



MINISTRY OF HEALTH  
MALAYSIA

# NUTRITION

## RESEARCH PRIORITIES IN MALAYSIA

FOR 12<sup>TH</sup> MALAYSIA PLAN  
(2021-2025)



TECHNICAL WORKING GROUP ON NUTRITION RESEARCH  
NATIONAL COORDINATING COMMITTEE ON  
FOOD AND NUTRITION  
MINISTRY OF HEALTH MALAYSIA

**NRP**





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2020

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The documentation of the Nutrition Research Priorities (NRP) in Malaysia for the 12<sup>th</sup> Malaysia Plan (2021-2025) was coordinated by the Technical Working Group (TWG) on Nutrition Research, which is under the purview of the National Coordinating Committee on Food and Nutrition (NCCFN), Ministry of Health Malaysia. The Nutrition Division, Ministry of Health Malaysia served as the secretariat for the NRP.

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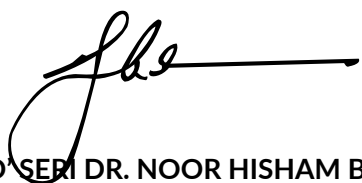
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## FOREWORD BY DIRECTOR-GENERAL OF HEALTH MALAYSIA

Malaysia is currently facing the burden of both communicable and non-communicable diseases apart from double burden of malnutrition. This situation is aggravated by the COVID-19 pandemic which has gone beyond the health crisis. This pandemic has caused huge negative impacts not only to the global but also to the local food system, nutrition, economic disruptions and psychological distress. Thus, further researches on this area need to be further explored and conducted to identify the extent of the problems.

Since 2009, the Nutrition Research Priorities (NRP) have been systematically formulated to address the gap of nutrition evidence in the country. Updating the National NRP is indeed timely. It is my fervent hope that this document will continue to facilitate the researchers and funders in prioritising nutrition research for more effective allocation of resources in producing high quality evidence in the country.

I am also pleased that this document has been successfully produced from the commendable efforts of the experts from various ministries, universities, and all related agencies. I would therefore like to congratulate the Technical Working Group of Nutrition Research, under the purview of National Coordinating Committee for Food and Nutrition (NCCFN) Ministry of Health, Malaysia, on their success of publishing "Nutrition Research Priorities in Malaysia for 12<sup>th</sup> MP (2021-2025)".



**TAN SRI DATO' SERI DR. NOOR HISHAM BIN ABDULLAH**  
Director-General of Health Malaysia  
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## FOREWORD BY DEPUTY DIRECTOR-GENERAL OF HEALTH (PUBLIC HEALTH)

First and foremost, I would like to express my heartfelt congratulation to the Technical Working Group of Nutrition Research, especially the Nutrition Research Priorities Technical Committee for a successful publication of the Nutrition Research Priorities (NRP) in Malaysia, for 12<sup>th</sup> Malaysia Plan (2021-2025) document. I would also like to extend my warm appreciation to all the experts and representatives from all the relevant ministries, universities, institutions and organisations who have contributed directly or indirectly towards the publication of this document.

The establishment of this NRP under the Facilitating Strategies of National Plan of Action Nutrition of Malaysia (NPNAM) III, 2016-2025, which is “Strengthening Food and Nutrition Research and Development”, will give a clear direction of nutrition research in the country. Thus, I hope this NRP will continue to serve as a key reference in prioritising nutrition research for more effective implementation and evaluation of nutrition programmes in the country. I am also glad to see that all the identified seven research priority areas are within the public health concern of our country.

Last but not least, I sincerely hope that this document can be a useful guide especially for the researchers, policy makers, funding agencies and other stakeholders. It is also hoped that this NRP is beneficial in planning and designing more effective future nutrition research.



**DATUK DR. CHONG CHEE KHEONG**

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## FOREWORD BY CHAIRPERSON OF TECHNICAL WORKING GROUP ON NUTRITION RESEARCH

On behalf of the Technical Working Group of Nutrition Research, I would like to express my utmost appreciation to all committee members of the Nutrition Research Priorities Technical Committee 2020 for their hard work towards the successful completion and publication of this precious "Nutrition Research Priorities in Malaysia for 12<sup>th</sup> MP (2021-2025)". The commendable efforts and the valuable contributions from those who have directly or indirectly involved in making this document a success are greatly acknowledged.

This NRP (2021-2025) is the continuation of the two previously published NRP and it is projected based on the national needs as outlined in NPANM III (2016-2025). One of the main Term of References of the Technical Working Group on Nutrition Research is to identify research priorities in nutrition for the country. Hence, I really hope that the document will ensure that nutrition research will be supported and carried out in Malaysia according to the priorities, taking into consideration of current nutrition situation and needs, especially in Malaysian context.

Last but not least, I would like to thank once again for the efforts and commitments given by all parties involved, starting from the publication of this document until it is being utilized in the next 5 years. May this publication benefit everyone who is involved in nutrition research in Malaysia.



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## EXECUTIVE SUMMARY

### Nutrition Research Priorities in Malaysia for the 12<sup>th</sup> Malaysia Plan (2021-2025)

The overall purpose of this report therefore is to define a framework through which available technical, human, and financial resources may be mobilized to ensure the nutrition status of Malaysians is significantly improved through evidence-based nutrition research. In order to turn the evidence into action, guiding principles for action are defined, and a series of strategies are organised into seven research priorities themes and objectives.

Optimal nutrition is essential for health and sustainable development of human throughout the entire life span. Malaysia is undergoing nutrition and health transition which is due to rapid industrialisation and urbanisation. Nutrition-related health conditions, including double burden of malnutrition and non-communicable chronic diseases still affect most of the Malaysia populations. In the long term, these nutritional situations may eventually affect the livelihood, productivity and economy of the country. Therefore, improving health and nutritional well-being of Malaysians continues to be one of the strategic thrusts of the 12<sup>th</sup> Malaysia Plan (2021-2025). Furthermore, improving the health and nutrition status of the Malaysian population is one of the priorities for the government, and is vital to its development in line with the Sustainable Development Goals (SDGs) of 2030.

To achieve the strategy of the 12<sup>th</sup> Malaysia Plan, “strengthening the food and nutrition research and development” is an important element for the implementation and evaluation of evidence based and effective nutrition programmes in Malaysia. This is in line with the facilitating strategies of the National Plan of Action for Nutrition of Malaysia (NPANM) III (2016-2025). Since 2011, the Nutrition Research Priorities (NRP) was systematically developed by the Ministry of Health Malaysia through Technical Working Group (TWGs) on Nutrition Research. The NRP (2021-2025) is the sequels of the NRP (2016-2020), whose advancement is projected based on the national needs as described in NPANM III (2016-2025). Generally, all the research and development activities proposed in the NRP (2021-2025) highlighted the critical gaps in nutrition related knowledge and evidence, and the issues/ innovative approaches that warrant further research, especially in the Malaysian context. The valuable information and evidence would be useful to optimise time, effort and resources for policy makers to draw up and make informed decision on new policies, and for individuals or related organisations (i.e. Ministry of Agriculture and Food Industries, Ministry of Education, universities and students, and food and beverages industries) to design and shape their future research.

The NRP (2021-2025) for the 12<sup>th</sup> Malaysia Plan is developed by a team of experts from universities, ministries and related agencies on food, nutrition and health research. After several meetings, seven high priority areas were identified (Table Executive\_1: NRP areas purposes and scopes). These 7 NRP areas are considered equally important in terms of meeting the national needs for further information and data/ evidence required for improving the health and nutritional well-being of Malaysian. Ranking according to order of priority is only made for the suggested topics within each NRP area.

**Table Executive\_1: NRP areas, purposes and scopes**

No.	Research priority area*	Research purpose	Research scope
1.	Maternal, infant and young child nutrition	A. To assess the effect of maternal nutrition on birth and health outcomes	<p>A 1. Maternal nutrition/ nutritional status and its outcome to mothers, infants and young children</p> <p>A 2. Maternal gestational weight gain and outcome to mothers, birth, infants and young children</p> <p>A 3. Maternal gestational diabetes mellitus and outcome to mothers, infants and young children</p>
		B. To determine nutritional status of infants and young children	<p>B 1. The impact of IYC nutritional status on growth and development</p> <p>B 2. The impact of feeding practices and dietary adequacy on IYC nutritional status and health outcomes</p> <p>B 3. IYC feeding practices of children with special needs and marginalised groups (single mothers, homeless, hard-core and urban poor)</p> <p>B 4. The impact of parental lifestyle on birth and infant outcomes</p>
		C. To strengthen implementation/ service delivery	<p>C 1. Evaluation of current strategies/ programmes/ policies for mothers</p> <p>C 2. Evaluation of current strategies/ programmes/ policies for infants and young children</p>
		D. To develop and strengthen strategies/ programmes/ policies on maternal, infant and young child nutrition	<p>D 1. Development of strategies/ programmes/ policies on maternal and IYC nutrition</p> <p>D 2. Evaluation of strategies/ programmes/ policies on maternal, infant and young child nutrition</p>
2.	National food and nutrition situation	A. To determine and monitor national food and nutrition situation regularly	A 1. Regular national surveys for monitoring global and national nutrition indicators

No.	Research priority area*	Research purpose	Research scope
			<p>A 2. Food and nutrition security among vulnerable groups</p> <p>A 3. Incorporation of nutrition components into national studies conducted by other agencies</p> <p>A 4. Determination of national foods and nutrition transition over time</p> <p>A 5. Strengthening methods for population-based assessment of nutritional status/ biomarkers</p>
		B. To strengthen evaluation of the existing national food and nutrition programmes	<p>B 1. Evaluation on the existing national nutrition programmes of Ministry of Health (MOH)</p> <p>B 2. Evaluation on the existing national nutrition programmes by other ministries</p> <p>B 3. Evaluation on the existing national nutrition programmes for private sectors</p>
		C. To identify determinants, causes and outcomes of food and nutrition security status	<p>C 1. Determination of the factors/ causes affecting food and nutrition security status</p> <p>C 2. Determination of the outcome/ impact of food and nutrition security</p> <p>C 3. Assessment on the impact of pandemic outbreaks/ disaster on food security and nutritional status</p>
3.	Life course approach to food intake and dietary practices	A. To identify the determinants of food intake and dietary practices of various age groups	<p>A 1. Effects of personal and environmental factors on food intake</p> <p>A 2. Effects of personal and environmental factors on dietary practices</p>
		B. To determine the health outcomes of food intake and dietary practices of various age groups	B 1. Effects of food intake and dietary practices on physical, mental and social well-being
		C. To develop effective strategies/ interventions to improve diet quantity and quality of various age group	C 1. Identification/ development of effective strategies/ interventions to improve diet quantity and quality

No.	Research priority area*	Research purpose	Research scope
			C 2. Strengthening of existing strategies/ interventions to improve diet quantity and quality
		D. To improve the assessment methodology of food intake and dietary practices	D 1. Improvement in methods/ tools/ instruments for assessment of food Intake  D 2. Improvement in assessment tools/ instruments of dietary practices
4.	Nutritional deficiencies and excesses	A. To develop and strengthen epidemiological and clinical understanding	A 1. Association between macronutrient status with health outcomes  A 2. Association between micronutrient status with health outcomes
		B. To develop and evaluate appropriate studies and intervention strategies	B 1. Development of studies to determine macronutrient and micronutrient status of all age groups  B 2. Evaluation on the current intervention to improve macronutrient and micronutrient status  B 3. Conduct new intervention to improve macronutrient and micronutrient status
5.	Overweight and obesity	A. To improve understanding on the epidemiology of obesity	A 1. Relationship between WC, waist-hip ratio (WHR), waist-height ratio (WHtR), and BMI on NCDs  A 2. Relationship between adiposity and NCDs risk factors  A 3. The impact of early nutrition on development of adult obesity  A 4. The impact of obesity on social and economic cost  A 5. Association of dietary intake, appetite control, eating behaviour and inflammatory status with obesity  A 6. Determination of socio-cultural factors influencing obesity



No.	Research priority area*	Research purpose	Research scope
			<p>A 7. Effect of metabolic predisposition to onset of obesity</p> <p>A 8. Association between physical inactivity, sedentary lifestyle and obesity</p> <p>A 9. Determination of genetic factors influencing development of overweight and obesity</p> <p>A 10. Obesity and COVID-19</p>
		B. To improve effectiveness of intervention and management of obesity	<p>B 1. Development and evaluation of obesity prevention and intervention programmes</p> <p>B 2. Development and evaluation of obesity management programmes</p> <p>B 3. The impact of policies and environment (food and physical activity) on obesity</p>
		C. To develop new modalities	<p>C 1. Identification of new methods to define obesity</p> <p>C 2. Identification of novel strategies to prevent and manage obesity</p>
6.	Diet-related non-communicable diseases	A. To strengthen understanding of aetiology of diet-related non-communicable diseases (NCDs)	<p>A 1. Consolidation of aetiological data of diet-related NCDs risk and control</p> <p>A 2. Role of nutritional genomics and metabolomics in diet-related NCDs risk and control</p> <p>A 3. Association of diet and lifestyle factors in relation to diet-related NCDs risk and control</p> <p>A 4. Behavioural nutrition issues related to diet-related NCDs risk and control</p> <p>A 5. Social and environmental factors in association with diet-related NCDs risk and control</p>

No.	Research priority area*	Research purpose	Research scope
		B. To develop and evaluate appropriate nutritional intervention strategies	<p>B 1. Consolidation of interventional data related to prevention and control of diet-related NCDs</p> <p>B 2. Development of novel and innovative diet and lifestyle intervention specific to age groups for prevention and control of diet-related NCDs</p> <p>B 3. Development of new nutritional products for prevention and control of diet-related NCDs.</p>
		C. To enhance nutritional care delivery system	<p>C 1. Evaluation of nutritional care delivery system for prevention and management of diet-related NCDs</p> <p>C 2. Monitoring and benchmarking nutrition policies to improve outcomes of diet-related NCDs risk and control</p>
7.	Nutrient and non-nutrient composition of foods	A. To enhance nutrient data in combatting nutrition related diseases	<p>A 1. Analysis of macro and micronutrients in foods</p> <p>A 2. Collation of macro and micronutrients data using standardized procedures</p>
		B. To enrich nutrient data for ethnic, new emerging and underutilised foods.	<p>B 1. Addition of ethnic foods items</p> <p>B 2. Addition of new emerging food items</p> <p>B 3. Addition of underutilised foods</p>
		C. To develop new data on non-nutrient (phytochemical) and anti-nutrients	<p>C 1. Analysis of phytochemicals in foods</p> <p>C 2. Analysis of anti-nutrients in foods</p>
		D. To improve and develop food analysis methods	<p>D 1. Improvement of analytical methods and related methodologies</p> <p>D 2. Development of reliable and accurate methods in food analysis</p>

\*The Research Priority Areas No. 1 to 7 is considered equally important for consideration of financial support and other resources.

The development of the current NRP is in accordance with the procedure or steps of the previous NRP for the 11<sup>th</sup> Malaysia Plan (2016-2020). These steps are as follows:

- i. Critical gaps in knowledge and research needs for the Malaysian context.
- ii. The research purposes, scopes and suggested topics within each NRP area.
- iii. The relative ranking of the research topic using standardised criteria.

## SCORING AND RANKING CRITERIA OF 12<sup>TH</sup> MP NRP

NRP research topics for the 12<sup>th</sup> MP were scored by the appointed experts based on the following criteria:

- Big impact on health status and/ or delivery of services
- Great public health significance
- Capacity strengthening
- Gap in knowledge/ evidence that necessitates research
- Feasibility, practicality, cost and time
- Importance for client satisfaction

The first two criteria were considered primary criteria while the remaining four criteria were secondary criteria, as shown in Table Executive\_2.

For each research scope, these criteria were used to rank the relative priorities of the research topics. Score “1” indicates the lowest score for each criteria. The scores obtained by each research topic were added, and the research topic that obtained the highest total score was ranked “1” and so on.

All criteria must be scored. The maximum total score is 48 points. Scores for each topic will be divided by the total score to get the percentage of the topic score. Only topics that have a percentage greater than or equal to 80% will be considered for inclusion in the priority list in this document.

Table Executive\_2: Ranking criteria for selection of research scopes and topics

Category	No.	Criteria	Score range
Primary Criteria	1	Big impact on health status and/ or delivery of services	1-10
	2	Great public health significance	1-10
Secondary Criteria	1	Capacity strengthening	1-7
	2	Gap in knowledge/ evidence that necessitates research	1-7
	3	Feasibility, practically, cost and time	1-7
	4	Importance for client satisfaction	1-7

# INTRODUCTION

## Nutrition Research Priorities in Malaysia for the 12<sup>th</sup> Malaysia Plan (2021-2025)

Nutrition is a fundamental pillar of human health and sustainable development (WHO, 2000). Optimal nutrition is vital for survival, physical growth, mental development, performance and productivity. It is also important in health and well-being across the entire life span, from the earliest stage of foetal development to adulthood and older age. However, rapid industrialisation and urbanisation in recent decades have inevitably brought about changes in diet, lifestyle and health of the Malaysian society. Nowadays, our society is facing double burden of nutritional deficiency (e.g., anaemia, stunting and wasting), overweight, obesity and diet-related non-communicable diseases (e.g. hypertension, diabetes mellitus, cardiovascular diseases and certain forms of cancers). These situations lead to increase of morbidity, mortality and healthcare costs/ expenditure, and eventually impact the productivity and economic development of the country.

In conjunction with the 12<sup>th</sup> Malaysia Plan (2021-2025) of achieving decent standard of living, the National Plan of Action for Nutrition of Malaysia (NPANM) III (2016-2025), which is in line with the National Nutrition Policy (NNP) 2005 continuously plays significant role in raising whole nations' nutritional well-being by providing a series of appropriate strategies and activities. One of the recommended facilitating strategies of the NPANM III (2016-2025) for the implementation and evaluation of evidence based and effective nutrition programmes in Malaysia is to strengthen the food and nutrition research and development.

Research and development play a vital role in food and nutrition services, keeping pace with the increasing demand for information and evidence that allow policy makers to make informed decisions about nutrition and health care policies and practices. Both of it also continuously help in improving the quality of life of the population. Research drives innovative ideas related to food and nutrition and brings about the transformation of food system in tandem to market demands and advances in technology. In Malaysia, many researches in relation to food, nutrition and health have been carried out. However, there are still lacking of longitudinal large-scale or nationwide studies in addressing critical national public health problems and concerns.

The COVID-19 pandemic in 2020 brought the greatest shock to the global health and economy of the twenty-first century. Almost the whole world underwent a locked down, and where we had to adjust to new means of working, studying, socializing, even entertaining ourselves. At the end of the year, more than 1.8 million people have died worldwide, with soaring unemployment, inequality, and poverty on a global scale. COVID-19 disruptions have also had negative consequences for long-term and hard-won progress on nutrition. Which resulted in disruption of national food security, livelihoods and daily diets have become less healthy, and nutrition programmes for the poor and vulnerable population interrupted. The pandemic can be regarded as a global wake-up call, due to persistent neglect of SDGs pledges, which will require us to uphold sustainability and social justice at the core of public policy.

Since 2011, the Nutrition Research Priorities (NRP) in Malaysia is initiated by Ministry of Health Malaysia through Technical Working Group (TWGs) on Nutrition Research. The establishment of priorities for nutrition research aims to fill current and critical knowledge gaps, and to streamline the nutrition research in gathering and building systematically relevant and useful body of knowledge and evidence. This would be important and effective in maximising resources to provide an evidence-based and well-planned guidance in conducting research in Malaysia. These NRP would also ultimately support the decision making of nutrition and health care policies, as well as to improve and expand the nutrition services and practices.

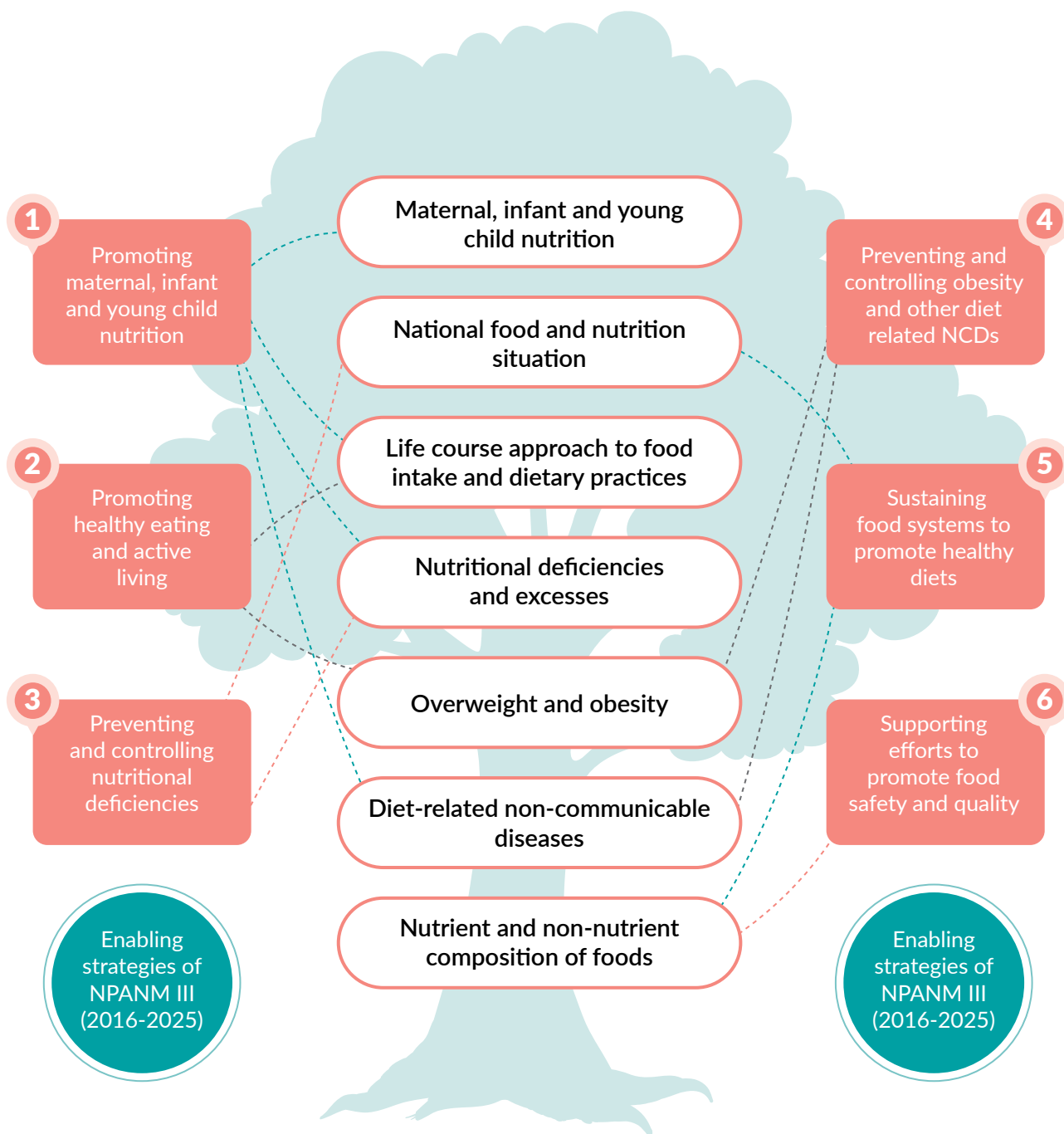
The NRP (2021-2025) is the sequel of the NRP (2016-2020), whose expansion is projected based on the national needs as delineated in NPANM III (2016-2025). The specific objectives of all the research and development activities proposed in the NRP (2021-2025) are:

1. To highlight the critical gaps in nutrition related knowledge and evidence, and the issues/ innovative approaches that warrant further research, especially in the Malaysian context.
2. To generate valuable information and evidence for policy makers to draw up and make informed decision on new policies, and
3. To provide a platform for individuals or related organizations (i.e. Ministry of Agriculture and Food Industries, Ministry of Education, universities and students, and food and beverages industries) to optimize time, effort and resources in designing and shaping future research.

The NRP (2021-2025) for the 12<sup>th</sup> Malaysia Plan focus on seven high priority areas (Figure Introduction\_1), which are considered equally important in meeting the national needs for further information and data/ evidence required for improving the health and nutritional well-being of Malaysian.

1. Maternal, infant and young child nutrition
2. National food and nutrition situation
3. Life course approach to food intake and dietary practices
4. Nutritional deficiencies and excesses
5. Overweight and obesity
6. Diet-related non-communicable diseases
7. Nutrient and non-nutrient composition of foods

# NUTRITION RESEARCH PRIORITY AREAS IN MALAYSIA FOR 12<sup>th</sup> MALAYSIA PLAN (2021-2025)



**Figure Introduction\_1.**  
Linkages between Nutrition Research Priority Area in Malaysia for 12<sup>th</sup> MP and the enabling strategies of NPANM III, 2016-2025

## METHODOLOGY

### Nutrition Research Priorities in Malaysia for the 12th Malaysia Plan (2021-2025)

Ministry of Health Malaysia has developed the Nutrition Research Priorities (NRP) in Malaysia since 2011, through Technical Working Group (TWGs) on Nutrition Research. The NRP aims to streamline all the nutrition research activities in Malaysia and provide evidence-based and well-planned guidance in maximising resources to conduct research, and to support the decision making of nutrition and health care policies as well as to improve and expand the nutrition services and practices.

#### The Technical Committee of Nutrition Research Priorities (NRP) for the 12<sup>th</sup> Malaysia Plan (2021-2025)

The Technical Committee of Nutrition Research Priorities (NRP) for the 12<sup>th</sup> Malaysia Plan (2021-2025) comprised of 57 professional and experienced nutritionists, academicians, research officers, and medical officers from ministries, government institutions, government hospitals, universities and non-governmental organisations (NGOs) (Table Methodology\_1).

**Table Methodology\_1:** The Technical Committee of Nutrition Research Priorities (NRP) for the 12<sup>th</sup> Malaysia Plan (2021-2025)

No.	Agencies	No. of committee	
1.	Ministries	Ministry of Health	
		● Nutrition Division	13
		● Disease Control Division	2
		Ministry of Education	1
		Ministry of Agriculture and Food Industries	1
		Ministry of Rural Development	1
	● Community Development Department		
	Ministry of Science, Technology and Innovation (MOSTI)	2	
	● Department of Chemistry Malaysia		
2.	Government Institutions	● Institute for Public Health	5
		● Institute for Medical Research	2
		● Institute for Health Behavioural Research	1
		● National Child Development Research Centre	1
		● Institute of Agricultural and Food Policy Studies	1
		● Malaysian Agricultural Research and Development Institute (MARDI)	1
		● National Sports Institute	1
3.	Governmental Hospital	● Ampang Hospital	1
		● Putrajaya Hospital	1
4.	Universities	● Universiti Putra Malaysia (UPM)	8
		● Universiti Kebangsaan Malaysia (UKM)	7
		● Universiti Sains Malaysia (USM)	3
		● Universiti Sultan Zainal Abidin (UniSZA)	1
		● Universiti Malaya (UM)	1
		● Universiti Teknologi MARA (UiTM)	1
		● International Islamic University Malaysia (IIUM)	1
		● UCSI University	1

No.	Agencies	No. of committee
5.	Non-governmental Organisations (NGOs) <ul style="list-style-type: none"> <li>• Nutrition Society of Malaysia (NSM)</li> <li>• Malaysian Association for the Study of Obesity (MASO)</li> </ul>	2*

**\*Represented by committee affiliated to UKM and UiTM**

The NRP Technical Committee is part of the Technical Working Group on Nutrition Research, which is under the purview of the National Coordinating Committee on Food and Nutrition (NCCFN). They are the experts in the fields of nutrition, food science, education, medicine, public health and epidemiology. They are also highly engaged in a variety of research activities and deemed to be capable of providing holistic and balanced views of nutrition research activities and needs.

The NRP Technical Committee is chaired by Prof. Dr. Hamid Jan bin Jan Mohamed, a Professor of Universiti Sains Malaysia, and was coordinated by Secretariat of the Technical Committee. The Secretariat of the Technical Committee was responsible to steer/ drive and coordinate the project by monitoring the timeline in achieving and managing the key milestones.

