Dynamic Stretching, and the Combination of Both MET and Dynamic Stretching Groups for VAS using One-Way ANOVA

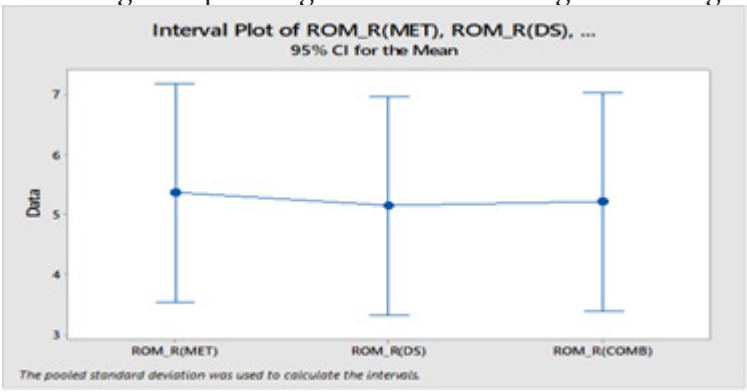


Note. The y-axis indicates the pre- and post-test changes of VAS in the MET, dynamic stretching, and the combination of both MET and dynamic stretching groups. The blue vertical lines represent the data set for each group, with its mean represented by a blue dot. The blue lines that connect

all three means represent the relationship among all three groups. The x-axis represents the respective data set of the MET, dynamic stretching (DS), and the combination of both MET and dynamic stretching (COMB) groups.

Appendix C5

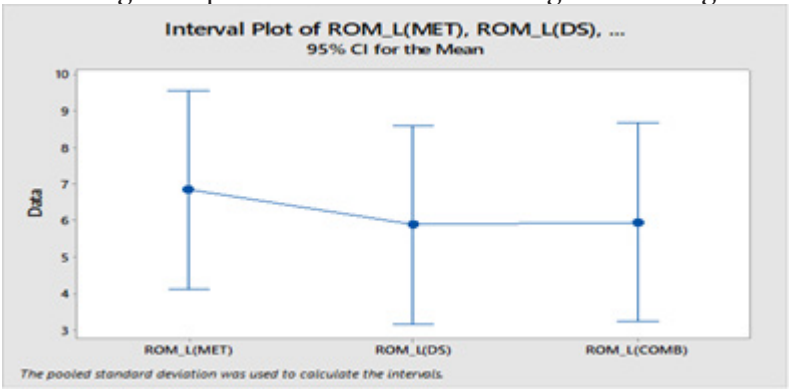
Interval Plot of the Mean Differences in pre- and post-test scores of MET, Dynamic Stretching, and the Combination of Both MET and Dynamic Stretching Groups for right neck side bending ROM using One-Way ANOVA



Note. The y-axis in this interval plot represents the right neck side bending ROM pre- and post-test changes. A blue dot shows the mean for each group. The vertical blue line represents the data set for each group. The relationship between the MET, dynamic stretching (DS), and the combination of both MET and dynamic stretching (COMB) groups is then plotted by connecting the means using a blue line.

Appendix C6

Interval Plot of the Mean Differences in pre- and post-test scores of MET, Dynamic Stretching, and the Combination of Both MET and Dynamic Stretching Groups for left neck side bending ROM using One-Way ANOVA



Note. The y-axis in this interval plot shows the left neck side bending ROM pre- and post-test changes. A blue dot is used to indicate the mean for each group. Blue vertical lines represent the data set for each group. The means of the MET, dynamic stretching (DS), and the combination of both MET and dynamic stretching (COMB) groups are plotted by a blue line to visualize the relationship between each group.

Appendix C7

Raw Data of the Visual Analogue Scale Scores in all intervention sessions

VAS												
	Pre test session 1	Post test session 1	Pre test session 2	Post test session 2	Pre test session 3	Post test session 3	Pre test session 4	Post test session 4	Pre test session 5	Post test session 5	Pre test session 6	Post test session 6
MET P1	4	3	1	0	5	3	3	1	0	0	0	0
MET P2	6	5	0	2	2	1	1	0	0	0	0	0
MET P3	5	3	4	3	3	1	2	1	0	0	0	0
MET P4	4	3	4	2	2	1	1	0	0	0	0	0
MET P5	3	3	3	2	6	2	0	0	2	1	0	0
MET P6	6	4	5	4	4	2	0	0	1	0	0	0
MET P7	5	4	0	0	0	0	0	0	0	0	0	0
MET P8	3	2	3	2	1	0	0	0	0	0	0	0
MET P9	5	4	5	4	2	1	1	0	0	0	0	0
MET P10	5	4	4	3	3	2	1	1	1	0	0	0
P is Participant												
	Pre test session 1	Post test session 1	Pre test session 2	Post test session 2	Pre test session 3	Post test session 3	Pre test session 4	Post test session 4	Pre test session 5	Post test session 5	Pre test session 6	Post test session 6
DS P1	4	3	4	2	2	1	1	1	1	0	0	0
DS P2	5	4	3	3	5	2	2	1	3	3	0	0
DS P3	5	4	5	4	5	4	4	3	3	3	0	0
DS P4	8	7	7	6	6	5	5	4	0	0	0	0
DS P5	2	1.5	1	1	0	0	0	0	0	0	0	0
DS P6	5	4	4	0	3	2	1	0	0	0	0	0
DS P7	3	0	3	2	0	0	0	0	0	0	0	0
DS P8	5	5	4	4	0	0	0	0	0	0	0	0
DS P9	3	3	2	2	2	1	3	0	0	0	0	0
DS P10	3	4	4	3	4	3	3	3	1	1	0	0
P is Participant												
	Pre test session 1	Post test session 1	Pre test session 2	Post test session 2	Pre test session 3	Post test session 3	Pre test session 4	Post test session 4	Pre test session 5	Post test session 5	Pre test session 6	Post test session 6
Combi P1	6	3	4	2.8	2	1.5	1	2	2	1.5	0	0
Combi P2	4	3	4	5	7	5	0	0	0	0	0	0
Combi P3	8	8	4	3	3	3	3	2	2	1	1	0
Combi P4	4	4	5	2	0	0	4	2	4	2	0	0
Combi P5	4	0	1	0	0	0	0	0	0	0	0	0
Combi P6	4	1	0	1	1	0	1	0	0	0	0	0
Combi P7	5	3	0	0	1	0	0	0	0	0	0	0
Combi P8	5	4	5	4	4	3	3	2	0	0	0	0
Combi P9	5	4.5	5	4	4	3	4	3	3	2	0	0
Combi P10	3	0	3	2	2	1	1	0	0	0	0	0
P is Participant												

Appendix C8

Raw Data of the Range of Motion Values in all intervention sessions on the left and right side