**Procedures of Developing the Nutrition Research Priorities (NRP) for the 12<sup>th</sup> Malaysia Plan (2021-2025)**

The development of the current Nutrition Research Priorities (NRP) was in accordance with the procedure or steps of the previous NRP for the 11<sup>th</sup> Malaysia Plan (2016-2020). These steps were as follows:

**Stage 1: Pre-prioritisation**

Prior the research areas identification, secretariat of the NRP Technical Committee had systematically searched, identified, selected, appraised and synthesized the relevant nutrition related research evidence in Malaysia since 2019. The secretariat identified and reviewed the relevant research evidence over a period of close to 10 years, based on the two volumes of published bibliographies (Volume II, 2011-2014 and Volume III, 2015-2017) as well as collection of database from 2018 onwards. These published bibliographies, also known as “Nutrition Research in Malaysia – Selected bibliography of Published Journal Articles” have been developed and compiled by the Editorial Boards under the Technical Working Group on Nutrition Research since 2006.

**Stage 2: Research areas identification**

In early 2020, a meeting among the members of NRP Technical Committee was conducted to discuss and identify/ determine the priority areas for nutrition research. During the meeting, the members of NRP Technical Committee had further reviewed the relevant research evidence that are synthesized/ established by the secretariat to identify and discuss the current critical gaps in nutrition related knowledge and evidence in Malaysia. At the end of discussion, the members summarised and streamlined the areas identified based on the national needs as delineated in NPANM III (2016-2025). Seven research priority areas were identified and conceptualized as below:

- 1) Maternal, infant and young child nutrition
- 2) National food and nutrition situation
- 3) Life course approach to food intake and dietary practices
- 4) Nutritional deficiencies and excesses
- 5) Overweight and obesity
- 6) Diet-related non-communicable diseases
- 7) Nutrient and non-nutrient composition of foods



### Stage 3: Identification of research purpose, scopes and topics

An intensive discussion and brainstorming workshop for three days and two nights was carried out among the members of NRP Technical Committee for each research area. This session aimed to identify the purposes, scopes and suggested relevant topics for the seven distinct research areas.

Prior to the brainstorming and discussion session, a brief preliminary on the seven research areas was firstly given by the leaders of each research area. Then, the members of each research area went on to discuss the purposes and scopes of respective research areas, which are aligned with the indicators and enabling strategies of the NPANM III. Based on the research purpose and scopes, the framework of each research area was then conceptualized. Subsequently, the members continued brainstorming to propose suggested research topics for each area. Two facilitators were also invited to facilitate the groups of each area for the development of topics for future research. The members were assisted by the facilitators to express and formulate their ideas into topic areas that could be researched.

### Stage 4: Scoring and ranking

All the research topics for each research area were scored and ranked by the members of NRP Technical Committee. All the suggested topics were assessed using six (6) criteria (Table Methodology\_2), and these criteria were used to rank the relative priorities of the research topics.

**Table Methodology\_2:** Clarification/ explanation of 12<sup>th</sup> MP NRP criteria

Category	No.	Agencies	Clarification/ Explanation	Score range
<b>Primary Criteria</b>	1	Big impact on health status and/ or delivery of services	Are the results of the research likely to be beneficial to health status and/or delivery of services to the nation?	1-10
	2	Great public health significance	Will the research have a significant impact on the current and future health status of the population?	1-10
<b>Secondary Criteria</b>	1	Capacity strengthening	Will there be sufficient individual or institutional capacity to carry out this research?	1-7
	2	Gap in knowledge/ evidence that necessitates research	<ul style="list-style-type: none"> <li>Will the findings of this research fill an important knowledge/ evidence gap in achieving national goals, and policies?</li> <li>Is the gap between the discovery of knowledge relevant to current and future practice</li> </ul>	1-7
	3	Feasibility, practically, cost and time	<ul style="list-style-type: none"> <li>Is there a strong probability that research could be initiated conducted within the 12<sup>th</sup> MP period (2021-2025)?</li> <li>Can this research be designed to provide a practical solution/ outcome?</li> <li>Is the cost and time required for this research reasonable?</li> </ul>	1-7
	4	Importance for client satisfaction	Can the results, solution or clarification of the research lead to client satisfaction?	1-7

The six criteria were divided into primary criterion which was the first two criteria that were weighted on a scale ranging from 1 to 10, and the secondary criterion that composed by the remaining four criteria with a score ranging from of 1 to 7. The score of “1” indicates the lowest level of the respective criteria. The overall score for each suggested topic was obtained by adding up all the scores on each criterion (score range: 6-48). The scores of each topic were then divided to a total score of 48 and multiplied by 100 to get the percentage (%) of research topic. Only the topic with a percentage greater than or equal to 80% would remain and be included in the list of NRP Malaysia for the 12<sup>th</sup> Malaysia Plan (2021-2025).

Based on the percentage of research topics, the suggested topics were then ranked accordingly within respective research scope of each area to identify the research priorities. The research topic with the highest percentage that reflected the highest priority was ranked “1”, followed by the next high priority with a rank of “2”, and so on. This priority ranking aimed streamline the suggested topic of each research scope and area that are more relevant and have higher potential in meeting the current and projected national planning and policy needs.

### **Stage 5: Evaluation of research priorities**

At the end of the workshop for development of NRP for 12th Malaysia Plan, the research priorities were presented to five panellist representing the main stakeholders and research institutions. They were the Director of Division of Nutrition Ministry of Health, Deputy Director of Division of Diseases Prevention Ministry of Health, Manager of the National Institutes of Health, Director of the Institute of Public Health, and a representative from Ministry of Higher Education and Nutrition Society of Malaysia (also the chairman of TWGs on Nutrition Research as moderator). This document was then revised based on the feedbacks and comments, and being harmonized by the members of NRP Technical Committee.

### **Stage 6: Review and endorsement**

The revised document was then presented again to all facilitators for review and endorsement. The final document will be published 2020. Through these links, the NRPs are expected to generate data needed to support the realisation of the Enabling Strategies, and in turn, the achievement of the objectives of the NPANM III by 2025.



RESEARCH PRIORITY

# AREA 1

MATERNAL, INFANT  
AND YOUNG CHILD  
NUTRITION



## RESEARCH PRIORITY AREA 1

### MATERNAL, INFANT AND YOUNG CHILD NUTRITION

#### 1.1 Introduction

The earliest years of life are a critical period of human development, thus, a healthy and nurturing surroundings for infants and young children will establish the building blocks for lifelong health. The first 1000 days of life span from conception until the child reaches the age of two years. It is an essential period of growth and development whereby any disturbance that occurs during this critical period could have a profound impact on a child's ability to grow and develop. Besides that, his or her future risk of developing chronic diseases, such as diabetes, cardiovascular disease, and cancer, is also increased. As the foetus is dependent on the mother for its nutrition, maternal diet and nutritional status during pregnancy is crucial for foetal health and development (Procter & Campbell, 2014). Data obtained periodically on early child growth and development information provide short-term and long-term outcomes of maternal glycaemia status and indicate the role of environment (e.g., infant feeding, diet, parent-infant interaction and home environment) that could potentially impact child growth and development (Yong et al., 2018).

During pregnancy, energy and nutrient requirements of women increase to meet both maternal and foetal demands. Insufficient or excessive gestational weight gain, micronutrient deficiencies and gestational diabetes are among some nutritional problems that are prevalent among pregnant women. These nutritional problems can have short-term and long-term adverse effects on the health of women and their offspring (Innis, 2014; Catalano & Shankar, 2017). Women with inappropriate gestational weight gain increase the risk of preterm birth and small- or large-for-gestational-age infant and foetal distress (IOM & NRC, 2009). These risks would further predispose individuals in developing chronic diseases such as hypertension, cardiac dysfunction, obstructive lung disease, glucose intolerance and osteopenia in later life (Luu et al., 2016). Women with excessive gestational weight may also have higher risks of gestational diabetes (GDM), postpartum weight retention, obesity, cardiovascular disease, and type 2 diabetes mellitus. The baby also has a higher risk to have neonatal hypoglycaemia, small birth weight (WHO, 2016).

The World Health Organization (WHO) (2014) recommended exclusive breastfeeding for the first six months of life and continuation of breastfeeding for up to two years of age. The WHO has articulated a global strategy for infant and young child feeding and recommendations in the form of guiding principles for complementary feeding of the breastfed and non-breastfed children (PAHO/WHO, 2003; WHO, 2005). Exclusive breastfeeding confers many benefits to both infant and mother, which include a lower risk of gastrointestinal infection for the infant and rapid postpartum weight loss for the mother. Breastfeeding also lowers the risk of breast and ovarian cancer in the mother. While Malaysia as a country advocates breastfeeding, having a national breastfeeding policy and implements the International Code of Marketing of Breast-milk Substitutes, exclusive breastfeeding rate is low at 47.1% (IPH, 2016). Exclusive breastfeeding practice will require a support system not only at the family and community level, but at the workplace and built environment, particularly for working mothers. Some mothers will also require financial assistance, wage compensation, maternity leave entitlement, provision of affordable child care services within or nearby their working places and nutritional counselling.

Once infants complete their first six months of life, they will need other foods in addition to breastmilk, as breastmilk alone will no longer meet growing nutritional requirements of infants after six months of age. Complementary feeding, which typically covers the period from six to 24 months of age, is a critical period of transition from exclusive breastfeeding to feeding with complementary foods and subsequently to family foods. Nearly a third of infants 4-5 months old are already fed solid foods, whereas almost 20% of 10-11 months old had not consumed solid foods during the day

before their survey. Of concern is the low rate (28.2%) of children 6-23 months receiving at least a minimally diverse diet (White et al., 2017). Complementary feeding should be timely, adequate, safe, and appropriate to ensure infants and young children have optimal diets. Inability to practice complementary guidelines, growth faltering, micronutrient deficiencies and infectious diseases would increase, especially in developing countries (Dewey & Adu-Afarwuah, 2008).

The National Health and Morbidity Survey (2016) found that the overall prevalence of exclusive breastfeeding among infants (less than six months old) was only 47.1%. Only 39.4% of children aged 20-23 months continued being breastfed (IPH, 2016). For complementary feeding, half of the children surveyed (53.1%) had minimal acceptable dietary diversity. Malaysia lacks data on maternal, infant and young child nutrition. Research in various aspects of maternal diet and nutritional status during pregnancy, infant and complementary feeding practices, is much needed. These include research on intakes of energy and nutrients as well as dietary patterns of pregnant women, consequences of maternal nutritional status, dietary adequacy in infants and young children. In addition, infant and young child feeding practices of marginalized groups, such as minority population groups, low birth weight and premature infants, are also necessary. Besides the focus on nutrition, parental lifestyles practices have been shown to imply birth and infant outcome and require attention.

The outbreak of coronavirus (COVID-19) pandemic in early 2020 has led to nearly 130 million cases and close to three million deaths worldwide at the end of March 2021 (WHO, 2021); and nearly 350,000 cases and more than a thousand deaths in Malaysia to date (MOH, 2021). The situation is fast evolving around the globe, with the availability of vaccines, but also with the emergence of more infectious variants of the virus. This has created a particular concern among pregnant women because severe complications could occur during pregnancy (Zhu et al., 2020; Schwartz & Graham, 2020). In response to this fast-spreading epidemic, the Malaysia government had locked down the country, which could affect the population in multiple ways, including the socio-economy, food security, dietary and health behaviours. Pregnant women can be among the group with the highest risks, especially if they are from marginalized, poor, or rural communities (B40 or Bottom 40 group) (FIAN International, 2020).

Restriction of movement, transportation difficulties, long waiting times and the complicated screening procedures may lead to fear of going out and to attend antenatal check-ups, or financial difficulties that hinder attendance to antenatal check-ups (WHO, 2007). The economy is also affected during this global crisis. The COVID-19 crisis increases the risk of loss of income, loss of jobs and also affects women's priority and movement (International Labour Organization, 2020). Women may have to leave their jobs to take care of their children because of the closure of school and nursery/ childcare centre. Movement restriction also exposes families to food insecurity, especially the marginalized groups (FIAN International, 2020). The current pandemic requires changes to our public policies, and studies are needed to understand the nutritional status of mothers and children due to changes in income status, food adequacy, food security and lifestyles, particularly among the marginalized group during the pandemic.

In order to effectively plan systematic action in combating the malnutrition issues and health challenges in the near future, research on various aspects of mothers, infants and young children nutrition states should be a Malaysian priority. Among the research conducted in Malaysia was SECOST (Seremban Cohort Study) in year 2018 (Yong et al., 2018). This study provided data on the determinants and outcomes of maternal glycaemia pregnancy in Malaysia for the purpose of strengthening existing strategies and formulates new strategies that were appropriate to improve the health of mother and child. Meanwhile, the birth cohort studies conducted in pregnant women among Malays in Kelantan by Loy et al. (2011) suggested that FFQ was a legitimate tool to collect dietary data and rank individuals according to the relative intake for pregnant women Malay. In conclusion, the process of developing new strategies for enhancing the overall health and nutritional status of pregnant women, infant and young children in Malaysia can be undertaken only when adequate information is available through relevant research.

## 1.2 Conceptual Framework on the Purpose and Scope of the Research Priority Area

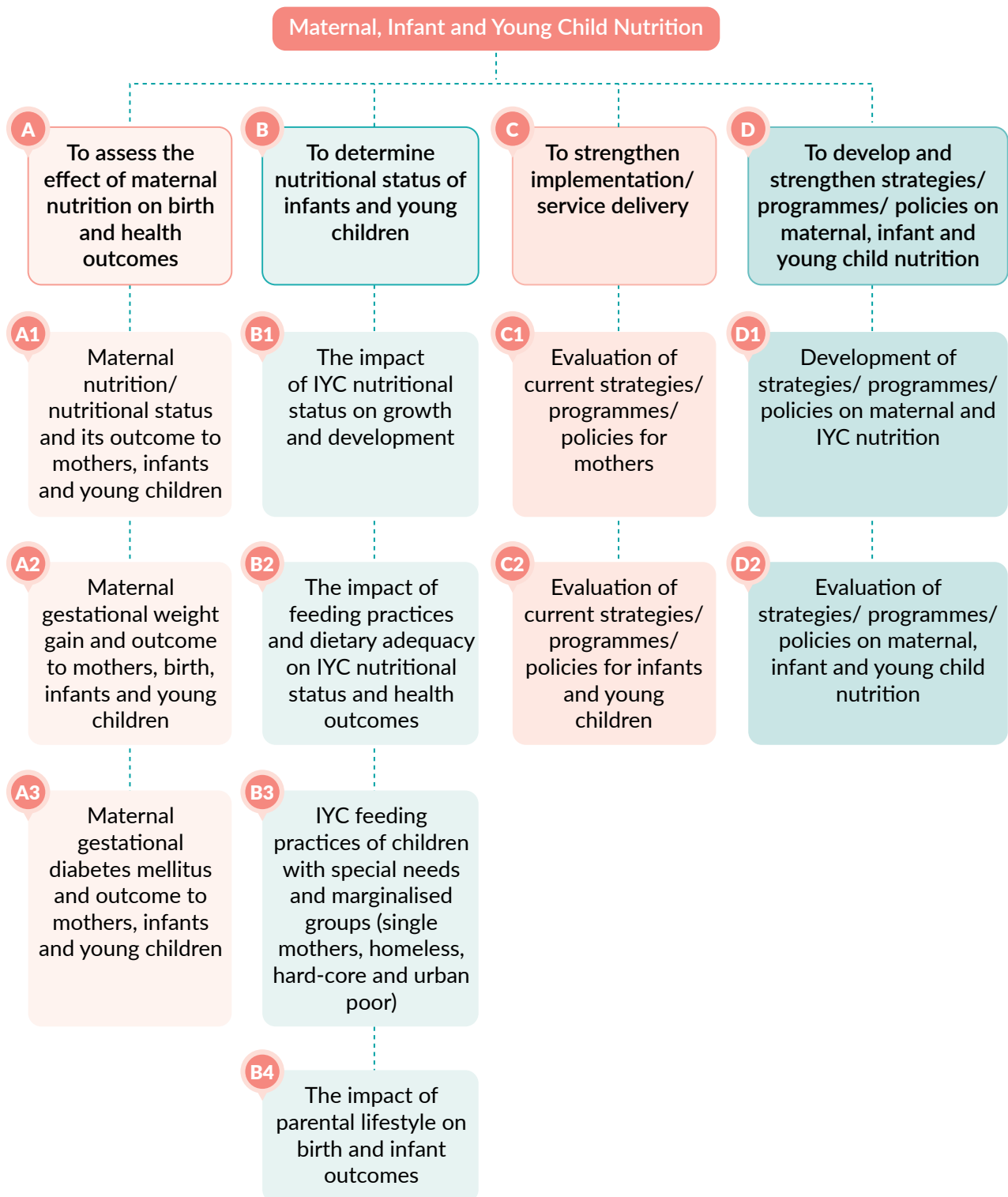


Figure 1.1. Purpose and scope of maternal, infant and young child nutrition

### 1.3 Table of Nutrition Research Priority Area

This NRP Area is presented in two tables. Table 1.1 shows the list of suggested topics. Appendix 1 presents the ranking criteria for the suggested topics in each research scope of this NRP Area.

The World Health Organization (WHO) has long advocated for and worked towards substantial and sustained improvements in maternal, infant, and young child nutrition worldwide. This is due primarily to the many acute and long-term effects of maternal and infant nutrition not only on individuals but on the entire community and the country. As such, it was improving nutrition in early life and during a woman's reproductive years has far-reaching implications on many levels, which are both, directly and indirectly, related to underlying health outcomes.

In Malaysia, research finding was benefited in the formulation of health policies, including nutrition-related policies. Nutrition-related policies need comprehensive direction and require the collaboration of multiple stakeholders to translate it into effective programmes or interventions. As such, setting the nutrition research priorities (NRP) in this area should not only consider the broad scope of maternal and infant nutrition but also incorporate an evaluation of existing nutrition strategies in relevant studies to improve the food and nutrition situation of mothers, infants and young children up to the age of three. These NRPs were proposed taking into consideration the nutrition situation in the country as well as global nutrition indicators, such as the Sustainable Development Goals (SDGs), and the Global Nutrition Target. Towards this end, it is crucial to strengthen further, expand and evaluate our national policies, programmes, and nutrition interventions.

There are four purposes in Area 1 for which research will be conducted. For each purpose, the gaps in the research area were identified based on an evaluation of the achievements of the previous NRP, which were based on published research papers. These published papers were used to guide in determining the scope of research for each research purpose. The first two purposes are to focus on researches that have an impact on the target groups: mothers and children whereas the last two purposes concentrate on research to improve and strengthen the service delivery and policies about the nutritional needs of the target groups in this area, namely mothers, infants and young children aged below three years. The first purpose is to assess the effect of maternal nutrition on birth and health outcomes. The second is to determine nutritional status of infants and young children, while the third is to strengthen implementation/ service delivery. The ultimate purpose is to develop and strengthen strategies/ programmes/ policies on maternal, infant, and young child nutrition. All these purposes underlined in Area 1 also incorporate issues faced by pregnant women due to the COVID-19 pandemic. Birth and infant outcomes may have its implications if women are infected during pregnancy. In addition to that, breastfeeding practices in times of COVID-19 require immediate research to be able to outline proper guidelines in promoting breastfeeding.

In order to ensure that research in Area 1 covers the needs of not just the mainstream community, the research scopes also address marginalized target groups, such as single mothers, the homeless, hard core and urban poor, as well as children with special needs, regardless of their ethnic background and cultural practices. In addition, research addressing new norms, such as social distancing and hygiene practices, in times of COVID-19 pandemic is critical to help address guidelines among pregnant women and young children. As such, we anticipate that the overall research needs in Area 1 related to maternal and child nutrition can be comprehensively researched. Ultimately, we hope that armed with further knowledge and deeper insights into this research area, the target group of mothers, infants and young children can achieve better nutrition and health outcomes.



## Research Priority Area 1: Maternal, Infant and Young Child Nutrition

Table 1.1: List of suggested topics in each research scope

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
A. To assess the effect of maternal nutrition on birth and health outcomes.	A 1. Maternal nutrition/nutritional status and its outcome to mothers, infants and young children.	There is limited information on the impact of anaemia on maternal and infant and young child (IYC) health outcomes, chronic diseases, psychological and cognitive outcomes.  Anaemia status is urgently required so that appropriate interventions can be taken to treat and prevent maternal related diseases.	A 1.1 Nutrition in the first 1000 days of life and health outcomes.	1
			A 1.2 The impact of maternal anaemia on mothers' health and nutritional status.	2
			A 1.3 The impact of maternal anaemia on IYC health and nutritional status.	1
			A 1.4 The impact of maternal nutritional status during pregnancy and lactation on breast milk composition and infant growth.	1
			A 1.5 The impact of maternal dietary intake during pregnancy and lactation on breast milk composition and infant growth.	1
			A 1.6 Dietary patterns and nutritional status among mothers of marginalised groups (single mothers, homeless, hard core and urban poor).	1
			A 1.7 The impact on maternal nutritional status due to changes in income status, mental health, lifestyle during/ post COVID-19 pandemic.	1

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
	A 2. Maternal gestational weight gain and outcome to mothers, birth, infants and young children.	There is limited information on the impact of inappropriate gestational weight gain on maternal and IYC health outcomes, chronic diseases, psychological and cognitive outcomes. Gestational weight gain status is urgently required so that appropriate interventions can be taken to treat and prevent related consequences.	A 2.1 The impact of maternal gestational weight gain on mother's health and nutritional status (anthropometry and biochemistry).	1
			A 2.2 The impact of maternal gestational weight gain on IYC health and nutrition.	1
			A. 2.3 The impact of COVID-19 pandemic on maternal nutrition and gestational weight gain including assessment of dietary intake and for early detection and treatment of under-nourished pregnant women.	1
	A 3. Maternal gestational diabetes mellitus and outcome to mothers, infants and young children.	There is limited information on the impact of gestational diabetes mellitus on maternal and IYC health outcomes.  Gestational diabetes mellitus can have adverse consequences on maternal and child health.	A 3.1 The impact of maternal gestational diabetes mellitus on mothers health and nutritional status.	2
			A 3.2 The impact of maternal gestational diabetes mellitus on IYC health and nutritional status.	1
B. To determine nutritional status of infants and young children.	B 1. The impact of IYC nutritional status on growth and development.	The availability of local studies on this issue is limited. With the rise in stunting cases in Malaysia of recent times, it is imperative to study how this factor could possibly have a role to play in cognitive development of a child. In addition, understanding the demographic of stunting cases is required to tackle the issue.  IYC nutritional status has been shown to have an impact on growth and cognitive of infants and young children.	B 1.1 Relationship between malnutrition/ stunting/ low birth weight and cognitive development.	1
			B 1.2 The impact of socio-economic status on malnutrition/ stunting/ low birth weight.	1

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
B 2. The impact of feeding practices and dietary adequacy on IYC nutritional status and health outcomes.		The availability of local studies on these issues are limited. Feeding practices among infants and young children require more exploration to understand the pattern and its relationship to growth and development. IYC feeding has long term impact on growth, development and health status.	B 2.1 The impact of care feeding practices on child development (cognitive, psychomotor and psycho-social).	3
			B 2.2 Relationship between IYC feeding practices with malnutrition (overweight, obesity, underweight, stunting and wasting).	2
			B 2.3 Relationship between IYC feeding with diet-related chronic diseases in children, adolescents and adults.	6
			B 2.4 Relationship between IYC feeding practices with infections and allergies (acute respiratory infection, asthma, gastro enteritis, eczema).	2
			B 2.5 Relationship between IYC feeding with micronutrient adequacy	5
			B 2.6 Relationship between IYC feeding with macronutrient sufficiency.	1
			B 2.7 Appropriate complementary feeding practices (timeliness, adequacy, diversity, frequency, safety).	1
			B 2.8 The use and impact of dietary supplements (e.g., vitamins, minerals) on IYC health and nutrition.	4

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
			B 2.9 The impact of COVID-19 pandemic on children's nutrition, including assessment of dietary intake and evaluation for early detection and treatment of child wasting.	1
	B 3. IYC feeding practices of children with special needs and marginalised groups (single mothers, homeless, hard core and urban poor).	Marginalized and special needs groups have different issues, which is important to be understood. The findings will potentially be useful in planning for health and intervention strategies for these groups. Socio-cultural differences among the various marginalised groups (single mothers, homeless, hard core and urban poor) affect feeding practices, dietary intake and nutritional status. Information is required to address the service needs of these marginalised groups.	B 3.1 Dietary patterns and nutritional status among infants and young children of marginalised groups (single mothers, homeless, hard core and urban poor).	1
			B 3.2 The impact of COVID-19 pandemic on food security and IYC feeding practices in relation to socio-economically vulnerable families from marginalised groups (e.g., single mothers, homeless, hard - core and urban poor).	1
		Lack of information on feeding practices among infants and young children with special needs in Malaysia. Information is required to address feeding practices among infants and young children with special needs.	B 3.3 Dietary patterns and nutritional status among infants and young children with special needs.	1
	B 4. The impact of parental lifestyle on birth and infant outcomes.	Lack of information on parental lifestyle on birth and infant outcomes in Malaysia. Foetal programming plays an important role in birth and health outcomes of infants. Thus, exploring parental lifestyle impact on their infants is highly needed.	B 4.1 The impact of parental lifestyle on birth and infant outcomes including adaptation to new norms post COVID-19 pandemic.	1

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
		Information is required to address parental lifestyle on birth and infant outcomes in Malaysia.		
		Information on postpartum practices is limited. More exploration in this area is needed to help improve confinement practices and understand its association to improving maternal health outcomes. Confinement practices during postpartum (controlling, restricting or responsive) have been shown to have an impact on maternal health, breastfeeding practice and breastmilk composition.	B 4.2 The impact of mother's belief and confinement practices during postpartum on maternal health, breastfeeding practices and breastmilk composition.	2
C. To strengthen implementation/ service delivery.	C 1. Evaluation of current strategies/ programmes/ policies for mothers.	Information on evaluation of nutrition education and breastfeeding strategies/ programmes/ activities is limited. Various programmes have been conducted however, up to date, the effectiveness and outcome of these programmes are not measured well. Thereby, conducting periodic evaluation of programmes would provide data to improvements and outcomes.  Many programmes have been implemented over the years. Hence, evaluation is needed to assess the effectiveness of the programmes.	C 1.1 Evaluation of the effectiveness of nutrition education on mothers' health.	1
			C 1.2 Evaluation of the effectiveness of post-natal home visit on breastfeeding practices.	1
		C 1.3 Evaluation of the effectiveness of BFHI.	1	
	C 2. Evaluation of current strategies/ programmes/ policies for infants and young children.	Information on evaluation of IYC feeding strategies/ programmes/ activities is limited. Various programmes have been conducted however, up to date, the effectiveness and outcome of these programmes are not measured well. Thereby, conducting periodic evaluation of programmes	C 2.1 Evaluation of the effectiveness of nutrition education on infant and young children's health.	1

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
		would provide data to improvements and outcomes. More nutrition education programmes on IYC feeding and health have been produced over the years. Hence, evaluation is needed to assess the effectiveness of these programmes.		
D. To develop and strengthen strategies/ programmes/ policies on maternal, infant and young child nutrition.	D 1. Development of strategies/ programmes/ policies on maternal and IYC nutrition.	Lack of information on perception, knowledge and attitude towards human milk bank among the public and parents. Human milk bank is a growing interest in Malaysia as there are needs for it. However, public understanding and perception are important to ensure its application in the future. Perception, knowledge and attitude status towards human milk bank among the public and parents are urgently required so that appropriate programmes can be developed to enhance breastfeeding practices.	D 1.1 Public perception, knowledge and attitude towards human milk bank.	1
			D 1.2 Parents' perception, knowledge and attitude towards human milk bank.	1
			D 1.3 Parents understanding on the different types of milk (e.g., infant formula vs GUM vs full cream milk) and commercial complementary food.	1
	D 2. Evaluation of strategies/ programmes/ policies on maternal, infant and young child nutrition	Lack of information on the effectiveness of the implementation of mother friendly workplace strategies and induced lactation/ relactation programme. Impact evaluation of programmes is much required to ensure its	D 2.1 The impact of mother friendly workplace (e.g., lactation breaks, availability of crèche, breastfeeding room, maternity leave) on exclusive breastfeeding and breastfeeding duration.	1

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
		sustainability and improvements.  Providing mother-friendly facilities at the workplace may support breastfeeding.	D 2.2 Factors influencing success of lactation induction and relactation.	1
		Information on evaluation of maternal strategies/ programmes/ activities is limited in Malaysia. Several antenatal programmes have been implemented over the years. Hence, evaluation is needed to improve the effectiveness of the programmes.	D 2.3 Evaluation on the effectiveness of antenatal programmes on anaemia, gestational diabetes mellitus and gestational weight gain.  D 2.4 Evaluation on the effectiveness of the MOH guidelines in relation to breastfeeding practices for suspected or confirmed COVID-19 cases and the effect on breastfeeding duration.	1  1

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RESEARCH PRIORITY

# AREA 2

NATIONAL FOOD  
AND NUTRITION  
SITUATION



## RESEARCH PRIORITY AREA 2 NATIONAL FOOD AND NUTRITION SITUATION

### 2.1 Introduction

Regular monitoring of national food and nutrition situation is crucial for any country in ensuring the nutritional well-being of its population. This includes the national evaluation of nutrition programmes and strategies as well as the determination of the factors and outcomes of food and nutrition security status in the country. The importance of monitoring and evaluation of national nutrition situation is well-recognised. Cross-sectional surveys of risk factors are needed to describe the prevalence and distribution of health and nutritional variables, risk factors, by age, sex, and ethnicity, in representative samples of the population.

Cross-sectional surveys are repeated at regular intervals to assess trends in the levels and distribution of risk factors. These surveys could also quantify the association of reported risk factor with diseases. Normally the purpose these surveys will be designed to repeat observations of many individuals and to take independent samples during successive surveys.

Apart from national scale studies conducted by other agencies, the Ministry of Health Malaysia has embarked on a regular series of the National Health and Morbidity Survey (NHMS), a population based survey on the patterns of health status including nutrition among Malaysians. The first NHMS was conducted in 1986, followed by NHMS II (1996) and NHMS III (2006) which were conducted at ten years interval. The subsequent NHMS were NHMS 2011; NHMS 2012: Global School-Based Student Health Survey; NHMS 2014: Malaysian Adult Nutrition Survey (MANS) and NHMS 2015. The scope of NHMS 2011, 2015 and 2019 focused on health care demands, non-communicable diseases (NCDs) and the risk factors of the NCDs. The NHMS also focus on more specific scope, namely NHMS 2016: Maternal and Child Health; NHMS 2017: Adolescent Health and Nutrition and NHMS 2018: Elderly Health. The findings of these population based nationwide surveys provide the baseline and trend on major health and nutrition parameters of Malaysian population which of utmost importance in programme planning and implementation. Thus, regular NHMS still need to be undertaken with more comprehensive assessment of nutritional status which includes anthropometric, dietary intake and practices, clinical and biochemical data for all age groups.

To optimise the studies conducted by the relevant agencies, it is therefore important to incorporate selected relevant nutrition components (e.g., social determinants) into national studies of Household Income and Expenditure Survey (HIES) and Malaysian Family Life Surveys (MFLS) conducted by Department of statistics Malaysia (DOSM) and Ministry of Women, Family and Community Development (LPPKN) respectively to obtain more diverse perspective of the food and nutrition situation in the country.

Taking into consideration a huge scarcity of data generated from existing survey findings, it is also strongly recommended to conduct national/ large scale longitudinal studies to identify the causes and effects for selected core health and nutritional problems and issues. Longitudinal studies have the advantage of measuring exposure to a risk factor prior to the development of nutritional outcomes. However, these studies must be large enough-with at least 20,000 young adults, if they are to reliably measure end points in multiple population groups, within a 5 to 10-year period. They will focus on questionnaires and physical measurements. Biological sample collection may be included. As longitudinal studies require rigorous follow-up over a number of years, they are best done when the required infrastructure and long-term research framework are in place.

In addition, national scale studies to support the monitoring of the global and national nutrition indicators such as anaemia among children, undernourishment (e.g., stunting and wasting), low birth weight, breastfeeding, healthy eating and diet related NCDs as stipulated in the Sustainable Development Goals (SDG) 2030, Global Nutrition Target (GNT) 2025 and National Plan of Action

for Nutrition of Malaysia (NPANM) III 2016-2025 shall be seriously taken into consideration by the research stakeholders.

Various national nutrition programmes have been undertaken not only by the Ministry of Health but also by other stakeholders such as the Ministry of Education, private sectors and non-governmental organisations (NGOs). However, there are limited evaluation studies to assess the effectiveness of these nutrition programmes. Therefore, a regular programme evaluation which also includes a comprehensive spectrum of the programme outcome and impact shall be executed and given priority by the stakeholders.

Mapping the link between behaviour and food choices can help tackle obesity and other nutrition related issues which are of public health importance. A person's food choices are influenced by different drivers including government policy; environmental cues; cultural differences; previous experiences, families and food marketing. More data are needed to identify the impact of these various drivers and comprehend how they work singly or all together to influence nutrition related behaviours. Therefore, more qualitative or quantitative studies are warranted to identify the key drivers that may influence individual behaviour and health status in general.

The inclusion of strengthening food and nutrition security as one of the three objectives of NPANM III (2016-2025) requires for the status, determinants, causes and outcomes of food and nutrition security to be further explored and studied. In this context, food and nutrition security is defined as when all people at all times have physical, social and economic access to food, which is safe and consumed in sufficient quantity and quality to meet their dietary needs and food preferences, and is supported by an environment of adequate sanitation, health services and care, allowing for a healthy and active life (Committee on World Food Security, 2012). Lack of food and nutrition security has negative consequences on the health and nutritional status of the individuals and population such as poor dietary intakes and low dietary diversity patterns (Chong et al., 2019; Norhasmah et al., 2011; Zalilah et al., 2014) and low quality of life (Susanti et al., 2019). Poor dietary habits and sedentary lifestyles are associated with health and nutritional status as well as increased prevalence of chronic diseases in the population (IPH, 2008; IPH, 2014; IPH, 2015). This situation is aggravated by the industrialisation and urbanisation that have unavoidably brought changes in the lifestyles and dietary habits of Malaysians. Thus, rapid demographic, socioeconomic and technology changes as well as globalisation have significantly contributed to nutrition transition that influences the dynamic shifts in dietary intake, physical activity patterns, obesity and other nutrition-related non-communicable diseases (Popkin, 2006). Therefore, establishment of country specific National Food Balance Sheet (FBS) to examine the trend in food and dietary energy supply (DES) for population should be given priority. It is also important to understand and monitor the shift of the nutrition transition in the country.

As a consequence of nutrition transition and global food trade, the consumption of ultra-processed foods has increased worldwide including in Malaysia. It has been reported to be directly linked to the energy density of the diet and the content of saturated fats, trans fats and free sugar, and proved to be inversely associated to fibre and protein content, thereby demonstrating the potential harmful characteristics of these foods related to increasing the risk of obesity, diabetes, cardiovascular disease and some types of cancer (Louzada, 2015). Research on the role of ultra-processed foods in the Malaysian diets and their impact are rather scarce.

To address the major data gap on the national food and nutrition security status among vulnerable groups such as under-five children, women of reproductive age, elderly, indigenous people in Peninsular, Sabah and Sarawak, refugees, bottom 40% (B40) and people with special needs, priority has been given for studies on food and nutrition security status for these groups to be conducted.

Another economic and social disruptions created by the COVID-19 crisis will also have deleterious effects due to existing inequities on vulnerable groups and low-resourced communities.

The disproportionate burden of COVID-19 on marginalized populations and the B40 workforce underscores the effects of economic and social conditions on the physical, emotional, cognitive, and intellectual health of persistently disenfranchised groups and populations.

The purpose and scope of the national monitoring and evaluation of nutrition situation are presented in the conceptual framework as shown in Figure 2.1.

## 2.2 Conceptual Framework on the Purpose and Scope of the Research Priority Area

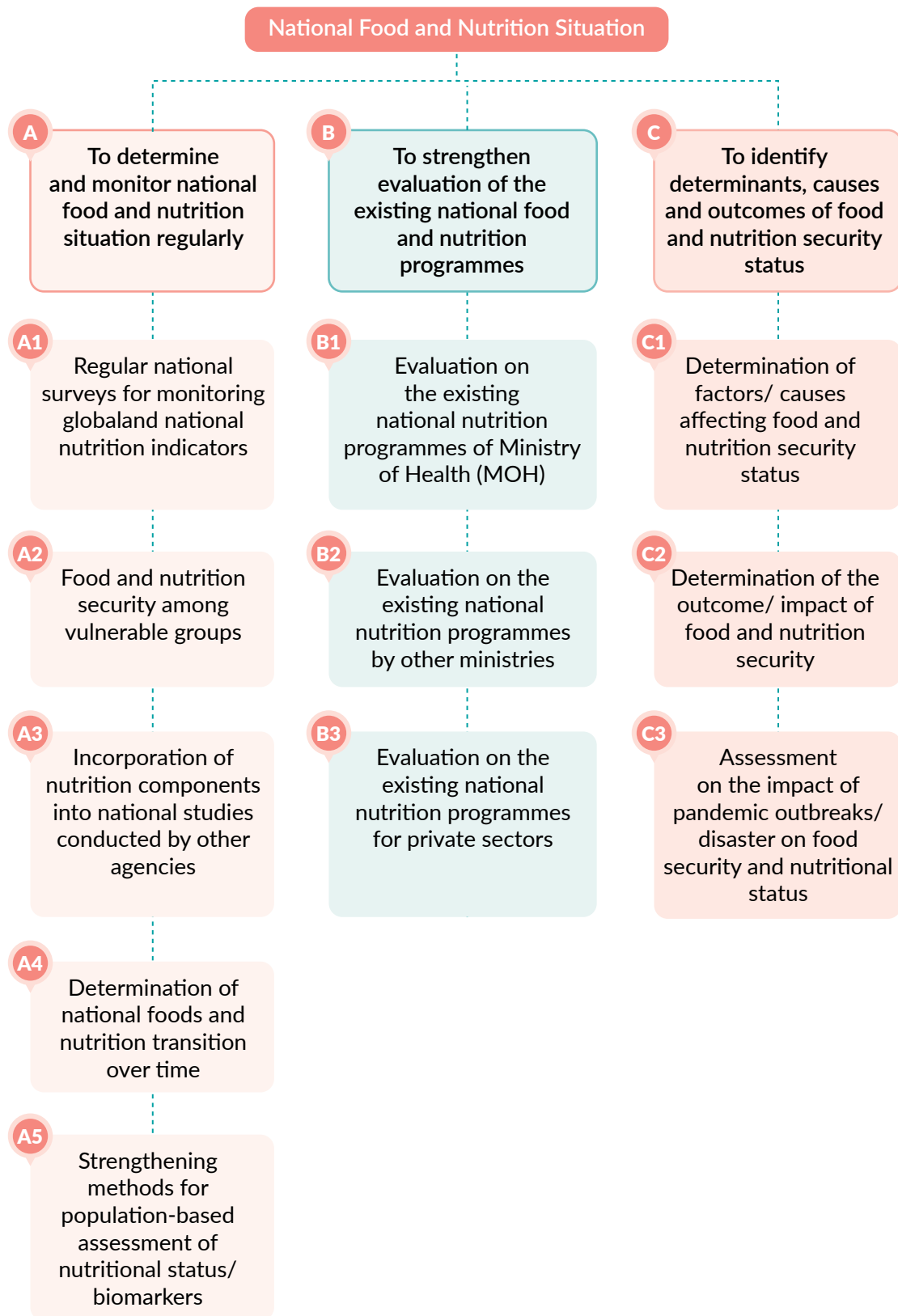


Figure 2.1. Purpose and scope of national food and nutrition situation



### 2.3 Table of Nutrition Research Priority Area

This NRP Area is presented in two tables. Table 2.1 presents the list of suggested topics. Appendix 2 presents the ranking criteria for the suggested topics in each research scope of this NRP Area.

The importance of promoting and ensuring the optimal nutrition well-being of the population is well documented. Thus, the formulation of nutrition policies and the development or the establishment of nutrition programme shall be corroborated with appropriate and reliable research evidence. As such, nutrition research priority (NRP) on this area shall incorporate the existing nutrition evidence gap for improving food and nutritional situation of the population. The identification of research under this research priority area has also taken into consideration the nutrition situation in the country as well as the global and regional direction such as the 2nd Rome Declaration for Nutrition 2014, Sustainable Development Goals (SDGs) 2030, and Global Nutrition Target 2025. As compared to the 11th MP, the title, purpose and scope under this priority area has been revised and consolidated accordingly with more explicit approach to address or capture national scale studies. There are three purposes, namely to determine and monitor national food and nutrition situation regularly, to strengthen evaluation of national food and nutrition programmes and to identify the determinants, causes and outcomes of food and nutrition security status. For each purpose, several key scopes have also been identified. Specific suggested topics and its ranking are also included. Since the proposed studies are large national scale in nature which requires significant budget allocation, the commitment and active participation from the various stakeholders and funders are crucially warranted. This is to ensure the fundamental and applied research stipulated in this document are conducted within the time line and in accordance with the standard and needs of the stakeholders which subsequently can be translated into practice.

## Research Priority Area 2: National Food and Nutrition Situation

Table 2.1: List of suggested topics in each research scope

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
A. To determine and monitor national food and nutrition situation regularly.	A 1. Regular national surveys for monitoring global and national nutrition indicators.	Lack of comprehensive national food and nutrition security data.	A 1.1 Comprehensive assessment of nutritional status (anthropometric, dietary intake and practices, clinical and biochemical data) for all age groups covering key components; through:	1
		To support the implementation and monitoring of the objectives of NPANM III, 2016-2025: To strengthen food and nutrition security.	A 1.1.1. Regular National Health and Morbidity Surveys (NHMS) by Institute of Public Health, National Institute of Health (NIH) Malaysia: <ul style="list-style-type: none"> <li>• NHMS 2021: Maternal and Child Health Survey</li> <li>• NHMS 2022: Adolescent Health</li> <li>• NHMS 2023: NCD and Healthcare Demand</li> <li>• NHMS 2024: Nutrition Survey</li> <li>• NHMS 2025: Communicable Diseases.</li> </ul>	
		To ensure and support nutrition sensitive national food production as stipulated in National Agro Food Policy (DAN) 2.0 (2021-2030).		
			A 1.1.2. National/ large longitudinal studies on priority areas and groups; <ul style="list-style-type: none"> <li>• Malaysian Children Longitudinal Study (from pregnancy until 18 years old)</li> <li>• The Malaysian Health and Adolescent Longitudinal Research Team (MyHeART) Study</li> </ul>	2
			A 1.2 Studies on global and national nutrition parameters/ indicators/ targets; <ul style="list-style-type: none"> <li>• Sustainable Development Goals (SDG) 2030 <ul style="list-style-type: none"> <li>○ Anaemia among children among 6.0-59.9 months</li> <li>○ Undernourishment status among population</li> </ul> </li> </ul>	1

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
			<ul style="list-style-type: none"> <li>• Global Nutrition Target (GNT) 2025</li> <li>• National Plan of Action for Nutrition of Malaysia (NPANM) III, 2016-2025.</li> </ul>	
A 2. Food and nutrition security among vulnerable groups.	Limited data at national level. In line with NPANM III and Shared Prosperity Vision 2030 and other National Food Security Priority Indicators.		<p>A 2.1 Assessment of food and nutrition security among vulnerable groups by using FIES:</p> <p>A.2.1.1 under-five children</p> <p>A 2.1.2 women of reproductive age.</p> <p>A 2.1.3 elderly.</p> <p>A 2.1.4 indigenous people in Peninsular, Sabah and Sarawak.</p> <p>A 2.1.5 refugees.</p> <p>A 2.1.6 B40 (urban, rural poor).</p> <p>A 2.1.7 people with special needs.</p>	<p>1</p> <p>1</p> <p>2</p> <p>1</p> <p>3</p> <p>1</p> <p>1</p>
A 3. Incorporation of nutrition components into national studies conducted by other agencies.	To optimise other determinants of food and nutrition security via inclusion of nutrition components by the relevant key stakeholders (e.g., social determinants).		<p>A 3.1 Incorporation of selected nutrition components into national studies conducted by various agencies (government or non-government sectors);</p> <ul style="list-style-type: none"> <li>• Household Income and Expenditure Survey (HIES) by Department of Statistics Malaysia (DOSM)</li> <li>• Assessment of Household Dietary Diversity (HDD) at National Level using HDD Scale.</li> <li>• Analysing food security using household survey data.</li> <li>• Food deprivation among vulnerable population using Household Hunger Scale.</li> </ul>	1

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
	A 4. Determination of national foods and nutrition transition over time.	Lack of comprehensive national trend data on food and nutrition transition in Malaysia.  To provide evidence to the relevant stakeholders for policy making and programme planning	A 4.1 Assessment of national foods and nutrition transition over time through food and nutrition surveillance system.	2
			A 4.1.1 National Food Balance Sheet (FBS) to examine trend in food supply and dietary energy supply (DES).	
			A 4.1.2 Household Income and Expenditure Survey (HIES) data to examine changes in food expenditure and affordability.	1
			A 4.1.3 Series of NHMS datasets to measure secular trend in food and nutrition indicators.	1
			A 4.2 Determination of changes on dietary patterns and behaviours including measuring shifts to ultra-processed food.	1
	A 5. Strengthening methods for population-based assessment of nutritional status/ biomarkers.	High reliance on self-reports.  The baseline data important for need assessment and decision making process (policies and programmes).	A 5.1 Development of feasible and reliable methods for population-based assessment of: <ul style="list-style-type: none"> <li>● dietary intake</li> <li>● physical activity</li> <li>● micronutrient status.</li> </ul>	2
			A 5.2 Harnessing technology for timely data collection, processing and reporting (i.e., electronic FFQ).	1
B. To strengthen evaluation of the existing national food and nutrition programmes.	B 1. Evaluation on the existing national nutrition programmes of Ministry of Health (MOH).	Limited data on the effectiveness of national nutrition programmes.  Ensuring proper implementation, coordination, monitoring and evaluation of programmes and projects.	B 1.1 National evaluation on the effectiveness of the Baby Friendly Hospital Initiative (launched in 1992).	1
			B 1.2 National evaluation on the effectiveness of the Baby Friendly Clinic Initiative.	1
			B 1.3 National evaluation on the effectiveness of the iron and folate supplementation to combat iron deficiency anaemia among pregnant mothers.	1

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
			B 1.4 Evaluation on the effectiveness of the universal salt iodisation to eradicate Iodine Deficiency Disorder (IDD).	1
			B 1.5 National evaluation on meeting Malaysian dietary guidelines following the Malaysian Food Pyramid 2020 and Malaysian Healthy Plate (SSS) 2020.	1
	B 2. Evaluation on the existing national nutrition programmes by other ministries.	Limited data on the effectiveness of national nutrition programmes.  Ensuring proper implementation, coordination, monitoring and evaluation of programmes and projects.	B 2.1 Evaluation on the effectiveness of national programme such as School Meal Programme ( <i>Program Hidangan Berkhasiat di Sekolah, HiTS</i> ).  B 2.2 Evaluation of food-related social safety net programme (e.g., Food Bank, MyKasih).	1  2
			B 2.3 Evaluation of urban farming to promote diet quality in households and community by Department of Agriculture.	2
	B 3. Evaluation on the existing national nutrition programmes for private sectors.	Limited data on the effectiveness of national nutrition programmes.  Ensuring proper implementation, coordination, monitoring and evaluation of programmes and projects.	B 3.1 Evaluation on the awareness and effectiveness of voluntary Front of Pack Labelling (FOP) including Healthier Choice Logo (HCL).  B 3.2 Evaluation on the effectiveness of Sugar Sweetened Beverages (SSB) Tax.	1  1
C. To identify determinants, causes and outcome of food and nutrition security status.	C 1. Determination of the factors/ causes affecting food and nutrition security status.	Limited national data on factors/ causes affecting food and nutrition security status.  To achieve SDG goal to end hunger (SDG 2.1.1 & 2.1.2) by 2030 and align with shared prosperity vision	C 1.1 Causes / factors contributing to food insecurity (availability, accessibility, utilization and stability) and the coping strategies among vulnerable groups;  ● under-five children ● women of reproductive age ● elderly ● indigenous people in Peninsular, Sabah and Sarawak	1

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
		of the <i>Wawasan Kemakmuran Bersama 2030</i> .	<ul style="list-style-type: none"> <li>● refugees</li> <li>● B40 (urban, rural poor)</li> <li>● people with special needs.</li> </ul>	
			<p>C 1.2 Causes/ factors contributing to specific national nutrition issues in the country;</p> <ul style="list-style-type: none"> <li>● stunting among under-five children</li> <li>● anaemia among women of reproductive age</li> <li>● childhood obesity</li> <li>● diet-related non-communicable diseases (e.g., diabetes, hypertension)</li> <li>● inadequate micronutrient intake (e.g., calcium, iron, iodine).</li> </ul>	1
			<p>C 1.3 Multidimensional determinants contributing to unhealthy dietary practices in targeted groups, including;</p> <ul style="list-style-type: none"> <li>● individual and family</li> <li>● community and society</li> <li>● social environment</li> <li>● cultural and food environment</li> <li>● spiritual factors</li> <li>● law and regulation.</li> </ul>	1
	C 2. Determination of the outcome/ impact of food and nutrition security.	<p>Lack of information on the outcome or impact of food and nutrition security.</p> <p>To ensure the overall impact of food security, including direct and indirect costs, on the nutritional well-being of the Malaysian population.</p>	<p>C 2.1 Assessment of outcome/ impact of nutrition and food security;</p> <ul style="list-style-type: none"> <li>● obesity, eating behaviour, nutritional status</li> <li>● cost benefit analysis</li> <li>● quality of life</li> <li>● morbidity and mortality.</li> </ul>	1

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
	C3. Assessment on the impact of pandemic outbreaks/ disaster on food security and nutritional status	<p>The crucial of assessing the outcome or impact of pandemic outbreaks/ disaster on food security and nutritional status.</p> <p>This scientific evidence is intended to enlighten and contribute to the development of comprehensive and integrated Food and Nutrition in Emergency Guidelines</p>	The impact of pandemic outbreaks on the nutrition situation in the country (e.g., nutritional status, food consumption, food supply chain, agriculture landscape, food prices/ trade and food environment/ availability).	1

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RESEARCH PRIORITY

# AREA 3

LIFE COURSE APPROACH  
TO FOOD INTAKE AND  
DIETARY PRACTICES



## RESEARCH PRIORITY AREA 3

### LIFE COURSE APPROACH TO FOOD INTAKE AND DIETARY PRACTICES

#### 3.1 Introduction

Globally, the rapid urbanisation, economic growth and modernization, particularly in the low- and middle-income countries (LMICs), have brought remarkable changes in population dietary, physical activity and inactivity patterns. These changes are very much related to nutrition transition that is characterized by the shift from traditional to Western-style diets that are more energy-dense alongside an increasingly sedentary lifestyle. Technology, urbanisation, income per capita or general economic welfare, and expansion of global trade are the four main underlying factors for the observed shifts in the present human diet and activity patterns (Popkin, 2015). The consequent shift in body composition is inevitable and has led to increasing prevalence of obesity-related chronic diseases, particularly cardiovascular diseases and diabetes.

In recent decades, Malaysia has experienced rapid demographic, economic and nutrition transitions that have generated marked changes in the population food intake and dietary practices. Data from the Food Balance Sheet (1961-2013), showed upward shifts in the amount of available (kg per capita per year) meats/ animal products, sugar and sweeteners as well as vegetable oils. With the current food environment and dietary patterns in Malaysia that favour energy-dense foods and beverages, the increment in the future availability and consumption of these food groups is expected. On the other hand, the population intake of nutrient-dense foods such as fruits, vegetables, milk and dairy products is not meeting the recommendation. The excess energy, sugar and fat as well as inadequate essential vitamins and minerals in the diets could put the population at risk of double-burden of malnutrition and subsequent diet-related non-communicable diseases.

The Malaysian Adult Nutrition Survey (MANS, 2003 & 2014) showed increasing trends in mean intakes of protein (2003: 74.0 g; 2014: 81.0 g) and fats (2003: 64.0 g; 2014: 70.0 g) but a decreasing trend in carbohydrate intake (2003: 288 g; 2014: 273 g) (Ahmad Ali et al., 2019). The MANS 2014 also reported that only 41%, 18% and 26% adults ( $\geq 18$  years) consumed the recommended servings/day for fruits, vegetables and milk/ dairy products, respectively (IPH, 2014). The recent National Health and Morbidity Survey 2019 reported that majority of Malaysian adults (94.9%) did not consume adequate fruit and/ or vegetables daily (IPH, 2020). The survey also showed that young adults aged 18-19 years (98.9%) had the highest prevalence of inadequate fruit and/ or vegetable intake. Similarly, for the elderly population of 50-59 years and 60+ years (IPH, 2019), only about one tenth met the recommendations for fruits (10-13%) and vegetables (10-12%). Shahar et al. (2019) reported that low dietary fibre and protein intakes were associated with lower socioeconomic status among urban older adults while among rural older adults, lower socioeconomic status was an important determinant of inadequate dietary fibre and fruit intakes. The overall current dietary patterns of Malaysian adults, particularly in relation to fats, protein, sugar, fruits and vegetables, dietary fibre, sodium and other essential micronutrients are in tandem with the rising trend of obesity and other diet-related chronic diseases in Malaysia.

Based on the Malaysian Adolescent Nutrition Survey 2017, majority of adolescents (10-17 years) did not meet the recommended intakes for fruits (69%), vegetables (92%) and milk/ dairy products (73%) and vitamin D (98.9%) (IPH, 2017). Compared to the Malaysian School-based Nutrition Survey 2012, there were increments in median intakes of energy, cholesterol and sugar (IPH, 2013). Similarly, MyHeARTs Study reported that adolescents in rural schools had higher intakes of energy and cholesterol compared to adolescents in urban schools. The study also showed that rural obese adolescents were more likely than their urban counterparts to have higher energy and sugar intakes. Generally, the intakes of Vitamin D and calcium were inadequate among male and female adolescents in the study (Abdul Majid et al., 2016). A nation-wide nutrition survey (SEANUTS Malaysia) of Malaysian children (6 months to 12 years) showed that more than one-third of the children did not meet the recommendation for energy, calcium and vitamin D (Poh et al., 2013).

The study also showed that majority of children aged 7-9 years (94.5%) and 10-12 years (96.3%) did not meet the Malaysian Dietary Guideline (MDG) for milk/ dairy products per day (Koo et al. 2016). A study among urban children aged 1-10 years across all socio-economic groups reported that generally children did not have adequate intake of dietary fibre but excess sodium intake, particularly among pre-schoolers and school-age children. Except for milk and dairy products, all age groups had mean intakes of food groups below the recommended servings. Additionally, children from low income households had higher proportions not meeting energy and nutrient recommendations compared to those from middle and high income groups (Zalilah et al., 2015).

The role of nutrition across the life course has been recognised as a cornerstone of sustainable health. Nutritional status trends over the years serve as an indicator of the health status of the population. Generally, in the span of ten years, while overweight and obesity are gradually increasing across all age groups, undernutrition still prevails. The NHMS 2019 reported that the prevalence of underweight, stunting, thinness and obesity among children aged less than 5-17 years was 15.4%, 12.7%, 10.0% and 14.8% respectively. Among adults ( $\geq 18$  years), 30.4% were overweight and 19.7% obese (IPH, 2020) while for the elderly ( $\geq 50$  years), the prevalence of overweight (39.4%) and obesity (22.8%) is relatively higher (IPH, 2018). The Maternal and Child Health Survey 2016 showed that 13.7%, 20.7%, 11.5% and 6.4% of children below 5 years were underweight, stunted, wasted and overweight, respectively (IPH, 2016). In adolescents (10-17 years), the prevalence of stunting (8.2%) and thinness (6.6%) were relatively lower than overweight (15.6%) and obesity (14.8%) (IPH, 2017).

Recognizing the interdependence of health and development, Malaysia should align its policy and action towards achieving the goals and indicators of the Sustainable Development Goals (SDGs) adopted by the United Nations Summit in September 2015. Specifically, in the context of addressing food intake and dietary practices towards better health and nutrition, the Zero Hunger (Goal 2) and Good Health and Well-being (Goal 3) goals should be monitored. The indicators of these two goals namely, the prevalence of undernourishment and prevalence of food insecurity and hunger in the population (Goal 2), as well as the indicators of at-risk nutritional status and diet-related non-communicable diseases among children, adolescents, elderly and vulnerable groups (Goal 3) will be addressed in this NRP Area.