RIGHT LATERAL FLEXION ROM												
	Pre test session 1	Post test session 1	Pre test session 2	Post test session 2	Pre test session 3	Post test session 3	Pre test session 4	Post test session 4	Pre test session 5	Post test session 5	Pre test session 6	Post test session 6
MET P1	30	38	32	41	30	38	45	47	UTT	UTT	UTT	UTT
MET P2	28	34	35	37	45	50	45	42	UTT	UTT	UTT	UTT
MET P3	20	32	30	31	30	43	40	44	UTT	UTT	UTT	UTT
MET P4	30	32	28	34	43	45	45	48	48	53	53	55
MET P5	28	30	34	36	38	45	45	50	47	55	50	53
MET P6	24	30	36	43	38	40	41	46	46	50	50	55
MET P7	32	32	41	45	40	42	UTT	UTT	UTT	UTT	UTT	UTT
MET P8	30	32	38	40	40	46	46	50	UTT	UTT	UTT	UTT
MET P9	38	41	39	44	40	42	45	47	50	55	55	58
MET P10	29	34	37	41	35	40	40	46	45	50	54	54
P is Participant	UTT is unable to test; participant did not return since there was no more pain											
	Pre test session 1	Post test session 1	Pre test session 2	Post test session 2	Pre test session 3	Post test session 3	Pre test session 4	Post test session 4	Pre test session 5	Post test session 5	Pre test session 6	Post test session 6
DS P1	46	46	40	40	28	52	50	60	43	60	UTT	UTT
DS P2	34	36	30	40	40	40	50	50	45	55	UTT	UTT
DS P3	30	32	27	40	31	38	40	50	30	40	UTT	UTT
DS P4	36	38	34	32	37	39	45	50	UTT	UTT	UTT	UTT
DS P5	24	40	47	50	UTT	UTT	UTT	UTT	UTT	UTT	UTT	UTT
DS P6	43	31	39	42	45	50	50	50	50	50	45	60
DS P7	35	36	32	30	40	40	43	45	UTT	UTT	UTT	UTT
DS P8	36	32	40	45	UTT	UTT	UTT	UTT	UTT	UTT	UTT	UTT
DS P9	30	40	30	40	40	44	40	50	UTT	UTT	UTT	UTT
DS P10	31	32	31	38	40	43	40	44	40	50	45	50
P is Participant	UTT is unable to test; participant did not return since there was no more pain											
	Pre test session 1	Post test session 1	Pre test session 2	Post test session 2	Pre test session 3	Post test session 3	Pre test session 4	Post test session 4	Pre test session 5	Post test session 5	Pre test session 6	Post test session 6
Combi P1	30	38	38	44	41	42	37	40	47	47	45	50
Combi P2	31	34	25	36	39	45	45	44	30	40	UTT	UTT
Combi P3	32	30	35	42	45	45	45	50	43	50	50	50
Combi P4	32	40	38	40	38	40	39	41	45	50	50	50
Combi P5	32	38	48	50	UTT	UTT	UTT	UTT	UTT	UTT	UTT	UTT
Combi P6	33	40	40	42	42	44	45	45	UTT	UTT	UTT	UTT
Combi P7	30	40	36	48	45	50	47	50	UTT	UTT	UTT	UTT
Combi P8	25	30	32	42	39	40	40	42	UTT	UTT	UTT	UTT
Combi P9	35	40	30	36	42	42	38	42	35	43	43	45
Combi P10	31	40	39	40	43	45	50	53	50	55	UTT	UTT
P is Participant	UTT is unable to test; participant did not return since there was no more pain											

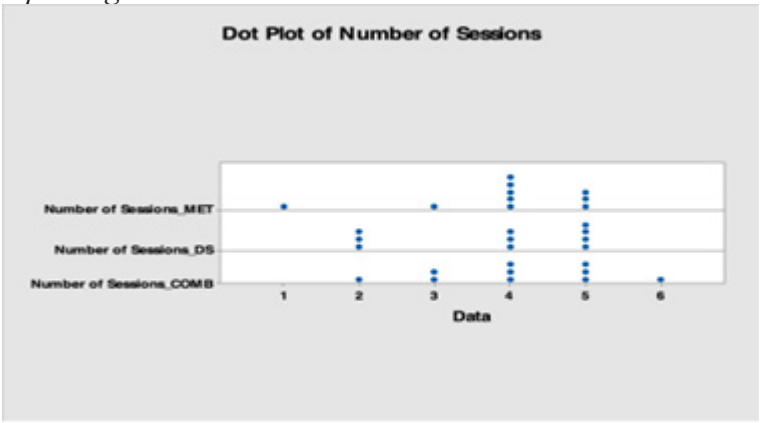
Appendix C8

Raw Data of the Range of Motion Values in all intervention sessions on the left and right side

LEFT LATERAL FLEXION ROM												
	Pre test session 1	Post test session 1	Pre test session 2	Post test session 2	Pre test session 3	Post test session 3	Pre test session 4	Post test session 4	Pre test session 5	Post test session 5	Pre test session 6	Post test session 6
MET P1	34	34	39	39	40	42	42	50	UTT	UTT	UTT	UTT
MET P2	30	34	34	39	44	47	42	50	UTT	UTT	UTT	UTT
MET P3	32	30	30	33	30	42	35	43	UTT	UTT	UTT	UTT
MET P4	22	39	20	31	40	43	47	52	47	50	50	53
MET P5	20	30	38	40	30	39	40	45	36	40	40	42
MET P6	18	20	38	42	30	35	40	44	48	55	55	55
MET P7	24	30	45	50	45	49	UTT	UTT	UTT	UTT	UTT	UTT
MET P8	30	36	36	39	43	45	49	52	UTT	UTT	UTT	UTT
MET P9	35	44	37	43	42	47	49	53	50	56	55	55
MET P10	30	40	33	40	30	40	46	51	53	57	57	57
P is Participant	UTT is unable to test; participant did not return since there was no more pain											
	Pre test session 1	Post test session 1	Pre test session 2	Post test session 2	Pre test session 3	Post test session 3	Pre test session 4	Post test session 4	Pre test session 5	Post test session 5	Pre test session 6	Post test session 6
DS P1	30	34	30	30	30	40	50	50	50	60	UTT	UTT
DS P2	34	40	38	45	40	40	40	47	50	55	UTT	UTT
DS P3	30	31	31	32	33	35	50	50	45	40	UTT	UTT
DS P4	36	38	31	31	43	45	45	52	UTT	UTT	UTT	UTT
DS P5	40	45	40	50	UTT	UTT	UTT	UTT	UTT	UTT	UTT	UTT
DS P6	39	40	40	41	50	50	50	50	50	60	45	50
DS P7	20	32	29	38	38	40	45	50	UTT	UTT	UTT	UTT
DS P8	20	35	30	40	UTT	UTT	UTT	UTT	UTT	UTT	UTT	UTT
DS P9	24	27	24	27	45	48	50	55	UTT	UTT	UTT	UTT
DS P10	25	30	25	35	48	55	51	55	40	50	45	50
P is Participant	UTT is unable to test; participant did not return since there was no more pain											
	Pre test session 1	Post test session 1	Pre test session 2	Post test session 2	Pre test session 3	Post test session 3	Pre test session 4	Post test session 4	Pre test session 5	Post test session 5	Pre test session 6	Post test session 6
Combi P1	32	40	40	42	40	43	40	46	44	50	50	55
Combi P2	22	36	40	42	40	45	30	40	40	45	UTT	UTT
Combi P3	30	22	39	43	40	40	50	52	50	50	50	55
Combi P4	30	30	40	45	40	45	40	44	45	49	50	50
Combi P5	30	32	44	47	UTT	UTT	UTT	UTT	UTT	UTT	UTT	UTT
Combi P6	30	35	42	45	45	46	47	50	UTT	UTT	UTT	UTT
Combi P7	22	38	40	50	35	50	45	55	UTT	UTT	UTT	UTT
Combi P8	25	32	32	36	36	41	40	44	UTT	UTT	UTT	UTT
Combi P9	30	41	30	34	40	42	40	46	45	51	47	54
Combi P10	30	30	40	43	44	48	50	54	55	55	UTT	UTT
P is Participant	UTT is unable to test; participant did not return since there was no more pain											