### 3.2 Conceptual Framework on the Purpose and Scope of the Research Priority Area

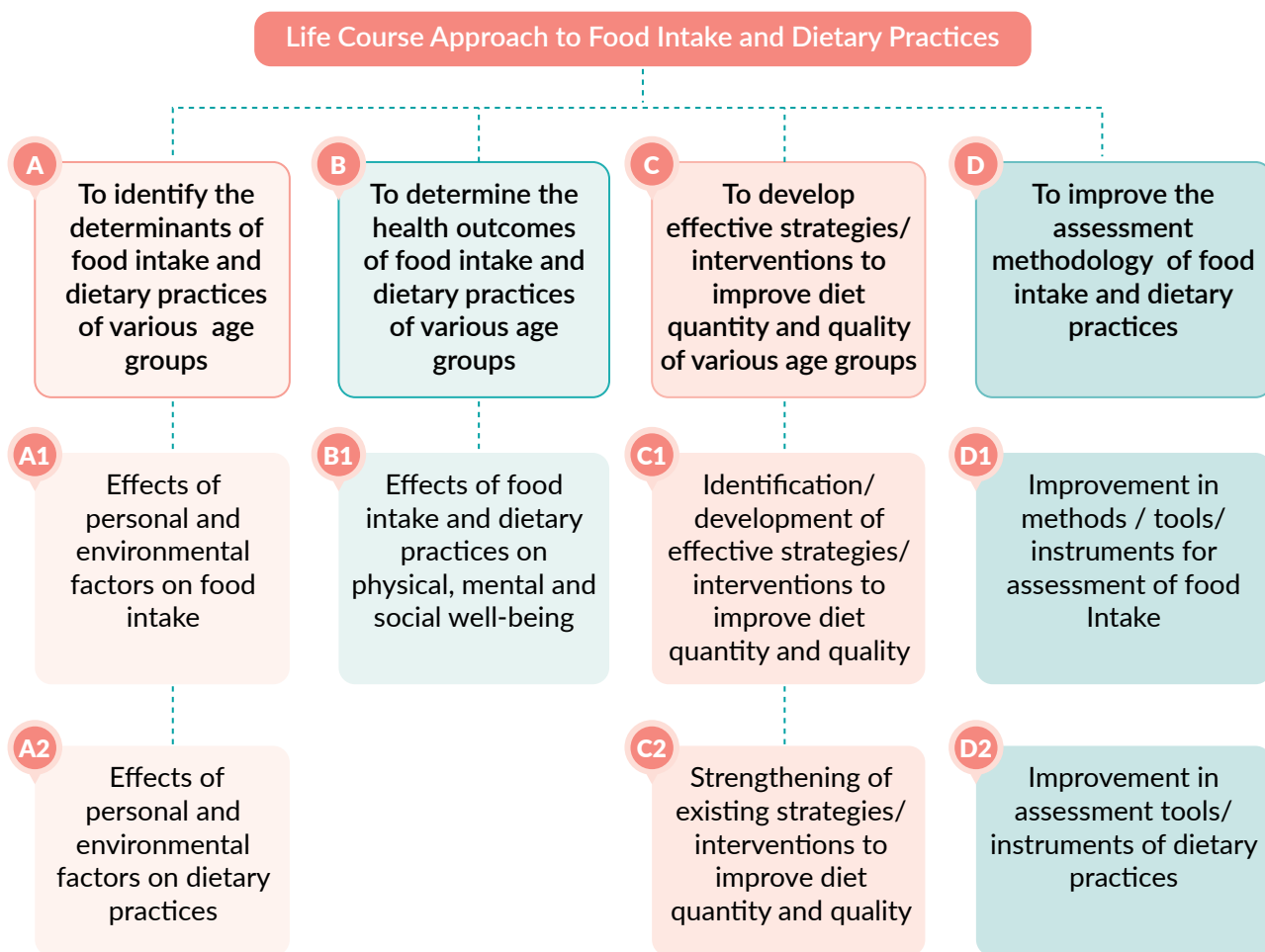


Figure 3.1. Purpose and scope of life course food intake and dietary practices

### 3.3 Table of Nutrition Research Priority Area

This NRP Area is presented in two tables. Table 3.1 presents the list of suggested topics. Appendix 3 presents the ranking criteria for the suggested topics in each research scope of this NRP Area.

The framework for the purpose and scope for this NRP Area is shown in Figure 3.1. The first focus is on identifying the determinants of food intake and dietary practices of various age groups. As individual response to diet is subject to personal and environmental (social, physical and cultural) factors, variability in quantity and quality of diet is inevitable. More research is warranted to better understand the complex role of these factors in driving the population dietary practices and subsequent food intake.

The second focus of this NRP Area is on determining the health outcomes of food intake and dietary practices in various age groups. Dietary habits established in early childhood could track into adolescence and adulthood and impact the physical, social and mental well-being in later life. Of concern is excess intake of sugar, salt, fats coupled with low intake of fruits and vegetables in the population. At present, there are limited studies in Malaysia on the effects of food intake and dietary practices on short-term and long-term nutrition and health status.

Developing effective strategies/ interventions to improve diet quantity and diet quality is another focus of the NRP Area. Such strategies/ interventions should address the specific needs of various life stage, socioeconomic and community groups. To keep up with technological advances, strategies/ interventions should also employ available technology to reach the target groups. Several interventions have been carried out by government agencies but their effectiveness have not been evaluated. More research on innovative and effective strategies/ interventions that are tailored to the target groups is needed.

The final focus of this NRP Area is to improve the assessment methodology of food intake and dietary practices. New developments and improvements in the assessment methods, tools and instruments pertaining to food intake and dietary practices are imperative to ensure the validity and reliability of dietary information. Only then, such information can be the basis for policy and action towards improving diets, nutrition and health of the population.

### Research Priority Area 3: Life Course Approach to Food Intake and Dietary Practices

**Table 3.1:** List of suggested topics in each research scope

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
A. To identify the determinants of food intake and dietary practices of various age groups.	A 1. Effects of personal and environmental factors on food intake.	Although studies are available on the role of personal and environmental factors on diet quantity and diet quality, the available information is restricted to only certain aspects of the personal and environmental factors and diet quantity or quality.	A 1.1 Effects of personal and environmental factors on diet quantity (nutrients, energy, food serving).	1
			A 1.2 Effects of personal and environmental factors on diet quality (dietary pattern, dietary diversity).	1
			A 1.3 Effects of emergency situation (e.g., flood, epidemic of infection diseases) on diet quantity and diet quality.	1
	A 2. Effects of personal and environmental factors on dietary practices.	Lack of information on the influence of personal and environmental factors towards eating out, late night eating practices, fast/ convenient/ restaurants/ hawkers food, food truck and food delivery.	A 2.1 Personal and environmental factors influencing eating out and late night eating.	1
			A 2.2 Personal and environmental factors influencing intake of fast/ convenient/ restaurants/ hawkers food, food truck and food delivery.	1
			A.2.3 Effects of emergency situation (e.g., flood, drought, infectious diseases) on dietary practices (e.g., unhealthy eating habit/ practice - compulsive over eating or under eating, food rationing, meal pacing).	1
B. To determine the health outcomes of food intake and dietary practices of various age groups.	B 1. Effects of food intake and dietary practices on physical, mental and social well-being.	Limited information/ studies on the effects of food intake and dietary practices on short-term and long-term nutrition and health status.	B 1.1 Effects of early childhood food intake and dietary practices on morbidity and mortality.	2

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
			B 1.2 Effects of early childhood food intake and dietary practices on stunting.	1
			B 1.3 Effects of early childhood food intake and dietary practices on NCD risk.	1
C. To develop effective strategies/ interventions to improve diet quantity and quality of various age group.	C 1. Identification/ development of effective strategies/ interventions to improve diet quantity and quality.	More information on effective strategies/ interventions that are tailored to the specific needs of life stage/ socioeconomic/ community groups is needed.	C 1.1 Identification/ development of strategies/ interventions to improve diet quantity and quality of children and adolescents.	3
			C 1.2 Identification/ development of strategies/ interventions to improve diet quantity and quality of elderly.	3
			C 1.3 Identification/ development of strategies/ interventions to improve diet quantity and quality of vulnerable groups (e.g., Orang Asli, B40, orphan).	3
			C 1.5 Identification/ development of community empowerment strategies in promoting healthy eating; <ul style="list-style-type: none"> <li>● to promote milk, fruits and vegetables consumption,</li> <li>● to reduce intake of salt , sugar and fat.</li> </ul>	1
			C 1.6 Identification/ development of age-specific innovative and interactive tools to promote healthy eating.	1



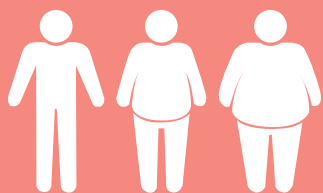
Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
			C 1.7 Identification/ development of effective delivery strategy of nutrition programs/ interventions by healthcare professionals to targeted population.	2
	C 2. Strengthening of existing strategies/ interventions to improve diet quantity and quality.	Limited information on evaluation of existing nutrition strategies/ interventions aimed to address diet quantity and quality.	C 2.1 Evaluation on the impact of nutrition components into 'edible garden project' (community, school, household).	3
			C 2.2 Evaluation on the impact of school food environment (school canteen, food outside school area).	1
			C 2.3 Evaluation on the impact of nutrition campaigns (e.g., <i>Suku Suku Separuh</i> ).	2
			C 2.4 Evaluation on the impact of school meal programmes.	2
			C 2.5 Evaluation on the delivery platform/ mode of nutrition education (digital based, social media, printed materials).	2
D. To improve the assessment methodology of food intake and dietary practices.	D 1. Improvement in methods/ tools/ instruments for assessment of food Intake.	Validated methods/ tools/ instruments are needed to improve food intake assessment.	D 1.1 Development/ adoption/ modification and validation of methods/ tools/ instruments to assess food intake.	1
	D 2. Improvement in assessment tools/ instruments of dietary practices.	Validated tools/ instruments are needed for assessment of dietary practices.	D 2.1 Development of tools/ instruments for assessment of dietary practices (e.g., perception, beliefs, values, attitude, barriers).	1

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
			D 2.2 Validation of tools/ instruments for assessment of dietary practices (e.g., perception, beliefs, values, attitude, barriers).	2

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RESEARCH PRIORITY

# AREA 4

NUTRITIONAL  
DEFICIENCIES AND  
EXCESSES



## RESEARCH PRIORITY AREA 4

### NUTRITIONAL DEFICIENCIES AND EXCESSES

#### 4.1 Introduction

The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. The second goal in the Sustainable Development Goals (SDGs) is “zero hunger” (United Nations, 2015). The goal of ending hunger involves a broad definition of hunger, including calorie deficiencies (chronic hunger), micronutrient deficiencies (hidden hunger) and their related health problems. Malnutrition, both under- and over nutrition are still very much prevalent in Malaysia. Data on overweight and obesity among children and adults are on the rise (IPH, 2020). At the other spectrum, the problem with protein-energy malnutrition and micronutrient deficiency still exist throughout the various populations in Malaysia (Khalili Rohin et al., 2018; Nik Shanita et al., 2018; Poh et al., 2016; Yusof et al., 2018).

Weight and height are used as indicators to assess and monitor children’s nutritional status. Growth monitoring of young children is an important responsibility of the health and nutrition division. When growth falters the child can become underweight or under height (stunting) or both. Ongoing data collection on weight-for-age, height-for-age, weight-for-height and body mass index (BMI), where these indices are used to classify underweight, stunting, overweight and obesity in adults.

Data from the Global Nutrition Report 2020 (GNR, 2020), revealed that in Malaysia, 20.7 % of children under five suffer from stunting and 11.5 % from wasting, 6.0 % from overweight, and State of the World’s Children 2019 (UNICEF, 2019) showed that 12.7 % of children (5–19-year-olds) are obese. Our under five wasting rates fared poorly as it is higher than the developing country’s average of 8.9%, while our children’s (5-19) obesity rate is ahead of our ASEAN neighbours. What is shocking is that stunting happened in almost a quarter of all under five children in the country. In 1999, the stunting rate was 20.7% and went down gradually; however, it resurged back to 20.7% in 2015. The under-5 coexistence of wasting, stunting and overweight is a challenge for nutrition researchers to unravel.

Although some progress was made in reducing problems related to hunger, however, much more need to be done, and it remains a global challenge (Allen & de Brauw, 2018; FAO et al., 2017). In Malaysia, programmes and activities targeted to mothers, children and specific population are planned and executed to address nutritional issues affecting this vulnerable group (NCCFN, 2016). Deficiencies of essential micronutrients could lead to damaging and sometimes irreversible effects on physical growth, immunological function and cognitive maturation. These include congenital disabilities, blindness, as well as decreased school and work performance (Downs, 2016). Beside physical and health impact, there are also economic impacts of micronutrient deficiency such as less educational attainment, diminished work capacity, and lower lifetime earning potential (Black et al., 2013; Campisi, Cherian & Bhutta, 2017).

After various decades, micronutrient deficiencies such as iron, iodine and mild subclinical vitamin A deficiency continue to persist in Malaysia especially among children, women of reproductive age, elderly and the Orang Asli (NCCFN, 2016; Wan Manan, Jomo & Tan, 2019). Anaemia is one of the most frequently reported conditions related to micronutrient deficiency, affecting 43% of children, 38% of pregnant women and 29% of non-pregnant women worldwide (WHO, 2015). The most common cause of anaemia is iron deficiency (~50% of cases). In Malaysia, prevalence of anaemia among children ranged from 4% to 27.1% (Murtaza et al., 2019; Nik Shanita et al., 2018), female vegetarians was 28.2% (Chai et al., 2019), pregnant women ranged from 19.3% to 35% (Haniff et al., 2007; IPH, 2016; Tan et al., 2013), the elderly was 35.3% (Yusof et al., 2018). Other nutritional factors implicated in the development of anaemia include deficiencies in vitamin A, vitamin B12,

folate and riboflavin (WHO, 2015). Besides, other micronutrients such as riboflavin, folate, vitamin B12, zinc and vitamin D deficiency are on the rise. Vitamin B2 (riboflavin), folate and sub-marginal vitamin B12 deficiency were found among Malaysian women (Aljaadi et al., 2019). As for vitamin D deficiency, it was found in various population group including children, pregnant women and elderly (Jan Mohamed et al., 2014; Mat et al., 2018; Palaniveloo et al., 2020; Poh et al., 2013; Woon et al., 2019). Iodine status among pregnant women in Sabah, Malaysia showed that the prevalence of goitre was 1.0% and nearly two-thirds of the women (60%) having a median urinary iodine concentrations of < 150 µg/L indicating insufficient (Lim et al., 2017). Among children 8-10 years old, the national prevalence of iodine deficiency disorders (IDD) with UI < 100 µg/L was 48.2% and the total goitre rate (grade 1 and grade 2 goitre) was 2.1% (Selamat et al., 2010).

As for macronutrient, the problem of excesses surpasses the problem of inadequate. A review study by Shahar et al. (2018) suggests that Malaysian adults aged 19 to 59 years tend to meet or (more frequently) exceed Malaysian RNI guidelines for protein and fat. Excess of macronutrients is an important risk factor for obesity and disease especially non-communicable diseases (NCDs). A recent study by Balasubramanian et al. (2020) concluded that habitual consumption of the SSB pattern (high intake of sugar-sweetened beverages) was associated with high cardio metabolic risk profile. Another study by Emi et al. (2020) found that dietary pattern characterized by food intakes high in free sugars and energy density was associated with elevated lipid profiles, particularly cholesterol and LDL-C levels among adolescents aged 13 years in Malaysia. The high prevalence of stunting problem among Malaysian children (21.8%) highlighted the importance of getting enough of both macro and micronutrients in the diet (IPH, 2020). Various studies showed that stunting could be contributed by maternal and child malnutrition and the timing and effect of malnutrition especially during the first 1000 days is very crucial (Goudet et al., 2019).



## 4.2 Conceptual Framework on the Purpose and Scope of the Research Priority Area

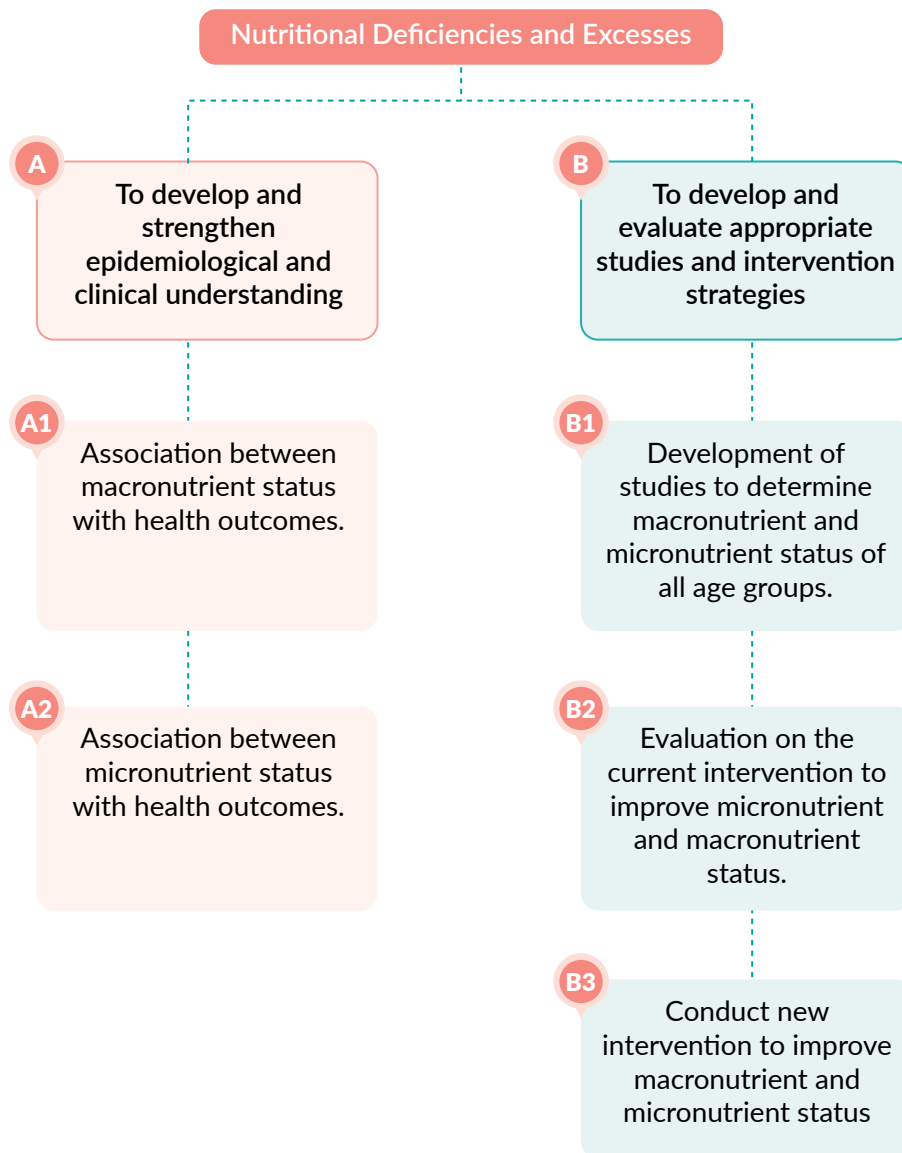


Figure 4.1. Purpose and scope of nutritional and deficiencies and excesses

### 4.3 Table of Nutrition Research Priority Area

This NRP Area is presented in two tables. Table 4.1 presents the list of suggested topics. Appendix 4 presents the ranking criteria for the suggested topics in each research scope of this NRP Area.

Nutrients are the main components required for the maintenance of an individual health. Balance intake of foods containing macronutrients and high intake of foods with micronutrients, particularly vegetables and fruits would give many benefits to an individual health which eventually prolonged their life. Contradictory, deficiencies or excesses of nutrient intake have been related to many adverse health outcomes. Despite of many foreign studies have reported the association between macronutrients status, and micronutrients status with health outcomes, the data among Malaysians are still scarce and the related clinical factors are still need to be elucidated. There are currently many grey areas of macronutrients/ micronutrients research priority areas that need to be explored including the role of macronutrients in non-communicable diseases and malnutrition not just in adults but all life cycle.

There are two purposes for the research to be conducted in Area 4 which include to develop and strengthen epidemiological and clinical understanding and to develop and evaluate appropriate studies and intervention strategies. The suggested research scopes are related to the intake and status, health outcomes and intervention of macronutrients and micronutrients of all age groups. We have also prioritized the need for evaluation of the current intervention and conducting a new intervention to improve macronutrients and micronutrients status. Specific groups including *Orang Asli*, urban poor (B40) and women at reproductive age are also included as the target population for future study in this area. We have suggested the intervention to improve dietary fibre intake and to reduce sugar intake as part of the strategy to reduce the prevalence of non-communicable diseases in Malaysia. The list of selected macronutrients and micronutrients were based on the lack of studies involving these nutrients, although these nutrients are known to be essential for human health. We have also suggested the application of digital technology as a way forward to improve macronutrients and micronutrient intake of all age groups.

Therefore, it is important for conducting studies in these areas in order to develop and strengthen epidemiological and clinical understanding of the role of macronutrients/ micronutrients on health of Malaysians which eventually could lead to provide data in order to develop policies and nutritional programmes to combat macronutrient/ micronutrients deficiencies and excesses among Malaysians.

## Research Priority Area 4: Nutritional Deficiencies and Excesses

Table 4.1: List of suggested topics in each research scope

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
A. To develop and strengthen epidemiological and clinical understanding.	A 1. Association between macronutrient* status with health outcomes.  *Macronutrient: Carbohydrate Protein Fat	Lack of data for policy and programmes.	A 1.1 Association between macronutrient intake and health outcomes (e.g., NCD, malnutrition) among various age groups.	2
	A 2. Association between micronutrient* status with health outcomes.  *Micronutrient: Vitamin A Vitamin D Vitamin B1 Vitamin B2 Vitamin B12 Folate Iron Iodine Zinc Selenium Calcium Chromium Sodium Potassium	Lack of data for policy and programmes.	A 2.1 Association between selected micronutrient intake and health outcomes (e.g., anaemia, NTD, cognitive impairment and IQ, growth retardation, bone mineral density, obesity, diabetes, stunting and infectious disease) among various age groups	1
B. To develop and evaluate appropriate studies and intervention strategies.	B 1. Development of studies to determine macronutrient* and micronutrient** status of all age groups.  *Macronutrient: Carbohydrate Protein Fat  **Micronutrient: Vitamin A Folate Vitamin B12 Vitamin C Vitamin D	Lack of data on suggested nutrient status in vulnerable groups.	B 1.1 Studies on suggested micronutrient status among specific groups (e.g., Orang Asli, Urban Poor, B40).	2
		Lack of data on food product enriched or fortified with micronutrient.	B 1.2 Studies to investigate the intake and status of macronutrient and micronutrient among children <5 years old.	1

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
	Iron Calcium Zink Iodine Selenium Chromium Potassium		B 1.3 Studies to investigate the intake and status of iron and/ or folic acid among women of reproductive age (WRA).	4
			B 1.4 Studies to investigate the intake of macro and micronutrient among older adults (Urban poor, B40).	3
			B 1.5 Assessment on the intake of enriched and fortified food product.	5
	B 2. Evaluation on the current intervention to improve micronutrient* and macronutrient** status.	Lacking data on hematinic supplementation in pregnancy: 1. Compliance by mothers 2. Cost effectiveness of supplementation programme.	B 2.1 Profiling the iron deficiency anaemia risk factor characteristics among pregnant women.	2
	*Micronutrient: Folic acid Iron Vitamin C Vitamin B complex (hematinics)		B 2.2 Comparison of cost effectiveness study of combination and single dose iron supplementation among pregnant women.	3
	*Micronutrient: Iodine			
	**Macronutrient: Carbohydrate Protein Fat			
		Increasing findings of congenital hypothyroidism in infants in Peninsular Malaysia. Lacking data on maternal iodine status.	B 2.3 Evaluation on the effectiveness of salt iodisation intervention (usage, handling, storage, toxicity, health impact).	1
		Universal Salt Iodization (USI) will be enforced starting September 2020. Evaluation studies on the impact of USI is needed		

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
		Food supplementation (macronutrient) among targeted group.	B 2.4 Effectiveness of food supplementation intervention among targeted group (poor and hard core poor).	4
	B 3. Conduct new intervention to improve macronutrient* and micronutrient** status.	Double burden of malnutrition on the rise. Lack of data on specific micronutrient and the impact to the health outcome.	B 3.1 Protein, calcium, vitamin D, and iodine rich food intervention for growth and development of under 5 years old children.	1
	*Macronutrient: Carbohydrate Protein Fat		B 3.2 Intervention study to improve dietary fibre intake.	4
	**Micronutrient: Vitamin A Folate Vitamin B12 Vitamin C Vitamin D Iron Calcium Zink Iodine Selenium Chromium Potassium		B 3.3 Intervention study to reduce sugar consumption.	3
			B 3.4 Nutrition intervention on weekly iron and acid folic supplementation among women of reproductive age (WRA).	2
			B 3.5 Nutrition intervention on fortified food products/ multiple micronutrient powders (MNPs) among under five years old malnourished children.	4
			B 3.6 Usage of digital technology to achieve optimum macro and micronutrient intake among all age group.	5

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RESEARCH PRIORITY

# AREA 5

OVERWEIGHT AND  
OBESITY



## RESEARCH PRIORITY AREA 5 OVERWEIGHT AND OBESITY

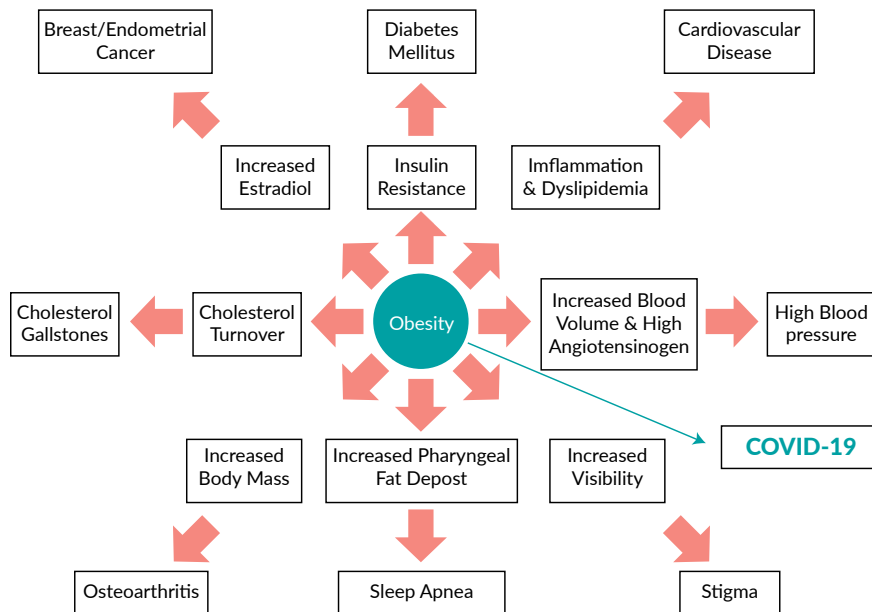
### 5.1 Introduction

Obesity is a chronic relapsing progressive disease process and is widely acknowledged not only as a risk factor for NCDs, but a complex disease linked to and caused by many metabolic and psychological drivers. The escalating pandemics of obesity and sedentary lifestyle leads to much higher risk of premature death and many serious disorders, including diabetes mellitus, hypertension, dyslipidaemia, cardiovascular disease, stroke, gall bladder disease, respiratory dysfunction, gout, osteoarthritis and certain types of cancer as shown in Figure 5.1 (Bray et al., 2017). Obesity also associated with many adverse maternal and foetal effects prenatally, that exerts a negative influence on female fertility (Broughton & Moley, 2017).

Obesity has now been identified as an independent risk factor for severity of illness and death rates due to COVID-19. In recent studies, Cai et al. (2020) reported obese patients in China had increased odds of progressing to severe COVID-19 while Caussy et al. (2020) in France, reported that a significant association between the prevalence of obesity and severe COVID-19, including critical COVID-19, and suggests that obesity might be a risk factor of pejorative evolution of COVID-19, increasing the risk of ICU admission. The percentage of obesity among COVID-19 patients that were admitted to intensive care units (ICU) or under invasive mechanical ventilation (IMV) was higher than those who did not (Barrasa, et al., 2020; Simonnet, et al., 2020). How obesity impacts the pathogenesis of COVID-19 may be characterized by alterations in inflammation, immunity, lipofibroblasts and pulmonary fibrosis, glucose metabolism, and lipid metabolism (Zhu, et al., 2020).

Various immune cells functions can change in obese patients, which will alter the immune system. Results from laboratory studies indicated that the number of lymphocytes including CD4+ T cells, CD8+ T cells, B cells, and natural killer (NK) cells were strikingly reduced in COVID-19 patients (Wang, et al, 2020). Obesity has been shown to compromise both T and B cell responses, therefore impedes the adaptive immune response to infection (Green & Beck, 2017). Thus, the depleted immune system in obese patients can lead to higher viral load, rapid viral replication and spreading (Zhu, et al., 2020).

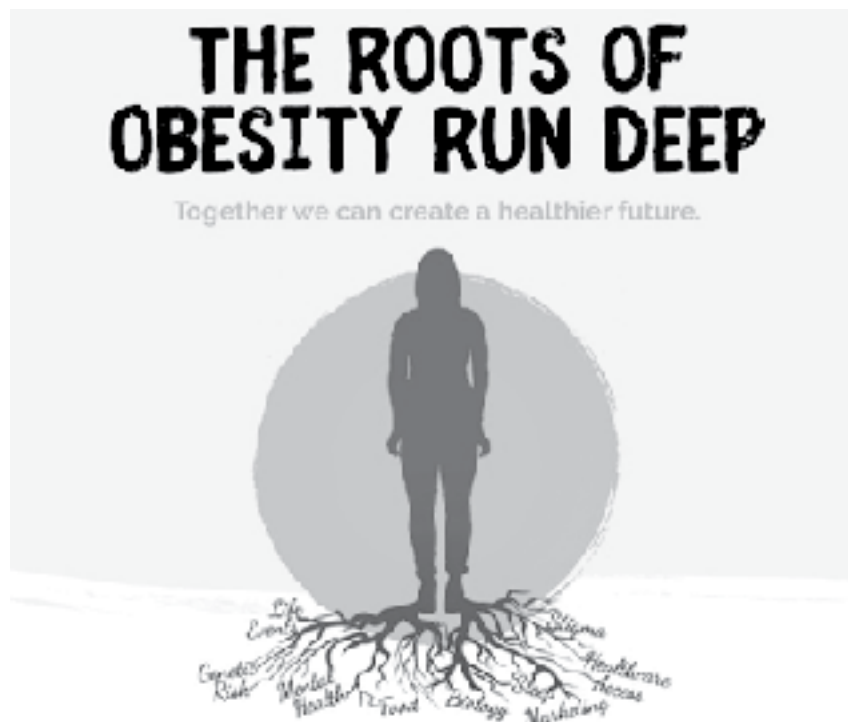
Therefore, there is a need for more evidence-based data on pathophysiological processes in relation to nutrition through strategic research and clinical data mining to elucidate the role of obesity in COVID-19 subjects.



Source: Modified from Bray et al., 2017

**Figure 5.1.** A model showing the relation of obesity in the centre and the diseases with which it is associated (Bray et al., 2017)

People with obesity are constantly shamed and blamed for their disease. This is because many people including doctors, policy makers and others do not understand that obesity is a chronic disease. The roots of obesity of obesity run deep (Figure 5.2), World Obesity Day 2020 (WOF, 2020a). Furthermore, people with obesity commonly face a pervasive, resilient form of social stigma (Rubino et al., 2020).



Source: Tackling Obesity report Foresight, 2007

**Figure 5.2.** The roots of obesity run deep (WOF, 2020a)

An unhealthy weight is often seen as a result of individual choice on diet, exercise and lifestyle. Maintenance of normal weight in the current obesogenic environment is challenging for many individuals. We now know the existence of a complex web of societal and biological factors that have, in recent decades, exposed our inherent human vulnerability to weight gain (Figure 5.3).



Figure 5.3. Obesity system map (Butland et al., 2007)

Obesity caused by unbalanced diet and lack of physical activity, has high socioeconomic and other costs for individuals and families, communities and states; threatens their health and well-being by impacting negatively on human physical and cognitive development; compromises the immune system; increases susceptibility to communicable and non-communicable diseases; and poses heavy burden on societies by restricting the attainment of human potential and reducing productivity. The EIU (2017) report estimated the total (direct and indirect) costs of obesity in Malaysia are between 10% and 19% of national healthcare spending equivalent to US\$1-2 Billion.

The Second National Health Morbidity Survey (NHMS II) in 1996 (IPH, 1998) reported a prevalence of 17% overweight and 4% obesity in adults, while the NHMS III conducted in year 2006 (IPH, 2008) revealed an increase of overweight and obesity to 29% and 14%, respectively. The NHMS 2011 (IPH, 2011) report indicated the prevalence have somewhat stabilised at 29.4% and 15.1%, the NHMS 2015 (IPH, 2015) reported a slight increase 30% overweight and 17.7% obese while the more recent NHMS (IPH, 2020) reported a slight increase to 30.4% and 19.7%, respectively, suggesting that 1 in 2 adult Malaysians are either overweight or obese. The increasing trends reported was aptly described earlier by Ismail et al. (2002) which stated that as Malaysia progresses rapidly towards a developed economy status, the health of its population would likely continue to deteriorate. A recent NHMS 2018 report revealed the prevalence for unhealthy weight status in Malaysian elderly population aged 60 years and above were 37% overweight, 17.6% obesity with 36.4% abdominal obesity (IPH, 2019).

Several nationwide studies were conducted in children between 6 to 12 years old and the combined overweight and obesity prevalence using the WHO (2007) reference BMI-for-Age z-scores guide was 34% (Poh et al., 2013; IPH, 2013). A recent study by Tee et al. (2018) reported the relationship between breakfast consumption and body weight status among primary and secondary school children in Malaysia and found that regular breakfast consumption was associated with a healthier body weight status. As for the Malaysian adolescents aged 13-17 years old, the overall prevalence f

for overweight, and obesity were 15.2%, and 13.3%, respectively (IPH, 2017). Chan et al. (2017) reported the levels and patterns of physical activity (PA) among normal-weight and overweight/obese adults and found the levels of PA were inversely related to the risk of overweight/ obesity in men but not in women.

The conceptual framework consist of three (3) broad purposes and 15 research scopes namely A) to improve understanding on the epidemiology and effect on obesity with 10 research scopes identified, B) to improve effectiveness of intervention and management of obesity with 3 research scopes identified and C) to develop new modalities with 2 research scopes (Figure 5.4).

## 5.2 Conceptual Framework on the Purpose and Scope of the Research Priority Areas

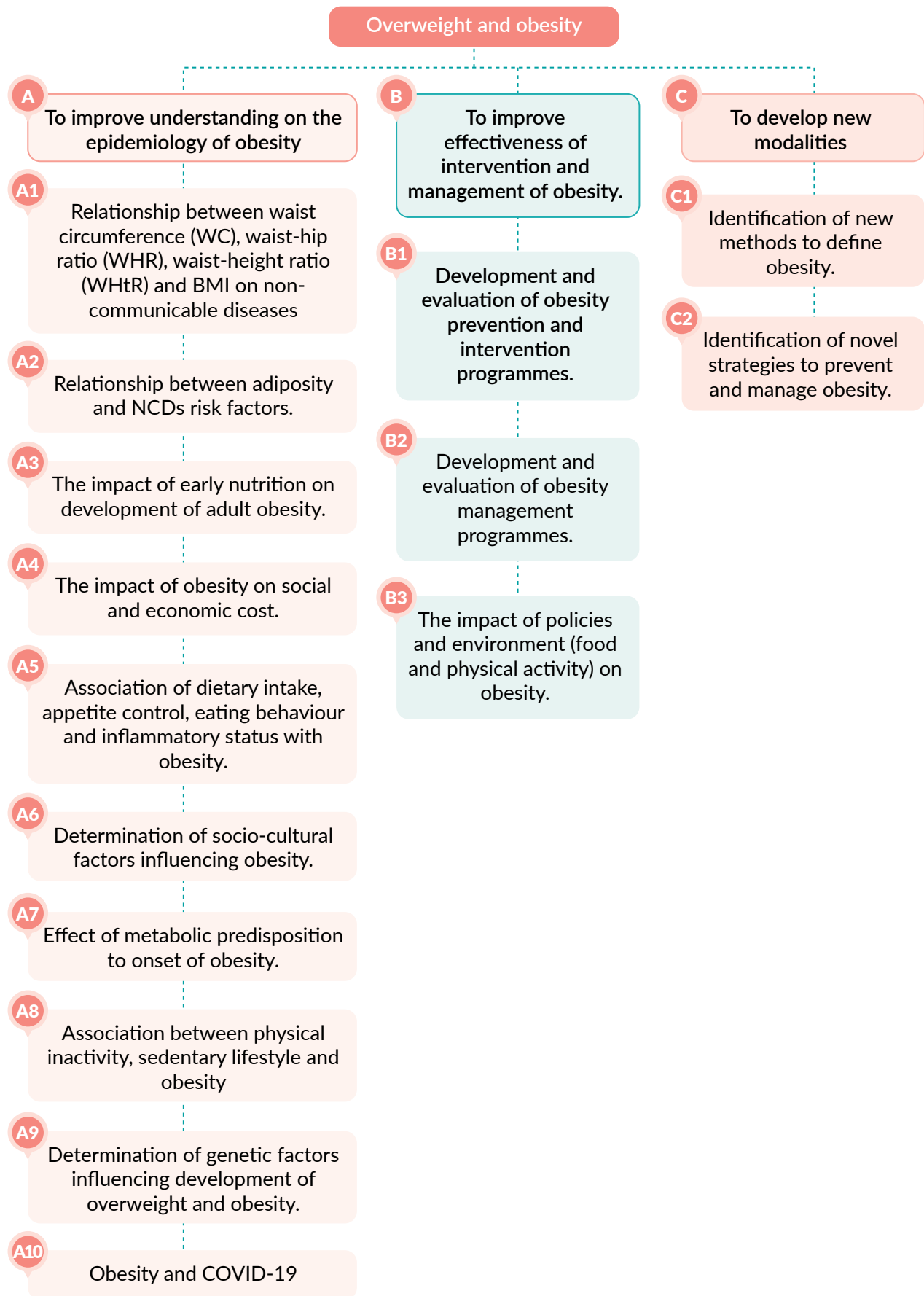


Figure 5.4. Purpose and scope of overweight and obesity

### 5.3 Table of Nutrition Research Priority Area

This NRP Area is presented in two tables. Table 5.1 presents the list of suggested topics. Appendix 5 presents the ranking criteria for the suggested topics in each research scope of this NRP Area.

Obesity as a research topic has attracted great attention in the scientific literature because of both its complex nature and growing societal relevance worldwide. Obesity is a chronic relapsing progressive disease process with a wide range of drivers and determinants. Genetics, biology, healthcare access, mental health, socio-cultural factors, economics, commercial interests, and environmental determinants all play a role in obesity and its rising trend we see today. These determinants interact and compound one another across a number of systems, resulting in the trends globally. Obesity requires systems thinking and interventions to address it (WOF, 2020b). The NPANM III (NCCFN, 2016a) have set a target of no increase in prevalence of overweight and obesity based on NHMS 2015 (IPH, 2015) data for all age groups by the year 2025. This report adopted the purpose and numerous scopes for research (SFR) of the NRP (NCCFN, 2016b) report, having noted its relevance and that over the last five years only a few suggested research topics have been funded despite its public health significance.

The three key purposes are A) to improve understanding on the epidemiology of obesity with 10 research scopes, B) to improve effectiveness of intervention and management of obesity with 3 research scopes and C) to develop new modalities with 2 research scopes (Figure 5.4). All the 15 research scopes identified were reviewed for apparent research gaps, published work done in Malaysia in the last decade and research needs to enable the listing of some 92 research topics. It is imperative that a better understanding of how, why, where and when obesity thrives and how these evidence-based research could support the relevant policies to help reduce the health and economic burden due to obesity in Malaysia.



## Research Priority Area 5: Overweight and Obesity

Table 5.1: List of suggested topics in each research scope

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
A. To improve understanding on the epidemiology of obesity.	A 1. Relationship between waist circumference (WC), waist-hip ratio (WHR), waist-height ratio (WHtR) and BMI on non-communicable diseases (NCDs).	WC is an important indicator of central obesity. Cut-off points for WC of adults, adolescent and children are known, but its relationship with co-morbidities is yet to be identified. WHR and WHtR are other tools to be explored in future studies.	A 1.1 Definition of obesity for Malaysians based on WC.	2
			A 1.2 Cohort study to identify appropriate WC cut-off points, WHR, WHtR and BMI for Malaysians based on co-morbidities.	1
			A 1.3 Association of WHR, WHtR and BMI with non-communicable disease risk factors.	1
	A 2. Relationship between adiposity and NCDs risk factors.	There is lack of sufficient data and the health consequences of higher body fat in Malaysian lacks scientific basis.	A 2.1 Relationship between body composition and morbidity in adult Malaysians.	1
			A 2.2 Relationship between body composition and health risks in children and adolescents.	2
	A 3. The impact of early nutrition on development of adult obesity.	Defining early predictors of obesity in Malaysia is important, as premature age of adiposity rebound and catch-up growth (after foetal, neonatal and infant growth retardation) have repeatedly been shown to be strong determinants of obesity in later life.	A 3.1 Establishment of appropriate growth standard chart from birth to adulthood in order to define the normal age-range for onset of adiposity rebound of healthy children in various ethnic groups in Malaysia (cohort study).	1
			A 3.2 Definition and identification on which paediatric population groups that are at risk of neonatal or post-natal catch-up growth.	2

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
			A 3.3 The relationship between gestational weight gain and breastfeeding practices on the development of obesity.	1
			A 3.4 Obesity in pregnancy: Epidemiology, mechanisms, nutritional and metabolic management.	2
			A 3.5 Preconception weight status of the mother and spouse and the relationship with childhood obesity (cohort study).	2
			A 3.6 Is early-life antibiotic exposure associated with obesity in children.	3
A 4. The impact of obesity on social and economic cost.		Economic costs of obesity are important issues for health care providers and policy makers alike. Effort to quantify the magnitude of economic burden of obesity-related morbidity and mortality is vital to reduce healthcare cost.	A 4.1 The economic and personal health costs of overweight and obesity.	1
			A 4.2 The economic burden of obesity and obesity-related chronic diseases.	1
			A 4.3 Psycho-socio-cultural determinants and quality of life in obese population.	2
A 5. Association of dietary intake, appetite control, eating behaviour and inflammatory status with obesity.		Appetite control studies have never been reported in Malaysia. There is a need to understand the effect of fats, as well as protein, on appetite control regulation.	A 5.1 Effects of proteins and amino acids on appetite control.	4
			A 5.2 Adipokines and other inflammatory markers in the era of paediatric obesity.	4

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
		Eating behaviour especially heavy meal consumption during night-time and dieting may affect energy intake. Psychological mechanisms influencing eating behaviour may help maintain appropriate body weight gain. Improper weight loss methods may lead to yoyo effect on body weight.	A 5.3 Night eating syndrome and its relationship with obesity.	2
			A 5.4 Energy intake regulation among late night eaters.	1
			A 5.5 Identification of psychological mechanisms influencing eating behaviour.	2
			A 5.6 Weight loss methods being practiced by Malaysian population.	3
			A 5.7 Dieting behaviour and body weight status of adolescents and young adults.	5
			A 5.8 The role of diet composition on body weight (relevant food database: sugar, fatty acids, prepared meals/ cooked foods, fast foods, international cuisine).	3
			A 5.9 The role of food addiction for weight control and obesity	2
A 6. Determination of socio-cultural factors influencing obesity.	Public perception of health in relation to obesity influences the success of obesity prevention and management.		A 6.1 Parental perception of childhood obesity.	3
			A 6.2 Food cultures and socio-cultural determinants of food habits (including native minorities).	2
		A 6.3 Socio-cultural determinants of body image.	3	

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
			A 6.4 Inter-disciplinary approach to decision making in food and nutrition (nutrition sociology, anthropology and psychology).	2
			A 6.5 Obesity at workplace, stigmatisation, well-being and productivity (efficacy and follow up).	1
			A 6.6 Understanding babies born small for gestational age (SGA) and its effects on obesity, metabolic syndrome, hypertension, insulin resistance and diabetes.	2
			A 6.7 The effect of obesity on employment discrimination.	1
			A 6.8 Weight stigma as a psychosocial contributor to obesity.	2
A 7. Effect of metabolic predisposition to onset of obesity.		Identification of individuals who are predispose to obesity is important as there is poor prognosis for the success of long-term management of obesity.	A 7.1 Metabolic predisposition to adult-onset of obesity (efficacy and follow up).	1
			A 7.2 Metabolic predisposition to childhood-onset of obesity (efficacy and follow up).	2
A 8. Association between physical inactivity, sedentary lifestyle and obesity.		With the advent of technological advances, Malaysians lead a sedentary lifestyle and consequently higher rates of obesity. There is a need for in depth understanding of the current situation and factors affecting physical inactivity and sedentary lifestyle.	A 8.1 Effect of working hours on opportunity for physical activity and exercise.	1
			A 8.2 Survey of existing physical activity curriculum and co-curriculum	3

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
			programme in schools.	
			A 8.3 Assessment of physical activity and sedentary level using objective methods.	2
			A 8.4 Factors influencing physical activity and sedentary level in older adults and elderly.	1
			A 8.5 Usage of Geographic Information Systems (GIS) to show trends in obesity (including fitness centre, recreational centre and 24 hours food outlet).	1
			A 8.6 Relationship between sleeping pattern and obesity in all age group.	2
			A 8.7 Obesity and the Built Environment (opportunities and barriers).	1
A 9. Determination of genetic factors influencing development of overweight and obesity.	Genes and the environment interact to influence development of overweight and obesity. To date, studies in this area carried out in Malaysia are scarce.		A 9.1 The genetics of childhood obesity.	3
			A 9.2 Determination of heritability of obesity-related phenotypes.	3
			A 9.3 Phenotyping of eating behaviour and food intake.	2
			A 9.4 Salivary epigenetic biomarkers as predictors of emerging childhood obesity.	2
			A 9.5 Understanding food behaviour, eating practices and appetite control	1

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
			among children with genetic/ syndromic obesity.	
A 10. Obesity and COVID-19		Obesity has now been identified as an independent risk factor for severity of illness and death rates due to COVID-19. The scarcity of information regarding the increased risk of illness for people with a higher BMI has led to ambiguity and might increase anxiety, given that these individuals have now been categorized as vulnerable to severe illness if they contract COVID-19. Thus, there is a need for more evidence on pathophysiological aspects through research on some key areas such as adipose tissue biology, comorbidities related to thrombosis and obesity-related respiratory function, altered gut microbiota, immunity and nutrition.	<p>A 10.1 Interaction between RAAS inhibitors and ACE2 in the context of COVID-19.</p> <p>A 10.2 Cytokine storm intervention in the early stages of COVID-19 pneumonia.</p> <p>A 10.3 The role of adipose tissue in viral shedding.</p> <p>A 10.4 Obesity a risk factor for severe COVID-19 infection: thrombosis susceptibility.</p> <p>A 10.5 Obesity-related respiratory function in COVID-19 infection.</p> <p>A 10.6 Risk of mechanical ventilation in obese COVID-19 infection.</p> <p>A 10.7 Altered gut microbiota in obese COVID-19 infection.</p> <p>A 10.8 Obesity-related intestine inflammation in COVID-19 infection.</p> <p>A 10.9 Immune cell perturbation linked to obesity in COVID-19 infection.</p> <p>A 10.10 Future COVID-19 vaccination response in obesity.</p>	<p>1</p> <p>2</p> <p>3</p> <p>2</p> <p>2</p> <p>2</p> <p>2</p> <p>3</p> <p>2</p> <p>2</p>

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
			A 10.11 Phytochemicals influence on gut microbiota and inflammatory diseases (COVID-19) in obese individuals.	2
			A 10.12 Leptin deficiency/ resistance association on dysregulation of cytokine production and susceptibility toward infectious diseases.	2
			A 10.13 Obesity and COVID-19: the role of food and nutrition.	2
B. To improve effectiveness of intervention and management of obesity.	B 1. Development and evaluation of obesity prevention and intervention programmes.	In dealing with inequalities in health status as a fundamental principle of public health, it is necessary to consider the specific issues which make particular groups more vulnerable to weight gain. There is a lack of available model for the prevention and intervention programme for obesity.	B 1.1 Development and evaluation of pre-school and school-based behavioural intervention programmes for the prevention of overweight and obesity in children.	2
			B 1.2 Development, implementation and assessment of the effectiveness of appropriate obesity intervention programmes in adolescents.	2
			B 1.3 Effectiveness of existing nutrition and physical activity curriculum and co-curriculum programme in pre-school and school-going children.	3
			B 1.4 Evaluation of best practices in workplace and institutional settings for obesity prevention and intervention.	2

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
			B 1.5 Effectiveness of existing obesity intervention programmes to reduce prevalence of diabetes, hypertension and cardiovascular disease in community (i.e., KOSPEN initiative, Jom Mama & MyBFF, Suku Suku Separuh & Cergas 3SC).	1
			B 1.6 Effectiveness of park-based obesity prevention and management programme.	3
			B 1.7 Evaluation on the effectiveness of the media campaign to prevent obesity.	2
			B 1.8 Impact of television advertising of foods and beverages high in fat and/ or high in sugar in childhood obesity.	2
			B 1.9 Cost effectiveness of obesity prevention and/ or intervention programmes.	1
B 2. Development and evaluation of obesity management programmes.		Success rate of the various approaches to obesity management is low, and as such there is a need to develop more practical and effective approaches.	B 2.1 Effectiveness of drugs and supplements/ herbs in obesity management.	3
			B 2.2 Development and evaluation of behaviour modification strategies for management of obese adults and children.	2
			B 2.3 Development and evaluation of strategies for promotion of weight	1



Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
			loss and weight maintenance, and prevention of weight regain.	
			B 2.4 Effectiveness of health education in managing obesity and its co-morbidities.	3
	B 3. The impact of policies and environment (food and physical activity) on obesity	There is lack of data on the impact of policies and the environment on obesity. To prevent and manage obesity, governments, food industries, the media, communities and individuals need to work together to modify the environment so that it is less conducive to weight gain.	B 3.1 Determination of political and macro sociological factors that contribute to overweight and obesity in the population.	2
			B 3.2 Evaluation of the feasibility of providing incentives to employees that support healthy eating habits and active lifestyle.	4
			B 3.3 The roles of food industry advertising and broadcasting agencies towards healthy eating and obesity prevention.	1
			B 3.4 The roles of school canteens, cafeteria, restaurants and food service industries (including food-truck) towards healthy eating and obesity prevention.	2
			B 3.5 Effectiveness of food service and restaurant empowerment programme on obesity prevention and management.	3
			B 3.6 The impact of social and built environment on physical inactivity, sedentary and obesity prevention.	2

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
			B 3.7 The 'obesogenic' environment and its effects on dietary intake and obesity.	1
			B 3.8 Compliance of food service providers towards current dietary guidelines.	2
			B 3.9 Reception of public health and nutrition messages: an analysis of socio-cultural and socio-economic differentiation for tailoring of healthy eating messages.	2
			B 3.10 Agriculture subsidies on food production and supply as well as cost and consumption pattern on development of obesity.	4
			B 3.11 Association between use of Sugar Sweetened Beverages (SSB) and childhood obesity prevalence.	2
			B 3.12 Effects of the removal of sugar subsidies on prevalence of obesity.	1
			B 3.13 Household food insecurity and its association with obesity.	2
C. To develop new modalities.	C 1. Identification of new methods to define obesity.	Obesity has traditionally been defined based on BMI cut-off points. However, it is known that BMI does not truly reflect body composition.	C 1.1 Development National Growth Chart and comparison with international standards using NHMS 2019 data.	1

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
			C 1.2 Identifications of other indices to define obesity (waist neck circumference).	2
	C 2. Identification of novel strategies to prevent and manage obesity.	Functional foods and herbal traditional medications have been used for the prevention and treatment of obesity. However, despite claims the scientific evidence on the efficacy and safety are scare.	C 2.1 Identification of foods rich in specific ingredients (e.g., specific fatty acids, polyphenols and other phytochemicals) that can stimulate thermogenesis and fat oxidation assessed by indirect calorimetry as well as improve glucose tolerance (assessed by OGTT).	5
			C 2.2 Identification of bioactive compounds in local food ingredients.	4
			Novel and practical intervention strategies are important for the prevention and treatment of obesity.	C 2.3 Comparison on the effectiveness of different methods of weight reduction for obese individuals.
			C 2.4 Randomised Control Trials of obesity prevention programmes (individual/ group).	3
			C 2.5 Psycho socio-logical, nutritional management and assessment of obese patients' pre and post bariatric surgery.	2
			C 2.6 The use of new technology AI (Artificial Intelligence) in the prevention and treatment of obesity.	1

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RESEARCH PRIORITY

# AREA 6

DIET-RELATED  
NON-COMMUNICABLE  
DISEASES





## RESEARCH PRIORITY AREA 6

### DIET-RELATED NON-COMMUNICABLE DISEASES

#### 6.1 Introduction

Non-communicable diseases (NCDs), also known as chronic diseases, tend to be of long duration and are the result of a combination of genetic, physiological, environmental and behaviours factors (WHO, 2018a). NCDs are now the leading cause of mortality worldwide in which they are responsible for the death of 40.5 million people each year, equivalent to 71% of all deaths globally (WHO, 2018b). Of these, an estimated 1.7 million (4% of NCD deaths) occurred in people younger than 30 years of age, 15.2 million (38%) in people aged between 30 years and 70 years, and 23.6 million (58%) in people aged 70 years and older. The majority of such deaths were often caused by the four main NCDs, namely: cardiovascular disease (17.9 million deaths; accounting for 44% of all NCD deaths); cancer (9.0 million deaths; 22%); chronic respiratory disease (3.8 million deaths; 9%); and diabetes (1.6 million deaths; 4%) in 2018. Adults in low- and lower-middle-income countries faced the highest risks (21% and 23%, respectively) - almost double the rate for adults in high-income countries (12%).

The challenge of the nutrition transition is not whether it will happen in Malaysia, but whether it is possible to cross quickly from the early stage of nutritional disorders that affect the young to the later stage of non-communicable diseases (NCDs) that affect mainly the elderly. Thus preventing the mid-stage of NCD epidemics should be prioritised when there is a major impact on individuals in their productive middle years, and further their disability-adjusted life year (DALY), which is a measure of the years of life lost (YLL) due to premature mortality plus years lived with disability (YLD). Knowledge gained from research conducted locally, can help in planning strategies to confront the emerging epidemics.

Research priorities and policies related to NCDs control, must address the emerging epidemic from a long-term perspective. Whereas, increases in NCDs risk factors precede the NCDs epidemic, therefore strategies for NCDs control must focus on the prevention and reduction of risk factors. These measures will require, first, prevention of risk factor progression in population and age groups currently at low risk (primordial prevention). Second, identification and curtailment of risk factors in populations that have already acquired an adverse risk profile (primary prevention); and third, risk factor reduction to minimize further complications in people with clinical disease (secondary prevention). For persons who have developed NCDs, they will need cost-effective clinical care to improve both their survival and the quality of life.. Relevant and focused research will be necessary to meet each of these goals.

The Global Burden of Diseases (GBD) 2017 shows that in a decade between 2007 and 2017, the worldwide disease burden indicated by disability-adjusted life years (DALYs) attributable to high systolic blood pressure remained on the top rank (GBD 2017 Risk Factor Collaborators, 2018). The disease burden attributable to smoking, high fasting plasma glucose, high BMI, high LDL cholesterol, impaired kidney function, ambient particulate matter, alcohol consumption, a diet low in whole grains, low in fruits and high in sodium, all increased significantly. In contrast, the disease burden attributable to short gestation for birth weight, low birth weight for gestation, child wasting, unsafe water source, unsafe sex, and unsafe sanitation, all decreased significantly. It seems that the combination of increasing metabolic risks and population ageing continue to drive the increasing trends in NCDs at the global level. Also, NCDs is part of the Sustainable Development Goal (SDG) target 3.4, in which "by 2030 reduce by one-third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being". Due to prolonged life expectancy, the risks of dying from NCDs between ages 30 and 70 have decreased from 22% in 2000 to 18% in 2016 globally (WHO, 2018b). Nonetheless, the pace of decline varies substantially even among countries in the same region (NCD Countdown 2030 Collaborators, 2018).