Appendix C9

Dot Plot on the Number of Sessions needed by the participants before reporting 0/10 VAS



Towards an Environment-Friendly Animal Feed Industry: The Role of the Nutritionist

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Abstract

Feed production is right at the heart of the animal feed supply chain. This supply chain is part of a dynamic global agricultural sector expanding rapidly due to the increasing demand for animal-sourced food, such as meat, dairy products, and eggs. This increasing demand for animal-sourced food results in the increased demand for animal feed, which uses raw materials, i.e., crops, by-products of the food industry, slaughter and processing of livestock, the marine industry, and biofuels, putting greater pressure on natural resources. The animal nutritionist, a major decision-maker in compound feed production systems, takes center stage in selecting and using feed materials, processing, and applying feed products in livestock production systems. This paper identifies the most significant environmental impacts of the feed supply chain and describes the role of the nutritionist in making decisions that could affect these impacts. Improving feed quality through formulation accuracy, increasing crop and animal by-products with the help of exogenous enzymes, and using alternative raw materials with lower life-cycle emissions and impacts were described as strategies nutritionists should adopt to help achieve a more environmentally friendly animal feed industry.

Keywords: animal feed supply chain, environmental impacts, nutritionist

Introduction

Feed production is right at the heart of the animal feed supply chain. This supply chain is part of a dynamic global agricultural sector expanding rapidly due to the increasing demand for animal-sourced food, such as meat, dairy products, and eggs. This increasing demand for animal-sourced food results in the increased demand for animal feed, which uses raw materials, i.e., crops, by-products of the food industry, slaughter and processing of livestock, the marine industry, and biofuels, putting greater pressure on natural resources (FAO, 2016). Life cycle assessment (LCA) studies have

shown that feed production primarily contributes to livestock systems' environmental impact (Middelaar et al., 2019).

LCA is a method to quantitatively assess the environmental impacts of goods and processes from "cradle to grave". It identifies and counts all impacts occurring throughout the entire value chain (supply chain plus use and disposal phases), avoiding burden shifting from one environmental impact to another, thereby identifying the most effective improvement strategies (Hellweg & Canals, 2014). FAO (2016) uses LCA in its recommended guidelines for assessing the environmental performance of animal feed supply chains, amidst the many different methods used to assess environmental impacts and performance of livestock products.

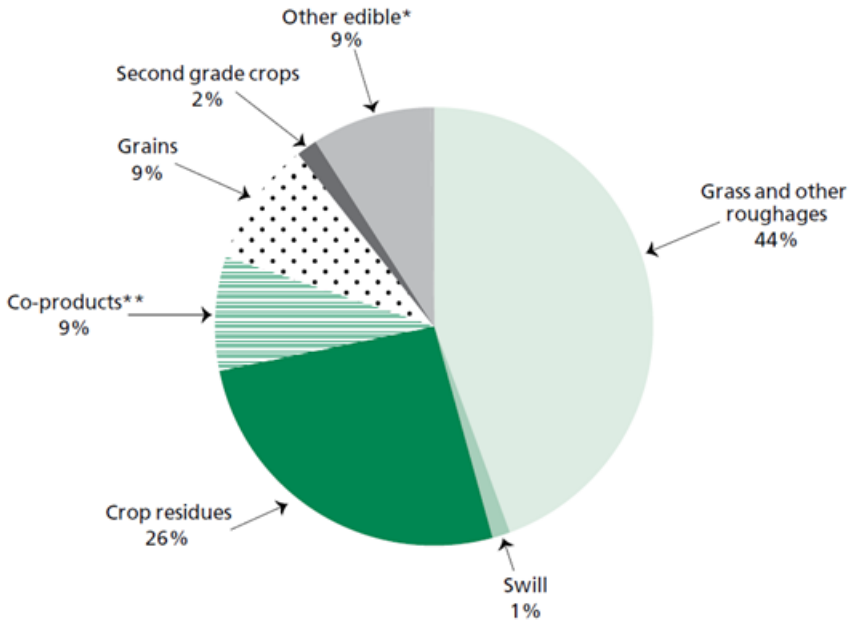
The animal nutritionist, a central decision-maker in compound feed production systems, takes center stage in selecting and using feed materials, processing, and applying feed products in livestock production systems. This paper identifies the most significant environmental impacts of the feed supply chain and describes the role of the nutritionist in making decisions that could affect these impacts. Strategies in diet formulation and feeding systems will be discussed, suggesting how today's nutritionist could make decisions toward an environment-friendly animal feed industry that supports the increasing demand for safe, sustainable, and affordable animal-sourced food for the growing population.

The Animal Feed Supply Chain and its Environmental Impacts

The world's livestock consumed 6.3 billion tons of feed (on a dry matter basis) in 2005 (Gerber et al., 2013), with ruminants consuming the bulk of feed (4.9 billion tons compared with 1.4 billion tons for pigs and poultry). Grasses and roughages comprise about 44 percent of the feed used by livestock, followed by crop residues (28 percent). Grains, by-products from processing, and other edible crops each comprised 9 percent of the feed used by the livestock sector, while swill and second-grade crops comprised 2 percent and 1 percent, respectively (Figure 1).

Figure 1

Feed Utilization by the Livestock Sector in 2005 (adapted from FAO, 2016)



Different feedstuffs are used to produce different livestock products. Most feed grain (69 percent) is fed to pigs and poultry; the rest is used in ruminant production, particularly in dairy and beef production. Fibrous feeds (grass, leaves, fodder, and crop residues) are of key importance in the diets of ruminants, which consume as much as 99 percent of fibrous feeds; the remainder is used in backyard pig production (FAO, 2016).

The structure of animal feed supply chains is diverse, ranging from simple production units or small-scale farms producing their feed or depending predominantly on local feed resources, to more complex and integrated production units where a variety of producers and industries contribute to the production, mixing, and distribution of feed ingredients and complete feed products. Feed raw material use also differs considerably among livestock production systems. Large industrial pig and chicken systems primarily use grains and other by-products from processing. In contrast, in small to medium-sized mixed livestock systems, where most ruminant livestock (73 percent) are raised, 69 percent of the animal feed supply comes from fibrous feeds (Gerber et al., 2013).

As large-scale, intensive livestock production methods have become the predominant model, animal feeds have been modified to include

include ingredients ranging from crop products and co-products from the processing and food industry to rendered animals, antibiotics, and additives. Feed also needed to be supplied more uniformly throughout the year, with its high-density nutritional content becoming the main priority. As a result, crop production and specialized feed processing plants have emerged to ensure a steady supply of high-quality feed to these large-scale livestock production units worldwide.

In 2013, the world's livestock and poultry used about 35 percent of total cropland and about 20 percent of green water for feed production (Opio et al., 2013). Feed-related greenhouse gas (GHG) emissions from the livestock sector, including those associated with land-use change, account for about 3.3 gigatons of carbon dioxide equivalent (CO2e). This represents about half of the total emissions from livestock supply chains (Gerber et al., 2013). The feed sector is aware of this, and there is a growing interest in measuring and improving the environmental performance of the feed-to-food supply chains because the demand for livestock products is projected to grow 1.3 percent per annum until 2050, driven by global population growth and increasing wealth and urbanization (Alexandratos & Bruinsma, 2012).