In Malaysia, the National Health and Morbidity Survey (NHMS) 2019 (IPH, 2020) documented tremendous increase in the prevalence of diabetes mellitus among adults from 11.2% in 2011, to 18.3% in 2019. One of the major risk factors for cardiovascular diseases, namely hypercholesterolemia, also showed an increasing trend from 35.1% in 2011 to 38.1% in 2019. On the other hand, the prevalence of hypertension has slightly decreased from 32.7% (NHMS 2011) to 30.0% (NHMS 2019) (IPH, 2011 & 2020). The health and economic repercussions of this expanding trend are enormous. Millions of people experience premature mortality or compromised quality of life, whereas countries and regions experience reduced productivity, and arrested economic growth (UNSCN, 2018).

Alongside the many other modifiable behaviours, unhealthy diet (high intake of sodium, low intake of whole grains, and low intake of fruits) was reported to increase the risk of NCDs (GBD 2017 Risk Factor Collaborators, 2019). This was concurred by local studies which have shown that dietary patterns of poor quality are associated with biomarkers of cardio metabolic, insulinemic and inflammatory status among adolescents (Emi et al., 2020), adults (Balasubramanian et al., 2020; Karupaiah et al., 2019) and elderly (Zainuddin et al., 2018). Researches on diet and risk of cancer also have found positive findings. Studies conducted among Malaysians identified that low energy density diet, high intake of fruits, vegetables and lycopene-rich foods were protective towards cancer development (Shahar et al., 2011; Shahril et al., 2013; Sulaiman et al., 2014; Tan et al., 2018).

As for diabetes mellitus, 35.5% of women with a history of gestational diabetes mellitus (GDM) have a higher risk of developing diabetes as compared to women without GDM (Chew et al., 2012). Besides that, being female, older age, Indian ethnicity, living in urban areas, low educational level and low socioeconomic level have been identified as potential non-nutrition factors that may predict the development of T2DM among Malaysian (IPH, 2020; Jan Mohamed et al., 2015; Tee & Yap, 2017). Nonetheless, it was found that diabetes control and dietary intake was rather poor in patients with diabetes, generally, (Hamdy & Barakatun-Nisak, 2016), which suggests critical needs to further explore best practices of nutrition management in diabetes. On the other hand, data on dietary behaviour is not available but finishing meal quickly (Iqbal et al., 2020) and skipping breakfast (Mustafa et al., 2019) were found to increase cardio metabolic risks. Metabolic syndrome by itself predicts future T2DM risk by more than three-fold (Sulistiowati et al., 2016). Therefore, a significant effort of research is needed for the prevention and control of diet-related NCDs in Malaysia. Since almost half of the Malaysian population is already at risk of diet-related NCDs, measures are needed to control and delay the course of the existing diet-related NCDs or indeed, reduce its severity.

In this chapter, the primary research priority area is on diet-related NCDs such as cardiovascular diseases, diabetes and cancer as these are the top NCDs ranked by DALYs (GBD 2017 Risk Factor Collaborators, 2018). Aside from the role of genetics, the dominant risk factors for diet-related NCDs are behavioural, which relates to unhealthy diets and inadequate physical activity. In principle, the optimal behaviour could be avoided and modified with appropriate lifestyle changes. Nonetheless, as the risk factors are embedded in behavioural, cultural, and political realities, modifying the up-stream drivers is a challenge which requires the engagement of different sectors of government and other groups (Greenberg & Deckelbaum, 2016). Therefore, understanding the complexity of the disease and translating them to effective interventions are vitally crucial in the prevention and control of diet-related NCDs.

Considering the recent coronavirus disease 2019 (COVID-19) pandemic, Wang et al. (2020) reported that diet-related NCDs are major risk factors of COVID-19. Although many COVID-19 deaths occur in older people who often have existing comorbidities, other patients with diet-related NCDs were also at risk of dying from COVID-19 (Zheng et al., 2020). Additionally, some of the restrictive measures such as movement control order, social distancing, and travel restrictions to reduce the spread of infection in many countries including in Malaysia impact specifically on people living with diet-related NCDs by limiting their physical activity, ability to secure healthy foods, and access to preventive or health promotion services (Kluge et al., 2020). Without proper health management, diet-related NCDs patient's condition might worsen due to stressful situations,

insecure economic situations, and changes in normal health behaviours. As with other health service and preventive programmes, the postponement of access to healthcare for intervention and treatment could disrupt the continuity of care for patients with diet-related NCDs (Palmer et al., 2020). This unintentional disruption risks increasing morbidity, disability, and avoidable mortality over time in diet-related NCD patients.

Figure 6.1 shows the conceptual framework of the purpose and scope of diet-related non-communicable diseases.

## 6.2 Conceptual Framework on the Purpose and Scope of the Research Priority Area

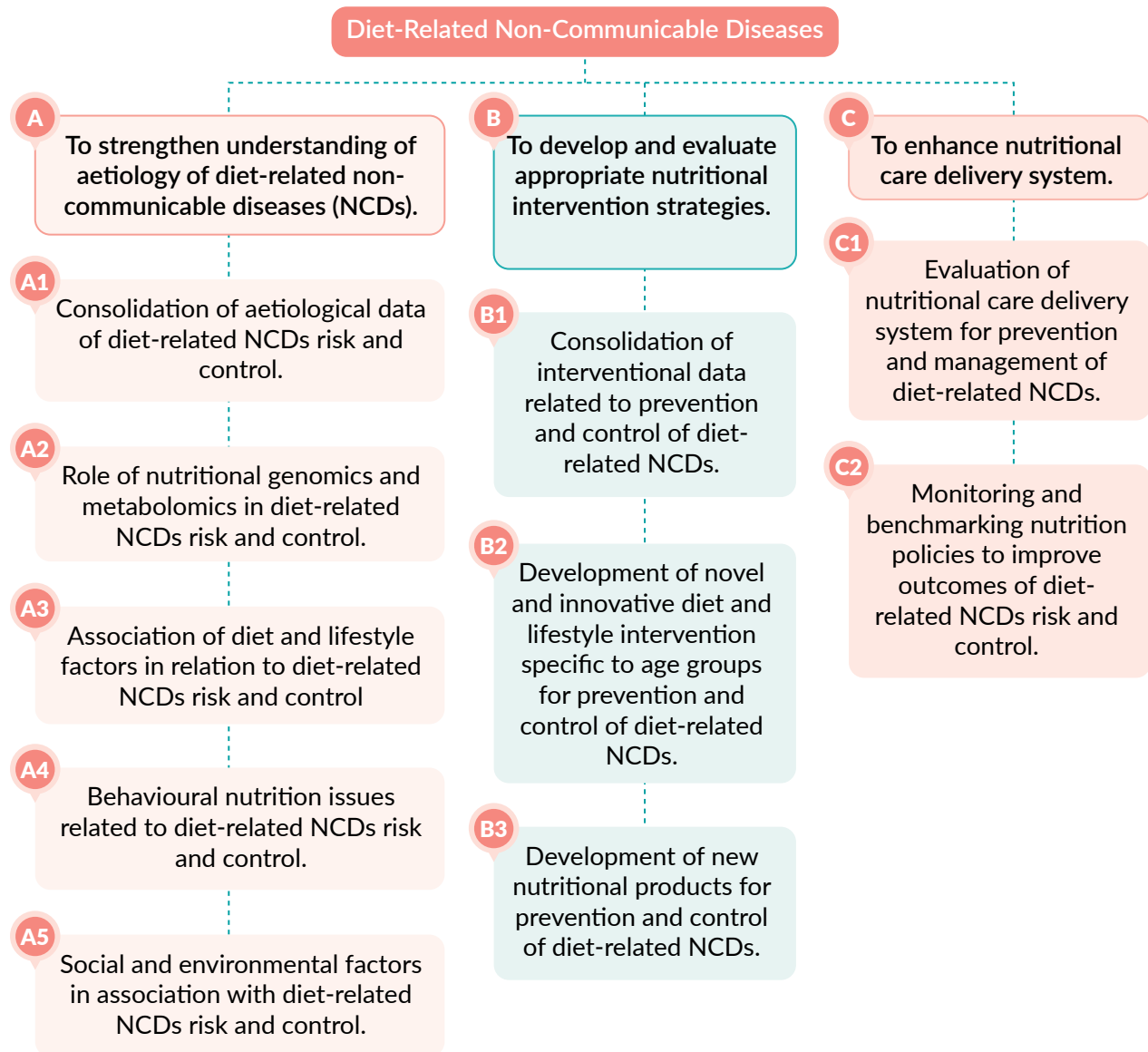


Figure 6.1. Conceptual framework on the purpose and scope of diet-related non-communicable diseases

### 6.3 Table of Nutrition Research Priority Area

This NRP Area is presented in two tables. Table 6.1 presents a list of suggested topics. Appendix 6 presents the ranking criteria for the suggested topics in each research scope of this NRP Area.

The working group identified three main purposes for the nutrition research priority area on diet-related NCDs. It includes (1) fundamental research to strengthen understanding of aetiology of diet-related NCDs, (2) translational research to develop and evaluate appropriate nutritional intervention strategies and (3) transdisciplinary research to enhance the nutritional care delivery system.

The first purpose is for fundamental research on diet-related NCDs, which is based on research gaps observed from the studies carried out in Malaysia (NCCFN, 2016 & 2019). More published scientific data on mechanistic role and interaction between diet/ nutrient intakes, biomolecules and genes in the Malaysian population for personalised management of risk and control for diet-related NCDs are needed. Data related to fundamental research on aetiological and risk factors of diet-related NCDs from extensive case-control and cohorts are limited. The data is necessary to develop targeted implementation and to strengthen future intervention program for the prevention and control of diet-related NCDs. It is noteworthy that, qualitative studies on behaviour, perception, beliefs, motivation, barriers and facilitators to diet-related NCDs risk and control were left unexplored in the Malaysian context. These behaviours are unique for each population, and data should be derived locally as a foundation in developing strategies for the prevention and control of diet-related NCDs (Marmot & Bell, 2019). Besides, emphasis should also be given to social and environmental factors such as psychosocial determinants, food insecurity, food-related inequalities, and built-environment, which relates to diet-related NCDs risk and control.

The second purpose is for translational research on the development and evaluation of appropriate nutritional intervention strategies. The research is made a priority due to a lack of novel and innovative diet and lifestyle intervention specific for age groups for the prevention and control of diet-related NCDs. Emerging evidence recognised the importance of novel and innovative intervention strategies to replace conventional intervention strategies, which might be no longer useful in modern society who impacted from globalization and nutrition transition (García-Dorado et al., 2019). Beyond that, nutrition intervention and management strategies for prevention and control of diet-related NCDs during pandemic such as COVID-19, requires a new adaptive mode of response to account for the needs of population and are crucial in preparedness for current and future public health emergencies and threat (Kluge et al., 2020). The working group has also identified an encouraging number of studies on underutilized local plants which contains unexplored bioactive compounds (NCCFN, 2016 & 2019; Murthy & Bapat, 2020). Nonetheless, there is a gap of evidence on the effectiveness of local functional foods, nutraceuticals and dietary supplements using randomized controlled trials design in the prevention and control of diet-related NCDs.

The third purpose is dedicated to transdisciplinary research to enhance the nutritional care and delivery system. The effectiveness of the current nutrition care and delivery system for the prevention and management of diet-related NCDs remains elusive. Due to recent development on COVID-19 pandemic, an additional measure to investigate the effectiveness of current nutrition care and delivery system during public health emergencies and threat is required. The existing data were also unable to provide an appropriate standard or benchmarking monitoring the implementation of nutrition programs and policies. The set of the standard is crucial to strengthen future nutrition care delivery system, nutrition program and policies in Malaysia. Effective government health program and policies are essential to diet-related NCDs, and their related inequalities in countries globally and monitoring the degree of implementation of recommended program and policies is an integral part of ensuring progress towards better population nutritional health (Vandevijvere et al., 2019).

## Research Priority Area 6: Diet-Related Non-Communicable Diseases

Table 6.1: List of suggested topics in each research scope

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
A. To strengthen understanding of aetiology of diet-related non-communicable diseases (NCDs).	A 1. Consolidation of aetiological data of diet-related NCDs risk and control.	Require more published aetiological data for targeted implementation and strengthening future intervention programmes for prevention and control of diet-related NCDs.	A 1.1 Systematic reviews and meta-analysis on the aetiological data of diet-related NCDs risk and control.	1
			A 1.2 Scoping reviews on the aetiological data of diet-related NCDs risk and control.	2
	A 2. Role of nutritional genomics and metabolomics in diet-related NCDs risk and control.	Inadequate scientific data on mechanistic role and interaction between diet/ nutrient intake, biomolecules and genes in the Malaysian population for personalised management of risk and control for diet-related NCDs.	A 2.1 Studies on nutrigenomics and metabolomics in relation to diet-related NCDs risk and control.	3
			A 2.2 Identification of new nutritional biomarkers for diet-related NCDs risk and control.	2
			A 2.3 Development of nutrigenomics-based personalized nutrition intervention programmes for diet-related risk and control.	1
	A 3. Association of diet and lifestyle factors in relation to diet-related NCDs risk and control.	Inadequate published data from case control and cohort studies related to dietary and lifestyle risk factors and control of diet-related NCDs among Malaysians. This data is needed to develop targeted implementation and strengthening future intervention programmes for prevention and control of diet-related NCDs.	A 3.1 Nutrient and food group (e.g., ultra-processed foods, sugar sweetened beverages, energy dense food) intakes and risk and control of diet-related NCDs.	1
			A 3.2 Dietary patterns (e.g., <i>a priori</i> , <i>a posteriori</i> or hybrid-defined) and risk and control of diet-related NCDs.	1

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
			A 3.3 Eating patterns, dietary practices and risk and control of diet-related NCDs.	1
			A 3.4 Intrauterine exposures and long term consequences of risk and control of diet-related NCDs.	2
			A 3.5 Contribution of diet and lifestyle to disease related complication among those with diet-related NCDs.	1
			A 3.6 Contribution of gut microbiome in development and prognosis of diet-related NCDs.	2
A 4. Behavioural nutrition issues related to diet-related NCDs risk and control.		Inadequate qualitative studies on behaviour, perception, beliefs, motivation, barriers, facilitators which relate to diet-related NCDs risk and control. These behaviours are unique for each population and data should be derived from Malaysian studies as a foundation in developing strategies for prevention and control of diet-related NCDs.	A.4.1 Understanding of behaviour, beliefs, motivation, perception, barriers and facilitators with relate to diet-related NCDs risk and control.	1
A 5. Social and environmental factors in association with diet-related NCDs risk and control.		Inadequate published data on social and environmental factors which relate to diet-related NCDs risk and control. These factors are unique for each population and data should be derived from Malaysian studies as a foundation in developing strategies for prevention and control of diet-related NCDs.	A 5.1 Determination of psychosocial factors influencing dietary behaviours leading to NCDs risk and control.  A 5.2 Food insecurity and risk and control of diet-related NCDs among vulnerable groups (e.g., elderly, children, women at reproductive age, aboriginals, B40 and urban poor).	1  1

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
			A 5.3 Food environment and the risk and control of diet-related NCDs.	1
			A.5.4 Built environment and the risk and control of diet-related NCDs.	2
			A 5.5 Food related-inequalities i.e., food cost/ purchasing power/ socioeconomic status and the risk and control of diet-related NCDs.	1
B. To develop and evaluate appropriate nutritional intervention strategies.	B 1. Consolidation of interventional data related to prevention and control of diet-related NCDs.	Require evidence-based data to implement and strengthen future intervention programmes for prevention and control of diet-related NCDs.	B 1.1 Systematic reviews and meta-analysis on the interventional data for prevention and control of diet-related NCDs.	1
			B 1.2 Scoping reviews on the interventional data for prevention and control of diet-related NCDs.	2
	B 2. Development of novel and innovative diet and lifestyle intervention specific to age groups for prevention and control of diet-related NCDs.	Inadequate availability of novel and innovative diet and lifestyle intervention specific for age groups for prevention and control of diet-related NCDs including during public health emergencies and threat. Practice of traditional intervention strategies are no longer effective in modern society who impacted from globalisation and nutrition transition in Malaysia.	B 2.1 Development and evaluation of theory grounded intervention studies for prevention and control of diet-related NCDs.	1
			B 2.2 Development and evaluation of integrated and multi-faceted intervention (e.g., peer support, group therapy, structured nutrition therapy) for prevention and control of diet-related NCDs.	1



Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
			B 2.3 Development and evaluation of dietary and lifestyle interventions using interactive web-based technology/ mobile app technology for prevention and control of diet-related NCDs.	1
			B 2.4 Development and evaluation of dietary and lifestyle interventions using adaptive mode of response during public health emergencies and threat for prevention and control of diet-related NCDs.	1
	B 3. Development of new nutritional products for prevention and control of diet-related NCDs.	Inadequate published scientific evidences on local functional foods, nutraceuticals and dietary supplements for prevention and control of diet-related NCDs. Malaysia, a tropical country, is rich with local underutilized plants which contains unexplored bioactive compounds.	B 3.1 Development and evaluation of potential local functional foods, nutraceuticals and dietary supplements for prevention and control of diet-related NCDs.	1
			B 3.2 RCTs on the efficacy and effectiveness of local functional foods, nutraceuticals and dietary supplements for the prevention and control of diet-related NCDs.	1
C. To enhance nutritional care delivery system.	C 1. Evaluation of nutritional care delivery system for prevention and management of diet-related NCDs.	Inadequate published data on effectiveness of nutritional care delivery system for prevention and management of diet-related NCDs including during public health emergencies and threat. The data could be used to strengthen nutritional care delivery system in Malaysia.	C 1.1 Assessment of awareness among health care providers on importance of nutritional care delivery system and guidelines for prevention and management of diet-related NCDs.	2

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
			C 1.2 Evaluation of effectiveness of nutritional care delivery system for prevention and management of diet-related NCDs.	1
			C 1.3 Evaluation of effectiveness of nutritional care delivery system for prevention and management of diet-related NCDs during public health emergencies and threat.	1
			C 1.4 Determination of factors that influences clients adherence to dietary advice (intervention) for prevention and management of diet-related NCDs.	2
			C 1.5 Evaluation on the effectiveness of existing tools (MNT, QAP, CPG, SOP) in relation to for prevention and management of diet-related NCDs.	1
	C 2. Monitoring and benchmarking nutrition policies to improve outcomes of diet-related NCDs risk and control.	Inadequate monitoring and benchmarking of nutrition policies with regards to prevention and control of diet-related NCDs. The data could be used to strengthen nutrition policies in Malaysia.	C 2.1 Evaluation on the effectiveness of the nutritional component in community intervention initiatives (e.g., KOSPEN, KOSPEN PLUS) on diet-related NCDs risk and control.	1
			C 2.2 Understanding the role of food industry and its association with diet-related NCDs risk and control using business impact assessment.	2

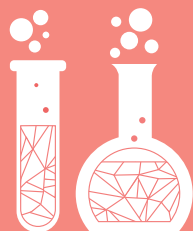
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RESEARCH PRIORITY

# AREA 7

NUTRIENT AND NON-  
NUTRIENT COMPOSITION  
OF FOODS





## RESEARCH PRIORITY AREA 7

### NUTRIENT AND NON-NUTRIENT COMPOSITION OF FOODS

#### 7.1 Introduction

Nutrient is one of components in food that provides energy for growth, development and maintenance of life; and deficiency of which will cause abnormality in biochemical or physiological conditions (Joint FAO/ WHO Food Standards Programme Codex Alimentarius Commission, 2007). Nutrients can be acquired from various food sources (NCCFN, 2017). Recently, various types of new emerging food products those are available in Malaysia such as fusion and hipster foods (Hairon et al., 2017; Jalis et al., 2014). These foods contain high sugar and fat. Data on macronutrients of these foods are important in relation to disease development. In addition, in line with UN Sustainable Development Goals, underutilized foods include those foods known for generations by local communities are rich in nutrients and non-nutrients (such as phenolics, flavonoids, tannins, carotenoids and others) can be utilised for combating hidden hunger and improving food security among rural communities (Khoo et al., 2016; Mohd Shukri et al., 2013).

Nowadays, interest in non-nutrients is increasing. These include dietary phytochemicals and anti-nutrients. Numerous studies have reported their health-promoting properties in reducing the risk of non-communicable diseases, and improving gut and bone health (Greenfield & Southgate, 2003). Therefore, comprehensive data generation and compilation of phytochemicals are warranted for Malaysian Food Composition Database (MyFCD). On the other hand, data of anti-nutrients in certain food items should be generated and compiled into MyFCD because of their undesirable physiological effects as inhibitors for nutrient bioavailability.

The Nutrient Composition of Malaysian Foods Table was published in 1988 and it was revised and published in 1997 (Tee et al., 1997). It has 783 food items and 19 nutrients. Furthermore, from 2011-2015, the updated version of MyFCD contains 29 mandatory and 11 optional nutrients that are important to human health. It also includes the addition of 140 raw and processed foods which were not included in 1997 version. Nutritionists, dietitians, food scientists, food safety personnel, policy makers and the industry refer to food composition tables for various purposes (Greenfield & Southgate, 2003). Recognizing the wide applications of food composition data, there is an urgent need to update MyFCD with additional foods and nutrients.

MyFCD should be updated in view of the increasing prevalence of diet-related chronic diseases especially diabetes, hypertension and hypercholesterolemia in Malaysia (IPH, 2020). This development was parallel with an increasingly industrialized food system using large-scale production of high-yield, inexpensive, agricultural food products such as corn, soy or wheat that are highly processed and distributed in abundance worldwide (Stuckler et al., 2012; Blatt, 2008; Roberts, 2008). Ultra-processed foods have become more common in Malaysia now constitute a significant amount of calories consumed (Ali, 2013). Ultra-processed foods are typically high in calories, salt, sugar, and fat (Poti et al., 2015). This calls for updated data particulars of food high in added salt, sugar and saturated fats. Such information might be helpful for reformulation of the products as well as to increase the effectiveness of nutritional interventions. The updated MyFCD will provide better quality of nutrient data especially for health professionals, researchers in the field of food and nutrition, and those who are involved in food production and food preparation.

As for this region, the Association of Southeast Asian Networks of Food Data Systems (ASEANFOODS) under the auspices of INFOODS. Malaysia is a member of the ASEANFOODS, and actively participated in several activities organised by the ASEANFOODS and INFOODS. The availability of an updated database will support various food and nutrition-related activities in providing data on food composition. The updated MyFCD also serve as a reference for industry in developing and improving their products. The roles of nutrient and non-nutrient composition of foods towards preventing nutrition-related problems are in Figure 7.1.

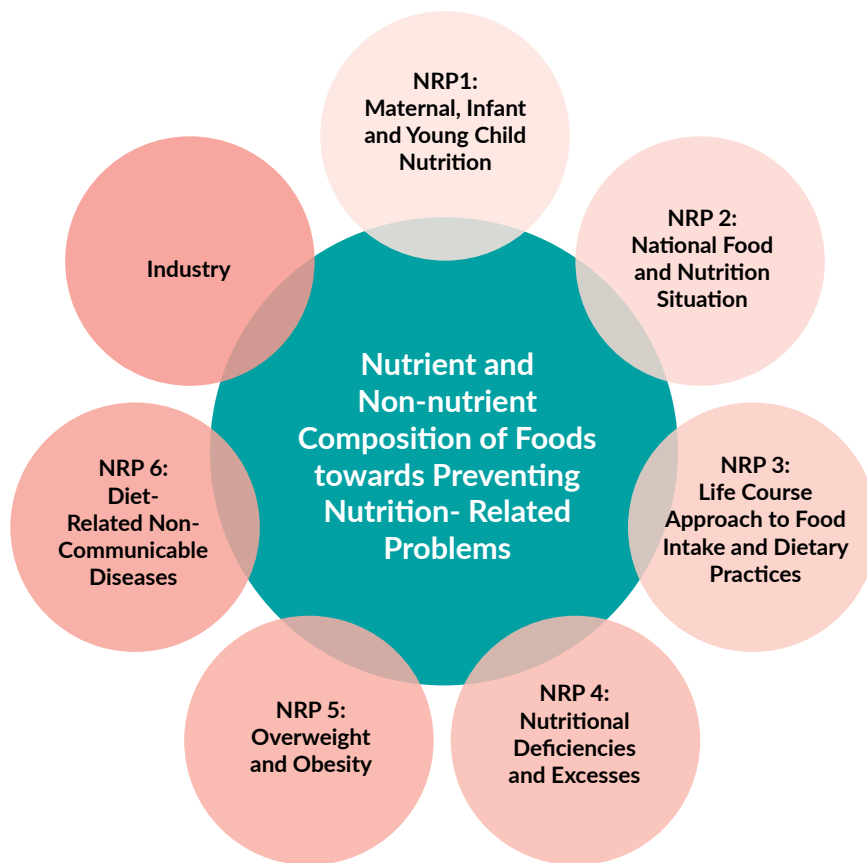


Figure 7.1. Nutrient and non-nutrient composition of foods towards preventing nutrition-related problems

## 7.2 Conceptual Framework on the Purpose and Scope of the Research Priority Area

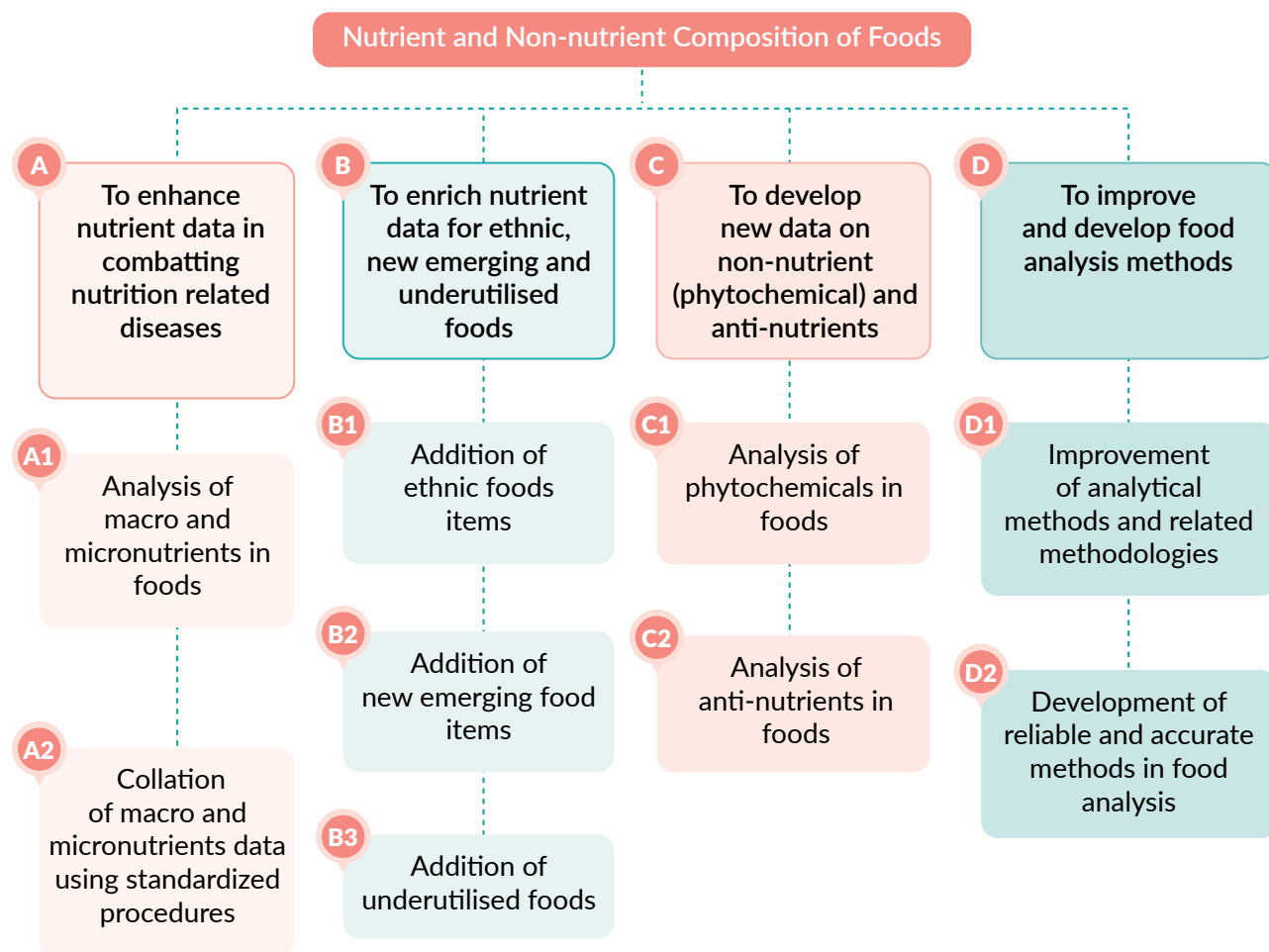


Figure 7.2. Purpose and scope of Nutrient and Non-nutrient Composition of Food

### 7.3 Table of Nutrition Research Priority Area

This NRP Area is presented in two tables. Table 7.1 presents the list of suggested topics. Appendix 7 presents the ranking criteria for the suggested topics in each research scope of this NRP Area.