GHG emissions from the production, processing, and transport of feed account for about 45 percent of global livestock sector emissions in 2013 (Gerber et al., 2013). Feed production for pork and chicken supply chains contributes 47 percent and 57 percent of emissions, respectively (MacLeod et al., 2013). For cattle, small ruminants, and buffalo, feed production accounts for 36 percent, 36 percent, and 28 percent of the total emissions (Opio et al., 2013). In ruminant production systems, methane from feed digestion is the most significant contributor of GHG emissions.

Fossil carbon dioxide (CO2) and nitrous oxide (N2O) are the dominant GHGs emitted in animal feed production. The fertilization of feed crops and the deposition of manure on pastures generate substantial amounts of nitrous oxide emissions, representing about half of the emissions from feed (one-quarter of the sector's overall emissions). Carbon dioxide emissions result primarily from fossil fuels, particularly diesel in tractors and harvesting machinery, oil in dryers, and natural gas in manufacturing mineral nitrogen fertilizer. In the post-farm stages, carbon dioxide is emitted in conjunction with various feed processes and is associated with the processing, mixing, and distributing feed ingredients (FAO, 2016).

Among feed materials, grass and other fresh roughages account for about half of the emissions, mainly from manure deposition on pasture and from direct land-use change. Crops produced for feed account for an additional quarter of emissions, and all other feed materials (crop by-

products, crop residues, fishmeal, and supplements) for the remaining quarter (Gerber et al., 2013).

Feed links livestock to land use, directly via grazing and indirectly via traded feedstuffs. Global changes in how land is managed and the appropriation of natural habitats, such as forest land, have been partly driven by the need to feed animals for animal production. Global croplands for feed and pasture areas have expanded in recent decades, accompanied by significant increases in inputs, such as energy, water, and fertilizer, resulting in considerable losses of biodiversity. In addition, land use and land-use change account for many GHG emissions in animal feed production (FAO, 2016).

About one-quarter of the emissions related to the feed supply chain (about 9 percent of the livestock sector's emissions) are associated with land-use change (Gerber et al., 2013). Land-use change could result in distinct or drastic changes in land quality, such as decreased biodiversity, increased soil compaction, loss of nutrients, and impacts on water availability and quality. These quality losses constitute the ecological damage from land-use change (FAO, 2016).

Role of the Nutritionist in the Feed Supply Chain

The role of the nutritionist in feed supply chain analysis would be better understood through the flow chart showing the step-by-step approach proposed by FAO (2016) in the life cycle modelling of the feed supply chain (Figure 2).

The cultivation stage analyzes the environmental impacts of the cultivation or production system where crops or animals (and their by-products) are grown for feed production. The processing stage is the analysis of the system where the crops and animals (and their by-products) are processed before use in feed production. These products (or by-products) are often further processed as a dry, tradable feed ingredient. These processes may include purification and concentration of the feed ingredients. Products can also be further processed to increase digestibility or may involve mixing with other raw materials, originating from the same process (e.g., adding soybean hulls to soybean meal or adding molasses to the pulp) or external processes (FAO, 2016).

Compound feed production is the stage after processing. In compound feed production, many feed materials from primary production (plant, animal, and non-biogenic origin) or the processing stage are brought together in a factory to produce compound feed as a final product.

Compound feed can consist of different fractions of various feed materials. Feed materials are added based on their nutritional characteristics and the specific requirements for the animal type and its production phase. Some incoming products are treated (e.g., grinding, toasting) before mixing. After the mixing process step, the product can be pelleted or left as a meal. Emissions and resource use counted in the analysis of a compound feed production system are shown in Figure 3 (FAO, 2016).

Figure 2

FAO Recommended Flow Chart to Analyze the Feed Supply Chain (adapted from FAO, 2016)

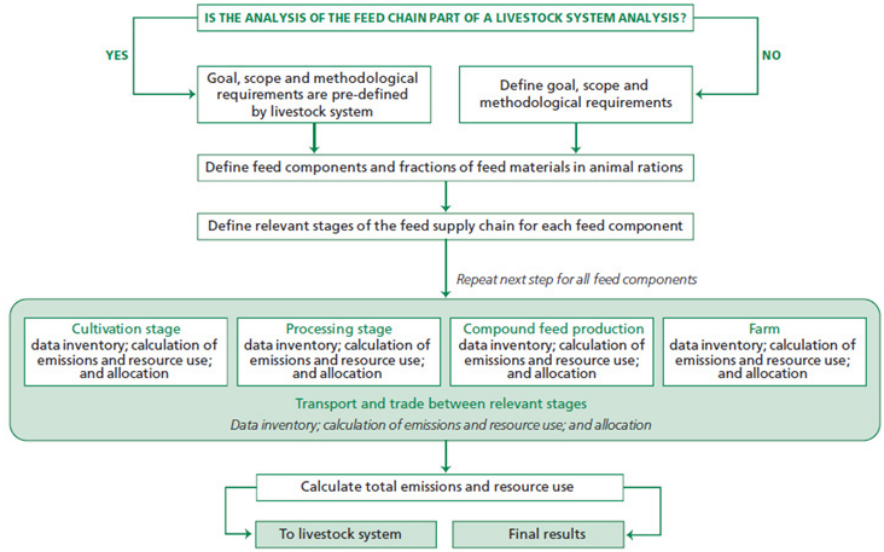
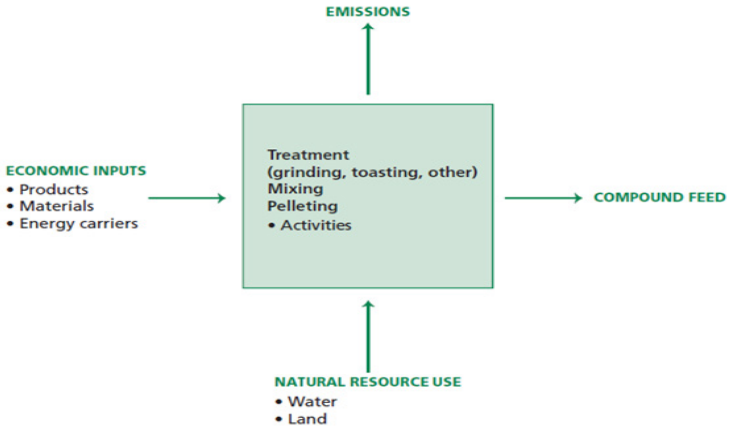


Figure 3

Emissions and Resource Use in Compound Feed Production (adapted from FAO, 2016)



A compound feed factory often produces dozens of different feed types. It is in this system where the nutritionist is a major decision-maker. Aside from deciding what products and materials from the cultivation and processing stage are to be used in feed production depending on the availability and the prices of raw materials, the nutritionist also decides on the composition of the feed types to be produced, depending on the animal's nutritional requirements, or sometimes depending on feed regulations and laws. In addition, the nutritionist may also wish to change what kind of treatment or processing activity should be done in the factory based on the animal type to be fed and the performance target. Product developments targeting better feeding performance or a bigger market could also result from product developments.

The animal on the farm is the final collection point of all feed materials. In massive industrial livestock operations, large quantities of feed are bought, produced, and stored for use at the right moment. Other feeds, such as fresh grass, are harvested and fed immediately, without storage. In the case of grazing, the feed chain ends with the product standing in the field, ready to be consumed by the animal (FAO, 2016). Unless raw feed materials are combined, manually or mechanically, to form a total mix of rations on the farm, the nutritionist has a minimal role in the farm stage of analysis (Figure 2).

Strategies to Reduce Environmental Impacts

Improving the production efficiency of crops and animals has been a significant focus for reducing environmental impacts related to livestock products because crops and animals that grow faster and produce more yield have less environmental impact (Middelaar et al., 2019). However, the best strategy to achieve efficiency rests on plant and animal geneticists who select and breed crops and animals for efficiency. On the other hand, the animal nutritionist could only improve the nutritive value of feed raw materials from crops and combine them effectively in compound feed so that the animal (when fed properly) could achieve its genetic potential—improving the quality and digestibility of feed results in reduced manure emissions and better animal performance (Gerber, et al., 2013).

This can be done in many ways, but the first is by formulation accuracy. Accuracy here is meant to be the correct estimation of the nutrient contents of raw materials used in feed production. It is not enough to use, for example, values of ileal digestible amino acids or net energy content of feedstuffs when formulating diets. What is more important is where and

how this digestible amino acid and the net energy content of feedstuffs are calculated and determined. Reliable energy and amino acid estimates require methods promoting accuracy and applicability. For example, an NE system based on a validated prediction equation is now available. It can be easily implemented from DE or ME values of feeds without the need for any further sophisticated measurement of NE values (Noblet et al., 2022). Improving the accuracy of nutrient content values of feedstuffs will result in more efficient utilization of raw materials and help produce high-quality feed.

Another way to improve the quality of animal feed is the addition of exogenous enzymes in feed formulations to improve raw material digestibility. These exogenous enzymes can also reduce nutrient excretion and the environmental impacts of pig and poultry feeding programs. For example, phosphorus excretion in manure can be reduced by adding the exogenous enzyme phytase (Madrid et al., 2013). Another such exogenous enzyme is β-mannanase. For pig feeds, β-mannanase supplementation was found to have mitigated both climate change and eutrophication impact up to 8.5 and 1.4% (45 kcal of ME/kg of feed) or up to 16.2 and 2.7% (90 kcal of ME/kg of feed) compared to control diets formulated without the enzyme. These impacts were mitigated up to 5.6 and 1.1% (45 kcal of ME/kg of feed) for broiler feeds, respectively; β-mannanase supplementation could also reduce the amount of soybean oil used in pig and broiler formulations. Soybean oil has high environmental impacts (Hickmann et al., 2021).

Related to endogenous enzymes is the increased use of by-products from arable production or the food processing industry to reduce livestock production's environmental impact. These two are related because using by-products, such as wheat bran, can only be increased significantly by adding the endogenous enzymes cellulase and xylanase. The environmental impacts related to the processing of by-products (e.g., wheat bran) are usually allocated to the main product (e.g., wheat flour), so using more by-products in the feed formula results in a lower inventory of environmental impacts (Middelaar et al., 2016).

Understanding not only the nutritional characteristics of feed raw materials but also the environmental impact of each is key in helping the nutritionist decide on how to effectively combine raw materials to result in a high-quality feed with less environmental impact. Several life-cycle inventory (LCI) databases for feed are now available online: Agri-footprint, EC Feed LCI database, GFLI database, and Feedprint NL/International, to name a few. Nutritionists may use these databases in combination with feed optimization software to ensure that nutritional and economic requirements

are fulfilled, while aiming for a reduced environmental impact (Middelaar et al., 2019).

This methodology of formulating diets using LCI databases to consider both the cost and environmental impacts of the resulting compound feed is called multi-objective (MO) feed formulation. In 2018, Garcia-Launay et al. investigated how MO formulation could effectively reduce the environmental impacts of feed. MO-formulated feeds had lower (−2 to −48 %) environmental impacts in all feed formulations for pig, broiler, and young bulls studied than baseline feeds. They concluded, however, that the ultimate potential for this method to mitigate environmental impacts is probably lower than this, as animal feed supply chains may compete for the same low-impact feed ingredients. This method may only complement other strategies, and ways to optimize the entire animal production system should be explored to decrease the associated impacts substantially.

Another strategy worth mentioning in this review is precision feeding. Several studies have been done by Andretta et al. (2016, 2018, and 2021) to show how precision feeding programs in pig production can be another strategy to decrease environmental impacts. This innovative feeding system, however, is not done by the nutritionist at the feed factory but at the farm. Precision animal nutrition or precision livestock feeding involves the use of feeding techniques that allow the proper amount of feed with the suitable composition to be supplied promptly to a group of animals (Parsons et al., 2007; Cangar et al., 2008; Niemi et al., 2010) or to individual animals in a group optimizing the use of dietary nutrients which results in less nutrient excretion. The practical application of precision livestock feeding to improve profitability was studied first, before its ability to reduce emissions. The on-farm application of precision livestock feeding, however, requires the design and development of measuring devices (e.g., to determine the animal's feed intake and weight), computational methods (e.g., estimating promptly nutrient requirements based on the actual animal's growth), and feeding systems capable of providing the required amount and composition of feeds that will generate the desired production trajectory (Pomar, et al., 2019). Thus, precision feeding could be challenging even in the most modern livestock facilities.

Choice feeding, which allows animals to choose and regulate their feed intake between diets differing in nutrient density, has been around for more than 25 years and could offer some potential in reducing emissions in livestock systems. Recently, Pichler et al. (2020) revisited choice feeding and studied its effect on the feeding behavior and fattening performance of pigs. For pigs offered a choice, they observed that the ratio between a

low nutrient density (LND) feed and a high nutrient density (HND) feed consumed by growing pigs changed during the growing period toward a higher percentage of HND. No difference in growth performance between pigs and those not given a choice was observed. They concluded that pigs of modern genetics can still cover their nutrient requirements by choosing between diets differing in nutrient density without impairing performance. It would be interesting to know if emissions (in manure) from pigs on choice feeding and those without would differ.

Conclusion

The global feed supply chain is vast and complex, and its contribution to global emissions can be reduced only by changing practices in all stages of the supply chain system. Although the nutritionist is at the compound feed production stage, several strategies can be taken to reduce the environmental impact of feed production. Decisions made by nutritionists today could pave the way for a more environmentally friendly animal feed industry in the future.

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Antibacterial Activity of Epidermal Mucus from Scarus Species

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Abstract

The antibacterial activities of epidermal mucus in crude extract from *Scarus dimidiatus, Scarus bleekeri,* and *Scarus forsteni* against three pathogenic bacteria (*Escherichia coli, Pseudomonas aeruginosa,* and *Staphylococcus aureus*) were tested by determining the zone of inhibition and Minimum Inhibitory Concentration (MIC). Stock cultures of the microorganisms were sub-cultured and inoculated into Mueller Hinton Agar plates with mucus-impregnated filter paper. The diameter of each zone of inhibition was measured after 16-18 hours of incubation. Gram Staining was also performed, and bacterial cultures were diluted into 4-fold steps. A total of 0.2 ml of mucus was inoculated into Mueller-Hinton Broth to determine the MIC. Test for significance of difference demonstrated that S. forsteni exhibited the largest average zones of inhibition, followed by *S. dimidiatus* and *S. bleekeri. P. aeruginosa* was the most susceptible to fish mucus, followed by *E. coli* and *S. aureus*. Gram staining results suggest that the three bacteria were successfully inhibited, but the bacteria intrinsically present in fish mucus were not. None of the tubes turned clear for the measurement of the MIC. The turbidity observed was most likely due to 1) the presence of other bacteria inherently present, 2) the mucus used was not purified, and 3) the mucus was already turbid. With these findings, it can be concluded that the epidermal mucus of *S. dimidiatus, S. bleekeri,* and *S. forsteni* inhibits the growth of *E. coli, P. aeruginosa,* and *S. aureus* and thus plays an important role in fish against invading pathogens.

Keywords: Antibacterial, Fish epidermal mucus, Parrotfish

Introduction

Changes in the environment over the past years may be attributed to the growing trend of industrialization and urbanization in global communities and the accumulation of waste products due to the

commercialization of society (Denamur & Matic, 2006). These particular human activities cause an increase in the number of disease-causing pathogens and the incidence of mutations in such organisms affecting flora, fauna, and most notably, human life (World Health Organization, 2012). As a result, there is a continuing need to develop more drugs that could specifically target these pathogens and their mutant forms (Schunk et al., 2006).

Commercial pharmaceutical companies are continually involved in the development of new drugs. Although these new drugs have proven their efficiency in inhibiting the growth of common disease-causing pathogens (Denamur & Matic, 2006), these drugs are often priced in a way that the general Filipino public would find expensive.

To address this problem, non-profit and government-based medical research institutions worldwide are conducting studies involving sustainable and cheap sources of alternative medicine (particularly antimicrobials) and their practicability. One of the most sought-after topics in scientific research today is finding a sustainable source of drugs for treating disease-causing pathogens and other diseases that have no known cure yet. By the word sustainable, it means organic and ecological. Most, if not all, sustainable sources utilized by research today are plant and animal sources. Marine life is one.

In fish, the epidermal mucus is one of the key components of innate immunity. Previous studies (Kimbrell & Beutler, 2001) have shown that mucus secreted by fish significantly inhibits parasite, bacteria, and fungi colonization (Kuppulakshmi et al., 2008).

Epidermal mucus is characterized by a slimy and clear fluid layer free from protozoa, fungi, or other viable cells. Previous studies have shown that mucus secreted from fish play a significant part in the inhibition of parasite, gram positive and gram negative bacteria (al Arifa et al., 2011), and fungi colonization (Kuppulakshmi et al., 2008), suggesting their possible contribution to the advancement of therapeutic medicine (Haniffa et al., 2009). In a study by Loganathan et al. (2011), the collection of fish mucus samples in Clarias batrachus (in a saline medium) showed a significant activity against both the Gram-positive and Gram-negative bacteria. In another study by Kuppulakshmi et al. (2008), strong inhibition against the growth of tested bacteria was observed using Channa punctatus and Cirrhinus mrigala mucus extract.

One locally thriving fish in the Philippines is the Parrotfish, usually found in shallow reefs. There are approximately 34 Parrotfish species in the Philippines, three of which are Scarus dimidiatus, Scarus bleekeri, and

Scarus forsteni (Broad, 2003). Although studies are available on the antibacterial activity of some fish, to date, no studies have been done on parrotfish yet. Hence, in the present study, the antibacterial activities of fish epidermal mucus isolated from Scarus dimidiatus, Scarus bleekeri, and Scarus forsteni against three pathogenic bacteria, viz., Escherichia coli, Pseudomonas aeruginosa, and Staphylococcus aureus, are investigated.

Materials and Methods

A. Pre-Data Collection

The fish samples were collected from a local market in Dumaguete City. The fish were then selected through convenience sampling, taking note of their species. Pictures of the selected Parrotfish were then sent to the Silliman University Marine Laboratory to identify and confirm the species.

B. Collection of Mucus and Preparation of Crude Extract

Following the procedure of Kuppulakshmi et. al. (2008), the mucus was collected through careful scraping of the dorsal body of the fish using a sterile wire loop. Care was taken in the collection process such that the ventral side of the fish did not come in contact with the spatula to avoid intestinal and sperm contamination. The collected mucus was then pooled, brought to the laboratory, and refrigerated at 40 °C to preserve its freshness and prevent bacterial growth and degradation.

After thawing the refrigerated samples, crude extract and pure fish mucus were prepared by centrifuging at 5000 rpm for 10 minutes. The supernatant obtained was then stored in a refrigerator at 4 °C as recommended in the study of Ong Yeong Wei et al. (2010).

C. Culture of *Escherichia coli, Pseudomonas aeruginosa* and *Staphylococcus aureus* and Impregnation of Mucus Samples

Stock cultures of the test microorganisms were subcultured into Nutrient Agar tubes. The freshly-prepared suspensions, which will be used as inocula, were exponentially grown from these overnight tube cultures. Five to eight colonies of the organism from the freshly-prepared suspensions were transferred into test tubes containing Trypticase Soy Broth. The tubes were then incubated for 2-4 hours at 37 0C. The densities of the inocula for the three cultured bacteria were compared to that of a standard (0.5%

MacFarland's Standard). Having the same turbidity as MacFarland's Standard, swabs saturated with the inocula were inoculated into Mueller-Hinton Agar plates using the multiple overlap streaking method, leaving no area of the plates unswabbed. Mahon, Lehman, and Manuselis adopted this method.

The plates inoculated with the bacteria were then placed with sterilized circle-shaped mucus-impregnated filter paper discs using sterile forceps. The discs were placed on the agar, 10 mm apart, and were immediately covered and incubated for 16-18 hours at 370C under aerobic conditions. The same method was also done for the positive control using Ampicillin, Penicillin, and Gentamicin for *E. coli, S. aureus,* and *P. aeruginosa*, respectively (Loganathan et al., 2011) as well as the negative control. Replication was done three times for each sample to ensure the results' validity and reliability. All plates were incubated for 16-18 hours at 37 0C under aerobic conditions.

D. Measurement of the Zone of Inhibition and Gram Staining

After 16-18 hours of incubation, the diameter of each zone of inhibition for each filter paper in each plate was measured. The plates were placed a few inches above a black, non-reflecting surface, and the zones were examined from the back side (where the agar is) of the plate, illuminated with reflected light.

Gram staining was immediately performed after measuring the zones of inhibition. Three drops of sterile water were placed on the slide. Inoculating a small amount of bacterial growth from the plate was performed by slightly touching the colony's surface, which was then emulsified into sterile water. After which, the smear was air-dried by passing the slide rapidly over the flame with the smear side up 2-3 times. The Gram Staining procedure was adapted from the book *Diagnostic Microbiology* by Mahon et al. (2010).

E. Measurement of Minimum Inhibitory Concentration (MIC)

Freshly-prepared suspensions were again obtained from overnight culture tubes and were transferred into test tubes containing Mueller-Hinton Broth. The concentration of the bacterial suspension was adjusted to 108 colony-forming units (108 CFU/mL) in Mueller Hinton Broth (Ong et al., 2010). Again, for visual comparison, a 0.5% McFarland standard was utilized (ESCMID, 2000). The tubes containing the cultured bacteria inoculated with 108 CFU/mL were diluted in 4-fold steps. With each successive dilution, the concentration was reduced by half.

In determining MIC for this particular study, 0.2 mL of the crude mucus treatment was delivered into the tubes as indicated in Subramanian, Ross, and Mackinnon's study and incubated at room temperature for 16 to 18 hours. The test tubes in the series were examined for growth by observing the clarity or turbidity of the broth.

Table 1

Antibacterial Activity of the Mucus of Three Species of Parrotfish against Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus, and Positive and Negative Controls as Measured in Zone of Inhibition (mm)

Treatment	Average Zone of Inhibition (mm)		
	Escherichia coli	*Pseudomonas aeruginosa*	*Staphylococcus aureus*
Scarus dimidiatus	18.67	20.67	15.33
Scarus bleekeri	18.00	17.67	11.33
Scarus forsteni	21.67	22.67	17.33
Positive Control (Ampicillin)	17.62		-
Positive control (Gentamicin)	-	23.33	-
Positive Control (Penicillin)	-	-	27.33
Negative Control	0	0	0

Results

A. Zone of Inhibition

Table 1 shows the zone of inhibition for each species of Parrotfish, for each bacterium, and for positive and negative controls after 16-18 hours of incubation. The mucus from all three Parrotfish species inhibited the growth of the three bacteria. Based on the data, S. forsteni recorded the largest zone of inhibition against all bacteria among the three fish species. Among the three bacteria, it is most potent against *P. aeruginosa.*

In addition, *S. dimidiatus* recorded the largest zone of inhibition in *P. aeruginosa,* while *S. bleekeri* recorded the largest zone of inhibition in *E. coli.* It is also noteworthy that for *E. coli,* all three species of Parrotfish yielded a zone of inhibition larger than the positive control (Ampicillin).

A test for the significance of the difference was also performed to assess whether there is a difference in the potency of epidermal mucus in bacterial growth inhibition among the three species of Parrotfish and three bacteria.

Table 2

Test for the Significance of the Difference in the Isolated Fish Epidermal Mucus

Source of Variation or Difference	f-test statistics			Interpretation (α= 0.05)
	f-computed	f-tabular	p-value	
Different species of Parrotfish	57.126	3.008	0.000	Significant
Different types of bacteria	56.736	3.403	0.000	Significant
Interaction (Antibacterial Activity)	17.088	2.508	0.000	Significant

Table 2 shows that there is a significant difference in the zone of inhibition of the isolated epidermal mucus among the three species of Parrotfish. The positive control made the largest zone of inhibition, followed by *S. forsteni, S. dimidiatus*, and *S. bleekeri*. The data also suggest that S. forsteni collectively has the same ability as the positive control regarding bacterial inhibition, while *S. dimidiatus* and *S. bleekeri* are also comparatively the same.

The same table also showed that there is a significant difference in the zone of inhibition of the isolated epidermal mucus among the three types of bacteria. P. aeruginosa was the most susceptible to the epidermal mucus, followed by E. coli and S. aureus. A significant interaction (antibacterial activity) was observed between the different species of Parrotfish and the different types of bacteria. Table 1 shows that Penicillin had the highest antibacterial activity in the positive control against S. aureus. On the other hand, the lowest antibacterial activity was seen in *S. bleekeri* against *P. aeruginosa.*

Finally, data for Duncan's Multiple Range Test at a 0.05 significance level is shown in Table 3. The results imply no significant difference in the inhibition zones among the first three combinations and combinations four to seven.

Table 3

Ranking of Zones of Inhibition as a Result of the Interaction of Crude Mucus Collected from Different Species of Parrotfish against Different Types of Bacteria

Combination of Parrotfish species and Type of Bacteria	Zone of Inhibition (Mean)	Rank
1. Scarus forsteni & Staphylococcus aureus	22.6667	2.0
2. Scarus forsteni & Escherichia coli	21.6667	2.0
3. Scarus dimidiatus & Staphylococcus aureus	20.6667	2.0
4. Scarus dimidiatus & Escherichia coli	18.6667	5.5
5. Scarus bleekeri & Escherichia coli	18.0000	5.5
6 Scarus bleekeri & Staphylococcus aureus	17.6667	5.5
7. Scarus forsteni & Pseudomonas aeruginosa	17.3333	5.5
8. Scarus dimidiatus & Pseudomonas aeruginosa	15.3333	8.0
9. Scarus bleekeri & Pseudomonas aeruginosa	11.3333	9.0

B. Gram Staining

Gram staining was performed to assess whether other bacteria, besides those tested, were inherently present in fish mucus. This was done after the zones of inhibition observed were not completely clear and translucent, which may imply that the bacteria were not completely inhibited. Table 4 shows the Gram staining results after 16-18 hours of incubation.

Table 4

Gram Staining Results of Antimicrobial-impregnated Discs of the Different Species of Parrotfish Measured in Terms of Zone of Inhibition against the Different Bacteria

Fish Species	Gram Stain Reaction		
	Escherichia coli	*Pseudomonas aeruginosa*	*Staphylococcus aureus*
Scarus dimidiatus	Gram positive rods	Gram positive rods	Gram positive rods
Scarus bleekeri	Gram positive cocci	Gram positive cocci	Gram positive rods
Scarus forsteni	Gram negative rods Gram positive cocci	Gram positive rods	Gram positive rods

C. Minimum Inhibitory Concentration

The measurement for the MIC was done right after Gram Staining. After the entire procedure, none of the tubes were clear after 16-18 hours of incubation.

Discussion

Epidermal mucus is found on the epithelial surface layer of fish. It acts as a physical and chemical barrier (Floyd, 2009). Antimicrobial compounds, incessantly secreted and cast off the skin of fish through its mucus (Ellis, 2001), are usually produced by the granular glands of amphibians and are linked with and diffused from the epithelial mucus-secreting cells of fish (Kuppuulakshmi et al., 2008).

The number of mucus-producing cells in the epidermal and epithelial layers, the exposure of fish to disease-causing microorganisms, and environmental agitation influence the amount of mucus produced among different fish species (Subramanian et al., 2008). The quantity of mucus secreted in different fish species has been found to play a part in the fish's vulnerability to certain infections. Fish with fewer or no scales produced more elevated amounts of epidermal mucus than fish with scales (Pickering, 1974). Moreover, the biochemical substances found in mucus differed depending on the ecological and physiological conditions where the

fish are found (Subramanian et al., 2008).

Epidermal mucus specifically contains specific and non-specific antimicrobial compounds and complement factors. These lysozymes degrade bacterial cell walls (Rakers et al., 2010), proteases, C-reactive protein, lectin-like molecules, agglutins, and glycoproteins (Caipang et al., 2011).

In addition, peptides and proteins in fish mucus exhibit a broad spectrum of antimicrobial activities against various fish and human pathogens (Gobinath et al., 2011). Peptides are thought to employ different strategies: fatal depolarization of the cell membrane, formation of pores, and subsequent leakage of the cell contents and damage of critical intracellular targets after internalization of the peptide (Balasubramanian et al., 2011).

The present study tested the antibacterial activity of epidermal mucus secreted by S. forsteni, S. dimidiatus, and S. bleekeri in crude extract against three common human pathogens-- *E. coli, P. aeruginosa*, and *S. aureus*. Based on the data obtained, *S. forsteni* recorded the largest zone of inhibition against all bacteria among the three fish species. Among the three bacteria, it is most potent against *P. aeruginosa.*

In a study by Loganathan et al. (2011) on the role of mucus from *Clarias batrachus* against selected microbes, *P. aeruginosa* was also observed to have the largest zone of inhibition, which was about 25 mm in diameter, when compared to other bacteria such as *Aeromonas hydrophila, Vibrio anguillarum, Vibrio fischeri,* and *Escherichia coli.* Similar findings have also been reported by Dhanaraj et al. (2009), wherein the maximum antibacterial activity (largest zone of inhibition) was observed in the intestinal mucus of all five *Channa spp.* against *P. aeruginosa.* According to Mahon et al. (2010), *P. aeruginosa* is ubiquitous in soil and water, on surfaces in contact with soil or water, and rarely found in the human microbiota. This explains why *P. Aeruginosa* exhibits the largest zone of inhibition because it more often comes in contact with fish and other marine fauna than the other bacteria in this study, thus increasing the fish mucus' resistance against it.

In addition, *S. dimidiatus* recorded the largest zone of inhibition in P. aeruginosa, while S. bleekeri recorded the largest zone of inhibition in E. coli. According to Loganathan et al. (2011), the cells that produce mucus in epithelial and epidermal layers have been reported to vary between fish species and therefore could influence mucus composition. The biochemical substances of mucus have been proven to vary depending on the physiological and ecological conditions such as pH, salinity, handling stress, and stages of growth and maturity.

The results for Duncan's Multiple Range Test at the 0.05 level of significance imply no significant difference in the inhibition zones among

the first three combinations and combinations four to seven. This is consistent with the findings in a study by Loganathan et al. (2011) wherein the mucus collected from *Clarias batrachus* showed a significant activity regarding the Gram-positive and Gram-negative bacteria.

As for Gram staining, the results generally suggest that the three bacteria in this study were successfully inhibited by fish mucus. However, the other bacteria present, which are contaminants intrinsically present in fish mucus, were not. Although the findings in a study by Loganathan et al. (2011) showed a significant activity with regards to Gram positive as well as Gram negative bacteria, the bacteria which are intrinsically present in fish mucus may serve as normal flora i.e., non-pathogenic to the fish, therefore the antibacterial properties found in fish mucus are not bactericidal to these particular bacteria. Examples of normal flora found in fish are *Bacillus spp*.— a Gram--positive rod, *Streptococcus spp*.— a Gram positive cocci (Olojo et al., 2002), *Enterobacter aerogenes*— a Gram-negative rod, and *Aeromonas hydrophila*— also a Gram-negative rod.

As for the minimum inhibitory concentration, the turbidity observed in all the tubes are most likely due to 1) the presence of other bacteria inherently present in fish mucus as was seen during Gram staining, 2) the fish mucus used was not purified therefore increasing the likelihood of contaminants; and 3) the fish mucus in itself was already turbid.

In other studies, acidic, aqueous, and organic extracts were also used apart from the crude extract utilized in the present study. However, only the acidic extracts were found to have a broad range of activity against the pathogens. All the other extracts, i.e., crude and organic, proved otherwise. The results of the present study showed that the epidermal mucus of Scarus dimidiatus, *Scarus bleekeri*, and *Scarus forsteni* inhibits the growth of three pathogenic bacteria-- *Escherichia coli, Pseudomonas aeruginosa*, and *Staphylococcus aureus,* and thus plays an important role in fish against invading pathogens. The results imply that fish mucus could thus be regarded as an alternative antibacterial agent against common pathogens such as the three bacteria tested in this study.

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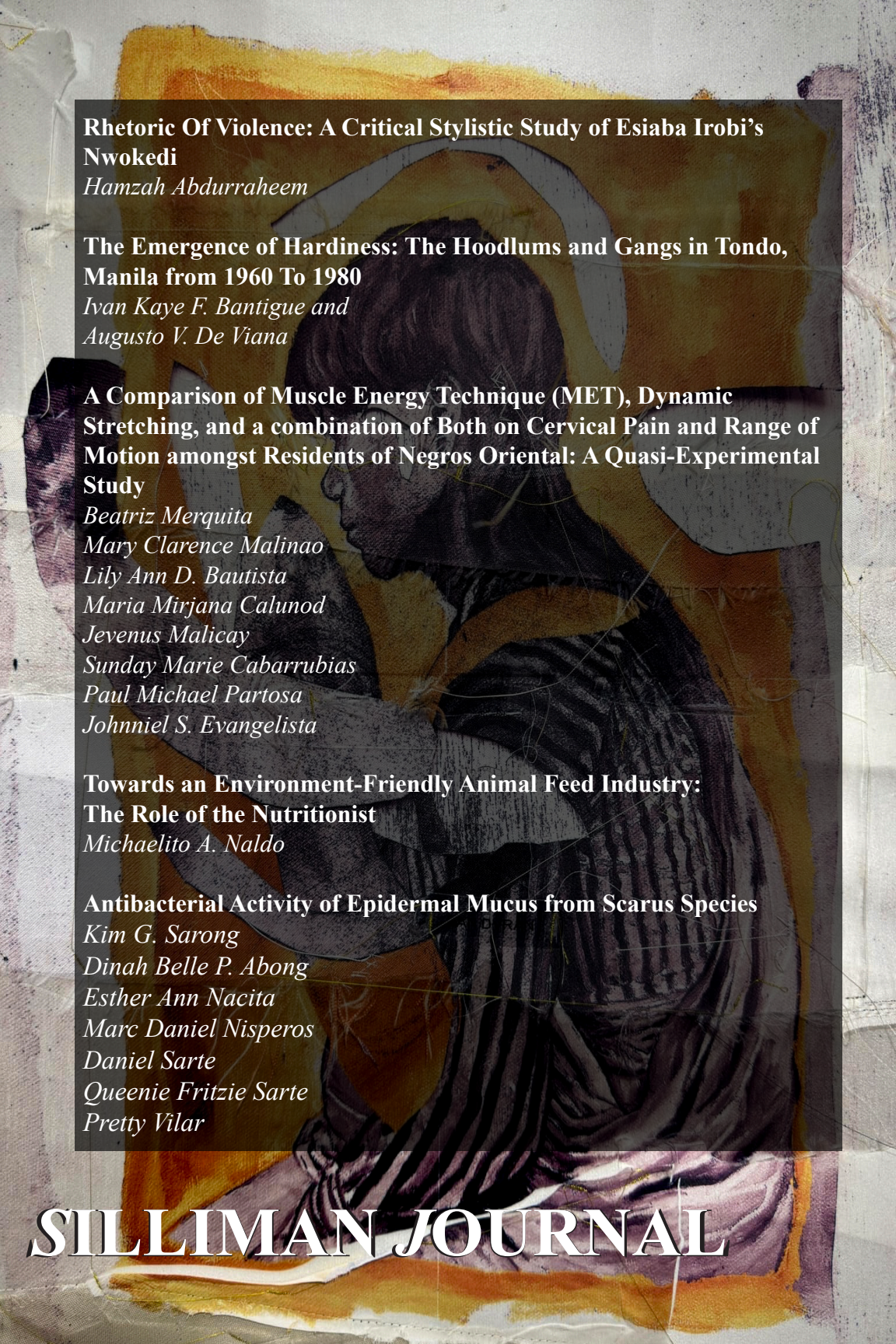

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