Data on nutrient and non-nutrient composition of foods play an important role in various nutrition-related activities and programmes. The formulation and development of policies, programme and intervention related to nutrition shall be supported with reliable and better-quality data of nutrient and non-nutrient. As such, the identification of research under this research priority area has taken into consideration the existing evidence gap, the nutrition situation in Malaysia as well as the global and regional direction such as the UN Sustainable Development Goals, ASEANFOODS and INFOODS target to provide better quality of food composition database. In this current NRP (2021-2025), the title, purpose and scope of the previous NRP (2016-2020) have been evaluated, revised and consolidated accordingly with more explicit approaches to address all research priority areas (NRP Areas 1-6).

There are four purposes, namely enhancement of nutrient data in combating nutrition related diseases, enrichment of nutrient data for ethnic, new emerging (fusion, hipster) and underutilised foods, development of new data on non-nutrient (phytochemical) and anti-nutrients and improvement and development of food analysis methods. For each purpose, several key scopes have also been identified. Specific suggested topics and their ranking are also included. Since the proposed studies will require significant budget allocation, thus commitment and active participation from the various stakeholders and funders are warranted. This is to ensure the proposed research related to nutrient and non-nutrient of foods is conducted within the time line and in accordance with the standard procedures and needs of the stakeholders.

## Research Priority Area 7: Nutrient and Non-nutrient Composition of Foods

Table 7.1: List of suggested topics in each research scope

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
A. To enhance nutrient data in combating nutrition related diseases.	A 1. Analysis of macro and micro-nutrients in foods.	<p>Incomplete macro and micronutrients data for raw, processed and prepared foods.</p> <p>No available data on human breast milk.</p>	A 1.1 Determination of macronutrients (sugars, dietary fibre, fatty acids and amino acid) in view of an increase prevalence of over and undernutrition.	1
			A 1.2 Determination of micronutrients (e.g., iodine, selenium, zinc, magnesium, iron, chromium, vitamins) in view of micronutrient deficiencies among susceptible population (maternal, women at reproduction age, children below 5 years old and elderly).	2
			A 1.3 Determination of macro and micronutrients in different cultivars and varieties (e.g., rice, vegetables, fruits, tubers, roots and legumes).	3
	A 2. Collation of macro and micronutrients data using standardized procedures.	<p>Scattered and lack of nutrient data.</p> <p>Insufficient resources (money, man, machine, materials and management).</p> <p>Increasing number of product reformulation in the market.</p>	A 2.1 Collation and validation of existing data from food industry into MyFCD.	1
			A 2.2 Collation and quality assessment of existing data from published articles into MyFCD.	2
	B. To enrich nutrient data for ethnic, new emerging and underutilised foods.	B 1. Addition of ethnic foods items.	Inadequate nutrient data for ethnic foods.	B 1.1 Determination of nutrient content of ethnic foods from different states.

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
	B 2. Addition of new emerging food items.	No available nutrient data for hipster foods.	B 2.1 Determination of nutrient content of hipster foods (e.g., <i>pisang goreng cheese</i> , <i>corn dog</i> , <i>bubble tea</i> ).	1
		Rapid modification of foods due to lifestyle changes.	B 2.2 Determination of nutrient content of street foods (e.g., <i>cakoi</i> , <i>apam balik</i> ).	1
		Introduction of new food from other countries.	B 2.3 Determination of nutrient content of fusion foods (e.g., <i>spagetti masak lemak cili padi</i> ).	1
	B 3. Addition of underutilised foods.	Insufficient data available. Many underutilised foods believed to have health promoting components without scientific evidence.	B 3.1 Determination of nutrient content of underutilised (fruits, vegetables and edible animals source) relating to nutrition and food security.	1
C. To develop new data on non-nutrient (phytochemical) and anti-nutrients	C 1. Analysis of phytochemicals in foods.	Insufficient data available for specific polyphenols. Many reported health benefits. Increasing number of functional food products in the market.	C 1.1 Determination of polyphenols content in plant-based foods.	1
	C 2. Analysis of anti-nutrients in foods.	Lack of data on impact of anti-nutrients on bioavailability of minerals.	C 2.1 Determination of anti-nutrients contents (e.g., phytates, oxalates, caffeine, tannin, theobromine etc.) in plant foods.	1
D. To improve and develop of food analysis methods.	D 1. Improvement of analytical methods and related methodologies.	Lack of robust, rapid, methodologies using latest technologies.	D 1.1 Adoption, modification and validation of analytical and instrumentation methods for nutrients and non-nutrients.	1
			D 1.2 Modification of procedures for sampling, preparation and storage of foods.	2

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics	Relative Rank
	D 2. Development of reliable and accurate methods in food analysis.	Inadequate quality assurance and control among laboratories (universities, research institutes and government related labs).	D 2.1 Method validation of nutrients and non-nutrients analysis in various matrices and concentrations.	1
		Challenges in analysing food components at low levels due to complexity of food matrices.	D 2.2 Inter and intra laboratory comparison using reference materials.	2

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# APPENDICES

## Research Priority Area 1: Maternal, Infant and Young Child Nutrition

### Appendix 1: Ranking criteria for suggested topics in each research scope

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
A. To assess the effect of maternal nutrition on birth and health outcomes.	A 1. Maternal nutrition/ nutritional status and its outcome to mothers, infants and young children.	<p>There is limited information on the impact of anaemia on maternal and infant and young child (IYC) health outcomes, chronic diseases, psychological and cognitive outcomes.</p> <p>Anaemia status is urgently required so that appropriate interventions can be taken to treat and prevent maternal related diseases.</p>	<p>A 1.1 Nutrition in the first 1000 days of life and health outcomes.</p> <hr/> <p>A 1.2 The impact of maternal anaemia on mothers' health and nutritional status.</p> <hr/> <p>A 1.3 The impact of maternal anaemia on IYC health and nutritional status.</p> <hr/> <p>A 1.4 The impact of maternal nutritional status during pregnancy and lactation on breast milk composition and infant growth.</p> <hr/> <p>A 1.5 The impact of maternal dietary intake during pregnancy and lactation on breast milk composition and infant growth.</p> <hr/> <p>A 1.6 Dietary patterns and nutritional status among mothers of marginalised groups (single mothers, homeless, hard-core and urban poor).</p> <hr/> <p>A 1.7 The impact on maternal nutritional status due to changes in income status, mental health, lifestyle during/ post COVID-19 pandemic.</p>
	A 2. Maternal gestational weight gain and outcome to mothers, birth, infants and young children.	<p>There is limited information on the impact of inappropriate gestational weight gain on maternal and IYC health outcomes, chronic diseases, psychological and cognitive outcomes.</p> <p>Gestational weight gain status is urgently required so that appropriate interventions can be taken to treat and prevent related consequences.</p>	<p>A 2.1 The impact of maternal gestational weight gain on mother's health and nutritional status (<i>anthropometry and biochemistry</i>).</p> <hr/> <p>A 2.2 The impact of maternal gestational weight gain on IYC health and nutrition.</p> <hr/> <p>A 2.3 The Impact of COVID-19 pandemic on maternal nutrition and gestational weight gain including assessment of dietary intake and for early detection</p>

Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
10	10	7	7	7	7	48	100	1
9	9	7	6	7	7	45	94	2
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	48	100	1
10	10	7	6	6	7	46	96	1
10	10	7	6	6	7	46	96	1
10	10	7	6	6	7	46	96	1

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
			and treatment of under-nourished pregnant women.
	A 3. Maternal gestational diabetes mellitus and outcome to mothers, infants and young children.	<p>There is limited information on the impact of gestational diabetes mellitus on maternal and IYC health outcomes.</p> <p>Gestational diabetes mellitus can have adverse consequences on maternal and child health.</p>	<p>A 3.1 The impact of maternal gestational diabetes mellitus on mothers health and nutritional status.</p> <p>A 3.2 The impact of maternal gestational diabetes mellitus on IYC health and nutritional status.</p>
B. To determine nutritional status of infants and young children.	B 1. The impact of IYC nutritional status on growth and development.	<p>The availability of local studies on this issue is limited. With the rise in stunting cases in Malaysia of recent times, it is imperative to study how this factor could possibly have a role to play in cognitive development of a child. In addition, understanding the demographic of stunting cases is required to tackle the issue.</p> <p>IYC nutritional status has been shown to have an impact on growth and cognitive of infants and young children.</p>	<p>B 1.1 Relationship between malnutrition/ stunting/ low birth weight and cognitive development.</p> <p>B 1.2 The impact of socio-economic status on malnutrition/ stunting/ low birth weight.</p>
	B 2. The impact of feeding practices and dietary adequacy on IYC nutritional status and health outcomes.	<p>The availability of local studies on these issues are limited. Feeding practices among infants and young children require more exploration to understand the pattern and its relationship to growth and development.</p> <p>IYC feeding has long term impact on growth, development and health status.</p>	<p>B 2.1 The impact of care feeding practices on child development (cognitive, psychomotor and psycho-social).</p> <p>B 2.2 Relationship between IYC feeding practices with malnutrition (overweight, obesity, underweight, stunting and wasting).</p> <p>B 2.3 Relationship between IYC feeding with diet-related chronic diseases in children, adolescents and adults.</p>

Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
10	10	6	6	6	6	44	92	2
10	10	7	6	6	7	46	96	1
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	48	100	1
9	9	7	6	7	7	45	94	3
10	10	7	5	7	7	46	96	2
10	10	7	7	4	4	42	88	6

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
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B 2.4 Relationship between IYC feeding practices with infections and allergies (acute respiratory infection, asthma, gastro enteritis, eczema).

B 2.5 Relationship between IYC feeding with micronutrient adequacy.

B 2.6 Relationship between IYC feeding with macronutrient sufficiency.

B 2.7 Appropriate complementary feeding practices (timeliness, adequacy, diversity, frequency, safety).

B 2.8 The use and impact of dietary supplements (e.g., vitamins, minerals) on IYC health and nutrition.

B 2.9 The impact of COVID-19 pandemic on children’s nutrition, including assessment of dietary intake and evaluation for early detection and treatment of child wasting.

B 3. IYC feeding practices of children with special needs and marginalised groups (single mothers, homeless, hard-core and urban poor).

Marginalized and special needs groups have different issues, which is important to be understood. The findings will potentially be useful in planning for health and intervention strategies for these groups.

Socio-cultural differences among the various marginalised groups (single mothers, homeless, hard core and urban poor) affect feeding practices, dietary intake and nutritional status. Information is

B 3.1 Dietary patterns and nutritional status among infants and young children of marginalised groups (single mothers, homeless, hard core and urban poor).

B 3.2 The impact of COVID-19 pandemic on food security and IYC feeding practices in relation to socio-economically vulnerable families from marginalised groups (e.g., single mothers, homeless, hard core and urban poor).

Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
9	9	7	7	7	7	46	96	2
9	9	7	7	6	5	43	90	5
10	10	7	7	7	6	47	98	1
10	10	7	7	6	7	47	98	1
9	9	5	7	7	7	44	92	4
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	48	100	1

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
		<p>required to address the service needs of these marginalised groups.</p> <p>Lack of information on feeding practices among infants and young children with special needs in Malaysia.</p> <p>Information is required to address feeding practices among infants and young children with special needs.</p>	<p>B 3.3 Dietary patterns and nutritional status among infants and young children with special needs.</p>
<p>B 4. The impact of parental lifestyle on birth and infant outcomes.</p>		<p>Lack of information on parental lifestyle on birth and infant outcomes in Malaysia. Foetal programming plays an important role in birth and health outcomes of infants. Thus, exploring parental lifestyle impact on their infants is highly needed.</p> <p>Information is required to address parental lifestyle on birth and infant outcomes in Malaysia.</p>	<p>B 4.1 The impact of parental lifestyle on birth and infant outcomes including adaptation to new norms post COVID-19 pandemic.</p>
		<p>Information on postpartum practices is limited. More exploration in this area is needed to help improve confinement practices and understand its association to improving maternal health outcomes.</p> <p>Confinement practices during postpartum (controlling, restricting or responsive) have been shown to have an impact on maternal health, breastfeeding practice and breastmilk composition.</p>	<p>B 4.2 The impact of mother's belief and confinement practices during postpartum on maternal health, breastfeeding practices and breastmilk composition.</p>



Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			

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10	10	7	7	7	7	48	100	1
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10	10	7	7	7	7	48	100	1
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10	10	6	7	7	6	46	96	2
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Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
C. To strengthen implementation/ service delivery.	C 1. Evaluation of current strategies/ programmes/ policies for mothers.	<p>Information on evaluation of nutrition education and breastfeeding strategies/ programmes/ activities is limited. Various programmes have been conducted however, up to date, the effectiveness and outcome of these programmes are not measured well. Thereby, conducting periodic evaluation of programmes would provide data to improvements and outcomes.</p> <p>Many programmes have been implemented over the years. Hence, evaluation is needed to assess the effectiveness of the programmes.</p>	<p>C 1.1 Evaluation of the effectiveness of nutrition education on mothers' health.</p> <hr/> <p>C 1.2 Evaluation of the effectiveness of post-natal home visit on breastfeeding practices.</p> <hr/> <p>C 1.3 Evaluation of the effectiveness of BFHI.</p>
	C 2. Evaluation of current strategies/ programmes/ policies for infants and young children.	<p>Information on evaluation of IYC feeding strategies/ programmes/ activities is limited. Various programmes have been conducted however, up to date, the effectiveness and outcome of these programmes are not measured well. Thereby, conducting periodic evaluation of programmes would provide data to improvements and outcomes.</p> <p>More nutrition education programmes on IYC feeding and health have been produced over the years. Hence, evaluation is needed to assess the effectiveness of these programmes.</p>	C 2.1 Evaluation of the effectiveness of nutrition education on infant and young children's health.

Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	48	100	1

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
<p>D. To develop and strengthen strategies/ programmes/ policies on maternal, infant and young child nutrition.</p>	<p>D 1. Development of strategies/ programmes/ policies on maternal and IYC nutrition.</p>	<p>Lack of information on perception, knowledge and attitude towards human milk bank among the public and parents. Human milk bank is a growing interest in Malaysia as there are needs for it. However, public understanding and perception are important to ensure its application in the future.</p> <p>Perception, knowledge and attitude status towards human milk bank among the public and parents are urgently required so that appropriate programmes can be developed to enhance breastfeeding practices.</p> <p>Lack of information on the impact of promotion and advertisement on consumption of Growing Up Milk (GUM) and commercial complementary foods.</p> <p>Mother's choice of Growing Up Milk (GUM) and complementary food may be influenced by aggressive advertisement and promotion, informative labelling and attractive packaging of milk products.</p>	<p>D 1.1 Public perception, knowledge and attitude towards human milk bank.</p> <hr/> <p>D 1.2 Parents' perception, knowledge and attitude towards human milk bank.</p> <hr/> <p>D 1.3 Parents understanding on the different types of milk (e.g., infant formula vs GUM vs full cream milk) and commercial complementary food.</p>

Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	48	100	1

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
	<p>D 2. Evaluation of strategies/ programmes/ policies on maternal, infant and young child nutrition</p>	<p>Lack of information on the effectiveness of the implementation of mother friendly workplace strategies and induced lactation/ relactation programme. Impact evaluation of programmes is much required to ensure its sustainability and improvements.</p> <p>Providing mother-friendly facilities at the workplace may support breastfeeding.</p> <p>Information on evaluation of maternal strategies/ programmes/ activities is limited in Malaysia.</p> <p>Several antenatal programmes have been implemented over the years. Hence, evaluation is needed to improve the effectiveness of the programmes.</p>	<p>D 2.1 The impact of mother friendly workplace (e.g., lactation breaks, availability of crèche, breastfeeding room, maternity leave) on exclusive breastfeeding and breastfeeding duration.</p> <hr/> <p>D 2.2 Factors influencing success of lactation induction and relactation.</p> <hr/> <p>D 2.3 Evaluation on the effectiveness of antenatal programmes on anaemia, gestational diabetes mellitus and gestational weight gain.</p> <hr/> <p>D 2.4 Evaluation on the effectiveness of the MOH guidelines in relation to breastfeeding practices for suspected or confirmed COVID-19 cases and the effect on breastfeeding duration.</p>

Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	48	100	1

## Research Priority Area 2: National Food and Nutrition Situation

### Appendix 2: Ranking criteria for suggested topics in each research purpose

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
A. To determine and monitor national food and nutrition situation regularly.	A 1. Regular national surveys for monitoring global and national nutrition indicators.	<p>Lack of comprehensive national food and nutrition security data.</p> <p>To support the implementation and monitoring of the objectives of NPANM III, 2016-2025: To strengthen food and nutrition security.</p> <p>To ensure and support nutrition sensitive national food production as stipulated in National Agro Food Policy (DAN) 2.0 (2021-2030).</p>	<p>A 1.1 Comprehensive assessment of nutritional status (anthropometric, dietary intake and practices, clinical and biochemical data) for all age groups covering key components; through:</p> <p>A 1.1.1. Regular National Health and Morbidity Surveys (NHMS) by Institute of Public Health, National Institute of Health (NIH) Malaysia:</p> <ul style="list-style-type: none"> <li>- NHMS 2021: Maternal and Child Health Survey</li> <li>- NHMS 2022: Adolescent Health</li> <li>- NHMS 2023: NCD and Healthcare Demand</li> <li>- NHMS 2024: Nutrition Survey</li> <li>- NHMS 2025: Communicable Diseases.</li> </ul> <hr/> <p>A 1.1.2. National/ large longitudinal studies on priority areas and groups;</p> <ul style="list-style-type: none"> <li>- Malaysian Children Longitudinal Study (from pregnancy until 18 years old)</li> <li>- The Malaysian Health and Adolescent Longitudinal Research Team (MyHeART) Study</li> </ul> <hr/> <p>A 1.2 Studies on global and national nutrition parameters/ indicators/ targets;</p> <ul style="list-style-type: none"> <li>- Sustainable Development Goals (SDG) 2030 <ul style="list-style-type: none"> <li>● Anaemia among children among 6.0-59.9 months</li> <li>● Undernourishment status among population</li> </ul> </li> <li>- Global Nutrition Target (GNT) 2025</li> <li>- National Plan of Action for Nutrition of Malaysia (NPANM) III, 2016-2025.</li> </ul>



Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
10	10	7	7	7	7	48	100	1

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10	10	6	7	6	7	46	96	2
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10	10	7	7	7	7	48	100	1
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Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
	A 2. Food and nutrition security among vulnerable groups.	<p>Limited data at national level.</p> <p>In line with NPANM III and Shared Prosperity Vision 2030 and other National Food Security Priority Indicators.</p>	<p>A 2.1 Assessment of food and nutrition security among vulnerable groups by using FIES:</p> <p>A.2.1.1 under-five children</p> <hr/> <p>A 2.1.2 women of reproductive age.</p> <hr/> <p>A 2.1.3 elderly.</p> <hr/> <p>A 2.1.4 indigenous people in Peninsular, Sabah and Sarawak.</p> <hr/> <p>A 2.1.5 refugees.</p> <hr/> <p>A 2.1.6 B40 (urban, rural poor).</p> <hr/> <p>A 2.1.7 people with special needs.</p>
	A 3. Incorporation of nutrition components into national studies conducted by other agencies.	To optimise other determinants of food and nutrition security via inclusion of nutrition components by the relevant key stakeholders (e.g., social determinants).	<p>A 3.1 Incorporation of selected nutrition components into national studies conducted by various agencies (government or non-government sectors);</p> <ul style="list-style-type: none"> <li>• Household Income and Expenditure Survey (HIES) by Department of Statistics Malaysia (DOSM)</li> <li>• Assessment of Household Dietary Diversity (HDD) at National Level using HDD Scale.</li> <li>• Analysing food security using household survey data.</li> <li>• Food deprivation among vulnerable population using Household Hunger Scale.</li> </ul>

Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	48	100	1
10	10	7	5	7	5	44	92	2
10	10	7	7	7	7	48	100	1
6	9	7	7	7	7	43	90	3
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	48	100	1

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
	<p>A 4. Determination of national foods and nutrition transition over time.</p>	<p>Lack of comprehensive national trend data on food and nutrition transition in Malaysia.</p> <p>To provide evidence to the relevant stakeholders for policy making and programme planning.</p>	<p>A 4.1 Assessment of national foods and nutrition transition over time through food and nutrition surveillance system.</p> <p>A 4.1.1 National Food Balance Sheet (FBS) to examine trend in food supply and dietary energy supply (DES).</p> <p>A 4.1.2 Household Income and Expenditure Survey (HIES) data to examine changes in food expenditure and affordability.</p> <p>A 4.1.3 Series of NHMS datasets to measure secular trend in food and nutrition indicators.</p> <p>A 4.2 Determination of changes on dietary patterns and behaviours including measuring shifts to ultra-processed food.</p>
	<p>A 5. Strengthening methods for population-based assessment of nutritional status/ biomarkers.</p>	<p>High reliance on self-reports.</p> <p>The baseline data important for need assessment and decision making process (policies and programmes).</p>	<p>A 5.1 Development of feasible and reliable methods for population-based assessment of:</p> <ul style="list-style-type: none"> <li>- dietary intake</li> <li>- physical activity</li> <li>- micronutrient status.</li> </ul> <p>A 5.2 Harnessing technology for timely data collection, processing and reporting (i.e., electronic FFQ).</p>
<p>B. To strengthen evaluation of the existing national food and nutrition programmes.</p>	<p>B 1. Evaluation on the existing national nutrition programmes of Ministry of Health (MOH).</p>	<p>Limited data on the effectiveness of national nutrition programmes.</p> <p>Ensuring proper implementation, coordination, monitoring and evaluation of programmes and projects.</p>	<p>B 1.1 National evaluation on the effectiveness of the Baby Friendly Hospital Initiative (launched in 1992).</p> <p>B 1.2 National evaluation on the effectiveness of the Baby Friendly Clinic Initiative.</p>

Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
10	10	6	7	7	7	47	98	2
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	47	98	2
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	48	100	1

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
			<p>B 1.3 National evaluation on the effectiveness of the iron and folate supplementation to combat iron deficiency anaemia among pregnant mothers.</p> <hr/> <p>B 1.4 Evaluation on the effectiveness of the universal salt iodisation to eradicate Iodine Deficiency Disorder (IDD).</p> <hr/> <p>B 1.5 National evaluation on meeting Malaysian dietary guidelines following the Malaysian Food Pyramid 2020 and Malaysian Healthy Plate (SSS) 2020.</p>
	<p>B 2. Evaluation on the existing national nutrition programmes by other ministries.</p>	<p>Limited data on the effectiveness of national nutrition programmes.</p> <p>Ensuring proper implementation, coordination, monitoring and evaluation of programmes and projects.</p>	<p>B 2.1 Evaluation on the effectiveness of national programme such as School Meal Programme (<i>Program Hidangan Berkhasiat di Sekolah, HiTS</i>).</p> <hr/> <p>B 2.2 Evaluation of food-related social safety net programme (e.g., Food Bank, MyKasih).</p> <hr/> <p>B 2.3 Evaluation of urban farming to promote diet quality in households and community by Department of Agriculture.</p>
	<p>B 3. Evaluation on the existing national nutrition programmes for private sectors.</p>	<p>Limited data on the effectiveness of national nutrition programmes.</p> <p>Ensuring proper implementation, coordination, monitoring and evaluation of programmes and projects.</p>	<p>B 3.1 Evaluation on the awareness and effectiveness of voluntary Front of Pack Labelling (FOP) including Healthier Choice Logo (HCL).</p> <hr/> <p>B 3.2 Evaluation on the effectiveness of Sugar Sweetened Beverages (SSB) Tax.</p>

Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	48	100	1
10	9	7	7	7	7	47	98	2
10	9	7	7	7	7	47	98	2
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	48	100	1

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
<p>C. To identify determinants, causes and outcome of food and nutrition security status.</p>	<p>C 1. Determination of the factors/ causes affecting food and nutrition security status.</p>	<p>Limited national data on factors/ causes affecting food and nutrition security status.</p> <p>To achieve SDG goal to end hunger (SDG 2.1.1 &amp; 2.1.2) by 2030 and align with shared prosperity vision of the Wawasan Kemakmuran Bersama 2030.</p>	<p>C 1.1 Causes / factors contributing to food insecurity (availability, accessibility, utilization and stability) and the coping strategies among vulnerable groups;</p> <ul style="list-style-type: none"> <li>- under-five children</li> <li>- women of reproductive age</li> <li>- elderly</li> <li>- indigenous people in Peninsular, Sabah and Sarawak</li> <li>- refugees</li> <li>- B40 (urban, rural poor)</li> <li>- people with special needs.</li> </ul> <hr/> <p>C 1.2 Causes/ factors contributing to specific national nutrition issues in the country;</p> <ul style="list-style-type: none"> <li>- stunting among under-five children</li> <li>- anaemia among women of reproductive age</li> <li>- childhood obesity</li> <li>- diet-related non-communicable diseases (e.g., diabetes, hypertension)</li> <li>- inadequate micronutrient intake (e.g., calcium, iron, iodine).</li> </ul> <hr/> <p>C 1.3 Multidimensional determinants contributing to unhealthy dietary practices in targeted groups, including;</p> <ul style="list-style-type: none"> <li>- individual and family</li> <li>- community and society</li> <li>- social environment</li> <li>- cultural and food environment</li> <li>- spiritual factors</li> <li>- law and regulation.</li> </ul>



Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
10	10	7	7	7	7	48	100	1

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10	10	7	7	7	7	48	100	1
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10	10	7	7	7	7	48	100	1
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Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
	C 2. Determination of the outcome/ impact of food and nutrition security.	<p>Lack of information on the outcome or impact of food and nutrition security.</p> <p>To ensure the overall impact of food security, including direct and indirect costs, on the nutritional well-being of the Malaysian population.</p>	<p>C 2.1 Assessment of outcome/ impact of nutrition and food security;</p> <ul style="list-style-type: none"> <li>- obesity, eating behaviour, nutritional status</li> <li>- cost benefit analysis</li> <li>- quality of life</li> <li>- morbidity and mortality.</li> </ul>
	C3. Assessment on the impact of pandemic outbreaks/ disaster on food security and nutritional status	<p>The crucial of assessing the outcome or impact of pandemic outbreaks/ disaster on food security and nutritional status.</p> <p>This scientific evidence is intended to enlighten and contribute to the development of comprehensive and integrated Food and Nutrition in Emergency Guidelines</p>	<p>The impact of pandemic outbreaks on the nutrition situation in the country (e.g., nutritional status, food consumption, food supply chain, agriculture landscape, food prices/ trade and food environment/ availability).</p>

Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
10	10	7	7	7	7	48	100	1

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10      10      7      7      7      7      48      100      1

## Research Priority Area 3: Life Course Approach to Food Intake and Dietary Practices

### Appendix 3: Ranking criteria for suggested topics in each research scope

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
A. To identify the determinants of food intake and dietary practices of various age groups.	A 1. Effects of personal and environmental factors on food intake.	Although studies are available on the role of personal and environmental factors on diet quantity and diet quality, the available information is restricted to only certain aspects of the personal and environmental factors and diet quantity or quality.	<p>A 1.1 Effects of personal and environmental factors on diet quantity (nutrients, energy, food serving).</p> <p>A 1.2 Effects of personal and environmental factors on diet quality (dietary pattern, dietary diversity).</p> <p>A 1.3 Effects of emergency situation (e.g., flood, epidemic of infection diseases) on diet quantity and diet quality.</p>
	A 2. Effects of personal and environmental factors on dietary practices.	Lack of information on the influence of personal and environmental factors towards eating out, late night eating practices, fast/convenient/ restaurants/ hawkers food, food truck and food delivery.	<p>A 2.1 Personal and environmental factors influencing eating out and late night eating.</p> <p>A 2.2 Personal and environmental factors influencing intake of fast/convenient/ restaurants/ hawkers food, food truck and food delivery.</p> <p>A.2.3 Effects of emergency situation (e.g., flood, drought, infectious diseases) on dietary practices (e.g., unhealthy eating habit/ practice - compulsive over eating or under eating, food rationing, meal pacing).</p>
B. To determine the health outcomes of food intake and dietary practices of various age groups.	B 1. Effects of food intake and dietary practices on physical, mental and social well-being.	Limited information/ studies on the effects of food intake and dietary practices on short-term and long-term nutrition and health status.	B 1.1 Effects of early childhood food intake and dietary practices on morbidity and mortality.
			B 1.2 Effects of early childhood food intake and dietary practices on stunting.
			B 1.3 Effects of early childhood food intake and dietary practices on NCD risk.

Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
9	9	7	6	7	6	44	92	1
9	9	7	6	7	6	44	92	1
9	9	7	6	7	6	44	92	1
9	9	6	6	7	6	43	90	1
9	9	7	6	6	6	43	90	1
9	9	7	6	6	6	43	90	1
9	9	6	6	7	7	45	94	2
10	10	6	7	6	7	46	96	1
10	10	6	7	6	7	46	96	1

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
C. To develop effective strategies/ interventions to improve diet quantity and quality of various age group.	C 1. Identification/ development of effective strategies/ interventions to improve diet quantity and quality.	More information on effective strategies/ interventions that are tailored to the specific needs of life stage/ socioeconomic/ community groups is needed.	<p>C 1.1 Identification/ development of strategies/ interventions to improve diet quantity and quality of children and adolescents.</p> <hr/> <p>C 1.2 Identification/ development of strategies/ interventions to improve diet quantity and quality of elderly.</p> <hr/> <p>C 1.3 Identification/ development of strategies/ interventions to improve diet quantity and quality of vulnerable groups (e.g., <i>Orang Asli</i>, B40, orphan).</p> <hr/> <p>C 1.4 Identification/ development of intervention strategies at work place, colleges and other institutions.</p> <hr/> <p>C 1.5 Identification/ development of community empowerment strategies in promoting healthy eating;</p> <ul style="list-style-type: none"> <li>i. to promote milk, fruits and vegetables consumption,</li> <li>ii. to reduce intake of salt, sugar and fat.</li> </ul> <hr/> <p>C 1.6 Identification/ development of age-specific innovative and interactive tools to promote healthy eating.</p> <hr/> <p>C 1.7 Identification/ development of effective delivery strategy of nutrition programs/ interventions by healthcare professionals to targeted population.</p>

Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
8	8	6	6	6	6	40	83	3
8	8	6	6	6	6	40	83	3
8	8	6	6	6	6	40	83	3
8	8	6	5	5	6	38	79	4
9	9	7	6	7	7	45	94	1
9	9	7	6	7	7	45	94	1
9	9	7	6	6	6	43	90	2

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
	C 2. Strengthening of existing strategies/ interventions to improve diet quantity and quality.	Limited information on evaluation of existing nutrition strategies/ interventions aimed to address diet quantity and quality.	<p>C 2.1 Evaluation on the impact of nutrition components into 'edible garden project' (community, school, household).</p> <hr/> <p>C 2.2 Evaluation on the impact of school food environment (school canteen, food outside school area).</p> <hr/> <p>C 2.3 Evaluation on the impact of nutrition campaigns (e.g., Suku Suku Separuh).</p> <hr/> <p>C 2.4 Evaluation on the impact of school meal programmes.</p> <hr/> <p>C 2.5 Evaluation on the delivery platform/ mode of nutrition education (digital based, social media, printed materials).</p>
D. To improve the assessment methodology of food intake and dietary practices	D 1. Improvement in methods/ tools/ instruments for assessment of food Intake.	Validated methods/ tools/ instruments are needed to improve food intake assessment.	D 1.1 Development/ adoption/ modification and validation of methods/ tools/ instruments to assess food intake.
	D 2. Improvement in assessment tools/ instruments of dietary practices.	Validated tools/ instruments are needed for assessment of dietary practices.	<p>D 2.1 Development of tools/ instruments for assessment of dietary practices (e.g., perception, beliefs, values, attitude, barriers).</p> <hr/> <p>D 2.2 Validation of tools/ instruments for assessment of dietary practices (e.g., perception, beliefs, values, attitude, barriers).</p>



Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
8	8	6	6	6	6	40	83	3
9	9	6	7	6	7	44	92	1
9	9	6	6	6	6	42	88	2
9	9	6	6	6	6	42	88	2
9	9	6	6	6	6	42	88	2
9	9	6	7	6	7	44	92	1
9	9	7	7	6	7	45	94	1
9	9	7	6	6	7	44	92	2

## Research Priority Area 4: Nutritional Deficiencies and Excesses

### Appendix 4: Ranking criteria for suggested topics in each research purpose

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
A. To develop and strengthen epidemiological and clinical understanding.	A 1. Association between macronutrient* status with health outcomes.  <b>*Macronutrient:</b> Carbohydrate Protein Fat	Lack of data for policy and programmes.	A 1.1 Association between macronutrient intake and health outcomes (e.g., NCD, malnutrition) among various age groups.
	A 2. Association between micronutrient* status with health outcomes.  <b>*Micronutrient:</b> Vitamin A Vitamin D Vitamin B1 Vitamin B2 Vitamin B12 Folate Iron Iodine Zinc Selenium Calcium Chromium Sodium Potassium	Lack of data for policy and programmes.	A 2.1 Association between selected micronutrient intake and health outcomes (e.g., anaemia, NTD, cognitive impairment and IQ, growth retardation, bone mineral density, obesity, diabetes, stunting and infectious disease) among various age groups.
B. To develop and evaluate appropriate studies and intervention strategies.	B 1. Development of studies to determine macronutrient* and micronutrient** status of all age groups.  <b>*Macronutrient:</b> Carbohydrate Protein Fat	Lack of data on suggested nutrient status in vulnerable groups.	B 1.1 Studies on suggested micronutrient status among specific groups (e.g., <i>Orang Asli</i> , Urban Poor, B40).
		Lack of data on food product enriched or fortified with micronutrient.	B 1.2 Studies to investigate the intake and status of macronutrient and micronutrient among children <5 years old.
	B 1.3 Studies to investigate the intake and status of iron and/ or folic acid among women of reproductive age (WRA).		

Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
9	8	5	5	6	6	39	81	2
10	10	5	7	4	7	43	90	1
10	10	6	7	4	6	43	90	2
10	10	7	7	4	7	45	94	1
8	9	5	7	5	6	40	83	4

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
	<b>**Micronutrient:</b> Vitamin A Folate Vitamin B12 Vitamin C Vitamin D Iron Calcium Zink Iodine Selenium Chromium Potassium		B 1.4 Studies to investigate the intake of macro and micronutrient among older adults (Urban poor, B40).  B 1.5 Assessment on the intake of enriched and fortified food product.
	B 2. Evaluation on the current intervention to improve micronutrient* and macronutrient** status.  <b>*Micronutrient:</b> Folic acid Iron Vitamin C Vitamin B complex (hematinics)	Lacking data on hematinic supplementation in pregnancy: 1. Compliance by mothers 2. Cost effectiveness of supplementation programme.	B 2.1 Profiling the iron deficiency anaemia risk factor characteristics among pregnant women.  B 2.2 Comparison of cost effectiveness study of combination and single dose iron supplementation among pregnant women.
	<b>*Micronutrient:</b> Iodine	Increasing findings of congenital hypothyroidism in infants in Peninsular Malaysia. Lacking data on maternal iodine status.	B 2.3 Evaluation on the effectiveness of salt iodisation intervention (usage, handling, storage, toxicity, health impact).
		Universal Salt Iodization (USI) will be enforced starting September 2020. Evaluation studies on the impact of USI is needed	
		Food supplementation (macronutrient) among targeted group.	B 2.4 Effectiveness of food supplementation intervention among targeted group (poor and hard core poor).

Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
9	8	5	6	6	7	41	85	3
7	8	6	7	5	6	39	81	5
10	10	6	7	4	7	44	92	2
9	9	5	7	5	7	42	88	3
10	9	7	6	6	7	45	94	1
9	7	5	7	6	7	41	85	4

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
	<p>B 3. Conduct new intervention to improve macronutrient* and micronutrient** status.</p> <p><b>*Macronutrient:</b>            Carbohydrate            Protein            Fat</p> <p><b>**Micronutrient:</b>            Vitamin A            Folate            Vitamin B12            Vitamin C            Vitamin D            Iron            Calcium            Zink            Iodine            Selenium            Chromium            Potassium</p>	<p>Double burden of malnutrition on the rise.</p> <p>Lack of data on specific micronutrient and the impact to the health outcome.</p>	<p>B 3.1 Protein, calcium, vitamin D, and iodine rich food intervention for growth and development of under 5 years old children.</p> <hr/> <p>B 3.2 Intervention study to improve dietary fibre intake.</p> <hr/> <p>B 3.3 Intervention study to reduce sugar consumption.</p> <hr/> <p>B 3.4 Nutrition intervention on weekly iron and acid folic supplementation among women of reproductive age (WRA).</p> <hr/> <p>B 3.5 Nutrition intervention on fortified food products/ multiple micronutrient powders (MNPs) among under five years old malnourished children</p> <hr/> <p>B 3.6 Usage of digital technology to achieve optimum macro and micronutrient intake among all age group.</p>

Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
10	10	7	6	5	7	45	94	31
9	8	6	6	5	6	40	83	4
8	9	6	6	6	6	41	85	3
9	9	7	6	5	6	42	88	2
10	8	5	6	5	6	40	83	4
8	7	6	6	5	7	39	81	5

## Research Priority Area 5: Overweight and Obesity

### Appendix 5: Ranking criteria for suggested topics in each research scope

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
A.To improve understanding on the epidemiology of obesity.	A 1. Relationship between waist circumference (WC), waist-hip ratio (WHR), waist-height ratio (WHtR), and BMI on non-communicable diseases (NCDs).	WC is an important indicator of central obesity. Cut-off points for WC of adults, adolescent and children are known, but its relationship with co-morbidities is yet to be identified. WHR and WHtR are other tools to be explored in future studies.	<p>A 1.1 Definition of obesity for Malaysians based on WC.</p> <hr/> <p>A 1.2 Cohort study to identify appropriate WC cut-off points, WHR, WHtR, and BMI for Malaysians based on co-morbidities.</p> <hr/> <p>A 1.3 Association of WHR, WHtR, and BMI with non-communicable disease risk factors.</p>
	A 2. Relationship between adiposity and NCDs risk factors.	There is lack of sufficient data and the health consequences of higher body fat in Malaysian lacks scientific basis.	<p>A 2.1 Relationship between body composition and morbidity in adult Malaysians.</p> <hr/> <p>A 2.2 Relationship between body composition and health risks in children and adolescents.</p>
	A 3. The impact of early nutrition on development of adult obesity.	Defining early predictors of obesity in Malaysia is important, as premature age of adiposity rebound and catch-up growth (after foetal, neonatal and infant growth retardation) have repeatedly been shown to be strong determinants of obesity in later life.	<p>A 3.1 Establishment of appropriate growth standard chart from birth to adulthood in order to define the normal age-range for onset of adiposity rebound of healthy children in various ethnic groups in Malaysia (cohort study).</p> <hr/> <p>A 3.2 Definition and identification on which pediatric population groups that are at risk of neonatal or post-natal catch-up growth.</p> <hr/> <p>A 3.3 The relationship between gestational weight gain and breastfeeding practices on the development of obesity.</p> <hr/> <p>A 3.4 Obesity in pregnancy: Epidemiology, mechanisms, nutritional and metabolic management.</p>



Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
9	9	6	6	5	6	41	85	2
9	10	6	7	6	6	44	92	1
9	10	6	7	6	6	44	92	1
9	10	6	7	6	6	44	92	1
9	9	6	7	6	6	43	90	2
10	10	6	6	6	6	44	92	1
9	9	6	7	6	6	43	90	2
9	10	6	6	6	7	44	92	1
10	8	6	6	6	7	43	90	2

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
			A 3.5 Preconception weight status of the mother and spouse and the relationship with childhood obesity (cohort study).
			A 3.6 Is early-life antibiotic exposure associated with obesity in children.
A 4. The impact of obesity on social and economic cost.		Economic costs of obesity are important issues for health care providers and policy makers alike. Effort to quantify the magnitude of economic burden of obesity-related morbidity and mortality is vital to reduce healthcare cost.	A 4.1 The economic and personal health costs of overweight and obesity.
		Obesity has a significant impact on health-related quality of life (QOL) and functional capacity of individual in the society.	A 4.2 The economic burden of obesity and obesity-related chronic diseases.  A 4.3 Psycho-socio-cultural determinants and quality of life in obese population.
A 5. Association of dietary intake, appetite control, eating behaviour and inflammatory status with obesity		Appetite control studies have never been reported in Malaysia. There is a need to understand the effect of fats, as well as protein, on appetite control regulation.	A 5.1 Effects of proteins and amino acids on appetite control.
		Eating behaviour especially heavy meal consumption during night-time and dieting may affect energy intake. Psychological mechanisms influencing eating behaviour may help maintain appropriate body weight gain. Improper weight loss methods may lead to yoyo effect on body weight.	A 5.2 Adipokines and other inflammatory markers in the era of paediatric obesity.
			A 5.3 Night eating syndrome and its relationship with obesity.
			A 5.4 Energy intake regulation among late night eaters.
			A 5.5 Identification of psychological mechanisms influencing eating behaviour.
			A 5.6 Weight loss methods being practiced by Malaysian population.

Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
10	8	6	6	6	7	43	90	2
8	9	6	6	6	6	41	85	3
10	10	6	7	5	6	44	92	1
10	10	6	7	5	6	44	92	1
9	9	6	6	6	7	43	90	2
8	8	6	7	6	6	41	85	4
9	8	6	6	6	6	41	85	4
10	9	5	7	6	7	44	92	2
10	9	6	7	6	7	45	94	1
10	9	6	7	6	6	44	92	2
8	8	7	6	7	7	43	90	3

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
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A 5.7 Dieting behaviour and body weight status of adolescents and young adults.

A 5.8 The role of diet composition on body weight (relevant food database: sugar, fatty acids, prepared meals/ cooked foods, fast foods, international cuisine).

A 5.9 The role of food addiction for weight control and obesity.

A 6. Determination of socio-cultural factors influencing obesity.

Public perception of health in relation to obesity influences the success of obesity prevention and management.

A 6.1 Parental perception of childhood obesity.

A 6.2 Food cultures and socio-cultural determinants of food habits (including native minorities).

A 6.3 Socio-cultural determinants of body image.

A 6.4 Inter-disciplinary approach to decision making in food and nutrition (nutrition sociology, anthropology and psychology).

A 6.5 Obesity at workplace, stigmatisation, well-being and productivity (efficacy and follow up).

A 6.6 Understanding babies born small for gestational age (SGA) and its effects on obesity, metabolic syndrome, hypertension, insulin resistance and diabetes.

A 6.7 The effect of obesity on employment discrimination.

A 6.8 Weight stigma as a psychosocial contributor to obesity.

Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
8	8	6	6	5	6	39	81	5
9	9	6	7	6	6	43	90	3
10	9	6	7	6	6	44	92	2
8	9	6	6	6	6	41	85	3
9	9	6	6	7	6	43	90	2
8	8	6	6	7	6	41	85	3
9	9	6	7	6	6	43	90	2
9	9	6	7	6	7	44	92	1
9	9	7	6	6	6	43	90	2
9	9	6	7	6	7	44	92	1
9	9	7	6	6	6	43	90	2

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
	A 7. Effect of metabolic predisposition to onset of obesity.	Identification of individuals who are predispose to obesity is important as there is poor prognosis for the success of long-term management of obesity.	<p>A 7.1 Metabolic predisposition to adult-onset of obesity (efficacy and follow up).</p> <hr/> <p>A 7.2 Metabolic predisposition to childhood-onset of obesity (efficacy and follow up).</p>
	A 8. Association between physical inactivity, sedentary lifestyle and obesity.	With the advent of technological advances, Malaysians lead a sedentary lifestyle and consequently higher rates of obesity. There is a need for in depth understanding of the current situation and factors affecting physical inactivity and sedentary lifestyle.	<p>A 8.1 Effect of working hours on opportunity for physical activity and exercise.</p> <hr/> <p>A 8.2 Survey of existing physical activity curriculum and co-curriculum programme in schools.</p> <hr/> <p>A 8.3 Assessment of physical activity and sedentary level using objective methods.</p> <hr/> <p>A 8.4 Factors influencing physical activity and sedentary level in older adults and elderly.</p> <hr/> <p>A 8.5 Usage of Geographic Information Systems (GIS) to show trends in obesity (including fitness centre, recreational centre and 24 hours food outlet).</p> <hr/> <p>A 8.6 Relationship between sleeping pattern and obesity in all age group.</p> <hr/> <p>A 8.7 Obesity and the Built Environment (opportunities and barriers).</p>

Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
10	9	6	6	7	6	44	92	1
10	9	6	6	6	6	43	90	2
9	9	6	6	7	7	44	92	1
8	8	5	6	6	6	39	81	3
9	9	6	7	7	5	43	90	2
9	10	6	7	6	6	44	92	1
9	9	6	7	6	7	44	92	1
10	9	6	6	6	6	43	90	2
9	9	6	6	7	7	44	92	1

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
	A 9. Determination of genetic factors influencing development of overweight and obesity.	Genes and the environment interact to influence development of overweight and obesity. To date, studies in this area carried out in Malaysia are scarce.	<p>A 9.1 The genetics of childhood obesity.</p> <hr/> <p>A 9.2 Determination of heritability of obesity-related phenotypes.</p> <hr/> <p>A 9.3 Phenotyping of eating behaviour and food intake.</p> <hr/> <p>A 9.4 Salivary epigenetic biomarkers as predictors of emerging childhood obesity.</p> <hr/> <p>A 9.5 Understanding food behaviour, eating practices and appetite control among children with genetic/ syndromic obesity.</p>
A 10. Obesity and COVID-19		Obesity has now been identified as an independent risk factor for severity of illness and death rates due to COVID-19. The scarcity of information regarding the increased risk of illness for people with a higher BMI has led to ambiguity and might increase anxiety, given that these individuals have now been categorized as vulnerable to severe illness if they contract COVID-19. Thus, there is a need for more evidence on pathophysiological aspects through research on some key areas such as adipose tissue biology, comorbidities related to thrombosis and obesity-related respiratory function, altered gut microbiota, immunity and nutrition.	<p>A 10.1 Interaction between RAAS inhibitors and ACE2 in the context of COVID-19.</p> <hr/> <p>A 10.2 Cytokine storm intervention in the early stages of COVID-19 pneumonia.</p> <hr/> <p>A 10.3 The role of adipose tissue in viral shedding.</p> <hr/> <p>A 10.4 Obesity a risk factor for severe COVID-19 infection: thrombosis susceptibility.</p> <hr/> <p>A 10.5 Obesity-related respiratory function in COVID-19 infection.</p> <hr/> <p>A 10.6 Risk of mechanical ventilation in obese COVID-19 infection.</p> <hr/> <p>A 10.7 Altered gut microbiota in obese COVID-19 infection.</p> <hr/> <p>A 10.8 Obesity-related intestine inflammation in COVID-19</p>



Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
8	8	6	7	6	6	41	85	3
8	8	7	7	6	5	41	85	3
9	9	7	5	7	6	43	90	2
9	8	7	6	7	6	43	90	2
9	9	6	7	6	7	44	92	1
9	9	6	7	6	8	45	94	1
9	9	6	7	6	7	44	92	2
9	9	6	7	7	5	43	90	3
9	9	6	7	6	7	44	92	2
9	9	6	6	6	8	44	92	2
9	9	6	6	6	8	44	92	2
9	9	6	7	6	7	44	92	2
9	9	6	7	7	5	43	90	3

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
			<p>A 10.9 Immune cell perturbation linked to obesity in COVID-19 infection.</p> <hr/> <p>A 10.10 Future COVID-19 vaccination response in obesity.</p> <hr/> <p>A 10.11 Phytochemicals influence on gut microbiota and inflammatory diseases (COVID-19) in obese individuals.</p> <hr/> <p>A 10.12 Leptin deficiency/ resistance association on dysregulation of cytokine production and susceptibility toward infectious diseases.</p> <hr/> <p>A 10.13 Obesity and COVID-19: the role of food and nutrition.</p>
<p>B. To improve effectiveness of intervention and management of obesity.</p>	<p>B 1. Development and evaluation of obesity prevention and intervention programmes.</p>	<p>In dealing with inequalities in health status as a fundamental principle of public health, it is necessary to consider the specific issues which make particular groups more vulnerable to weight gain. There is a lack of available model for the prevention and intervention programme for obesity.</p>	<p>B 1.1 Development and evaluation of pre-school and school-based behavioural intervention programmes for the prevention of overweight and obesity in children.</p> <hr/> <p>B 1.2 Development, implementation and assessment of the effectiveness of appropriate obesity intervention programmes in adolescents.</p> <hr/> <p>B 1.3 Effectiveness of existing nutrition and physical activity curriculum and co-curriculum programme in pre-school and school-going children.</p> <hr/> <p>B 1.4 Evaluation of best practices in workplace and institutional settings for obesity prevention and intervention.</p>

Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
9	9	6	7	6	7	44	92	2
9	9	6	7	6	7	44	92	2
9	9	6	7	6	7	44	92	2
9	9	6	7	6	7	44	92	2
9	9	6	6	6	8	44	92	2
9	10	6	6	6	6	43	90	2
9	10	6	6	6	6	43	90	2
8	8	6	6	6	7	41	85	3
9	9	6	6	7	6	43	90	2

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
			<p>B 1.5 Effectiveness of existing obesity intervention programmes to reduce prevalence of diabetes, hypertension and cardiovascular disease in community (i.e., KOSPEN initiative. Jom Mama &amp; MyBFF, Suku Suku Separuh &amp; Cergas 3SC).</p> <hr/> <p>B 1.6 Effectiveness of park-based obesity prevention and management programme.</p> <hr/> <p>B 1.7 Evaluation on the effectiveness of the media campaign to prevent obesity.</p> <hr/> <p>B 1.8 Impact of television advertising of foods and beverages high in fat and/ or high in sugar in childhood obesity.</p> <hr/> <p>B 1.9 Cost effectiveness of obesity prevention and/ or intervention programmes.</p>
	B 2. Development and evaluation of obesity management programmes.	Success rate of the various approaches to obesity management is low, and as such there is a need to develop more practical and effective approaches.	<p>B 2.1 Effectiveness of drugs and supplements/ herbs in obesity management.</p> <hr/> <p>B 2.2 Development and evaluation of behaviour modification strategies for management of obese adults and children.</p> <hr/> <p>B 2.3 Development and evaluation of strategies for promotion of weight loss and weight maintenance, and prevention of weight regain.</p> <hr/> <p>B 2.4 Effectiveness of health education in managing obesity and its co-morbidities.</p>

Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
9	10	6	6	6	7	44	92	1
8	9	6	6	6	6	41	85	3
9	9	6	6	6	7	43	90	2
9	9	6	6	6	7	43	90	2
9	10	6	7	6	6	44	92	1
9	9	6	6	5	6	41	85	3
9	9	6	6	6	7	43	90	2
9	10	6	6	6	7	44	92	1
8	8	6	6	7	6	41	85	3

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
	<p>B 3. The impact of policies and environment (food and physical activity) on obesity.</p>	<p>There is lack of data on the impact of policies and the environment on obesity. To prevent and manage obesity, governments, food industries, the media, communities and individuals need to work together to modify the environment so that it is less conducive to weight gain.</p>	<p>B 3.1 Determination of political and macro sociological factors that contribute to overweight and obesity in the population.</p> <hr/> <p>B 3.2 Evaluation of the feasibility of providing incentives to employees that support healthy eating habits and active lifestyle.</p> <hr/> <p>B 3.3 The roles of food industry advertising and broadcasting agencies towards healthy eating and obesity prevention.</p> <hr/> <p>B 3.4 The roles of school canteens, cafeteria, restaurants and food service industries (including food-truck) towards healthy eating and obesity prevention.</p> <hr/> <p>B 3.5 Effectiveness of food service and restaurant empowerment programme on obesity prevention and management.</p> <hr/> <p>B 3.6 The impact of social and built environment on physical inactivity, sedentary and obesity prevention.</p> <hr/> <p>B 3.7 The 'obesogenic' environment and its effects on dietary intake and obesity.</p> <hr/> <p>B 3.8 Compliance of food service providers towards current dietary guidelines.</p> <hr/> <p>B 3.9 Reception of public health and nutrition messages: an analysis of socio-cultural and socio-economic differentiation for tailoring of healthy eating messages.</p>

Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
9	9	7	7	5	6	43	90	2
8	8	5	7	5	6	39	81	4
9	9	6	7	6	7	44	92	1
9	10	6	6	5	7	43	90	2
8	8	6	6	7	6	41	85	3
9	10	6	6	6	6	43	90	2
9	10	7	7	5	6	44	92	1
9	9	6	6	6	7	43	90	2
9	10	6	6	6	6	43	90	2

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
			<p>B 3.10 Agriculture subsidies on food production and supply as well as cost and consumption pattern on development of obesity.</p> <hr/> <p>B 3.11 Association between use of Sugar Sweetened Beverages (SSB) and childhood obesity prevalence.</p> <hr/> <p>B 3.12 Effects of the removal of sugar subsidies on prevalence of obesity.</p> <hr/> <p>B 3.13 Household food insecurity and its association with obesity.</p>
C. To develop new modalities.	<p>C 1. Identification of new methods to define obesity.</p> <hr/> <p>C 2. Identification of novel strategies to prevent and manage obesity.</p>	<p>Obesity has traditionally been defined based on BMI cut-off points. However, it is known that BMI does not truly reflect body composition.</p> <hr/> <p>Functional foods and herbal traditional medications have been used for the prevention and treatment of obesity. However, despite claims the scientific evidence on the efficacy and safety are scare.</p> <hr/> <p>Novel and practical intervention strategies are important for the prevention and treatment of obesity.</p>	<p>C 1.1 Development National Growth Chart and comparison with international standards using NHMS 2019 data.</p> <hr/> <p>C 1.2 Identifications of other indices to define obesity (waist neck circumference).</p> <hr/> <p>C 2.1 Identification of foods rich in specific ingredients (e.g., specific fatty acids, polyphenols and other phytochemicals) that can stimulate thermogenesis and fat oxidation assessed by indirect calorimetry as well as improve glucose tolerance (assessed by OGTT).</p> <hr/> <p>C 2.2 Identification of bioactive compounds in local food ingredients.</p> <hr/> <p>C 2.3 Comparison on the effectiveness of different methods of weight reduction for obese individuals.</p>



Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
8	8	6	7	5	5	39	81	4
9	9	6	7	6	6	43	90	2
9	9	6	6	7	7	44	92	1
9	9	6	6	7	6	43	90	2
10	10	7	7	7	7	48	100	1
9	9	6	6	7	6	43	90	2
8	8	6	6	6	5	39	81	5
8	8	6	7	6	6	41	85	4
9	9	6	6	6	7	43	90	3

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
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C 2.4 Randomised Control Trials of obesity prevention programmes (individual/ group).

C 2.5 Psycho sociological, nutritional management and assessment of obese patients' pre and post bariatric surgery.

C 2.6 The use of new technology AI (Artificial Intelligence) in the prevention and treatment of obesity.

Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
9	9	6	7	6	6	43	90	3
9	9	6	7	6	7	44	92	2
10	9	6	7	7	7	46	96	1

## Research Priority Area 6: Diet-Related Non-Communicable Diseases

### Appendix 6: Ranking criteria for suggested topics in each research scope

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
A. To strengthen understanding of aetiology of diet-related non-communicable diseases (NCDs).	A 1. Consolidation of aetiological data of diet-related NCDs risk and control.	Require more published aetiological data for targeted implementation and strengthening future intervention programmes for prevention and control of diet-related NCDs.	<p>A 1.1 Systematic reviews and meta-analysis on the aetiological data of diet-related NCDs risk and control.</p> <p>A 1.2 Scoping reviews on the aetiological data of diet-related NCDs risk and control.</p>
	A 2. Role of nutritional genomics and metabolomics in diet-related NCDs risk and control.	Inadequate scientific data on mechanistic role and interaction between diet/nutrient intake, biomolecules and genes in the Malaysian population for personalised management of risk and control for diet-related NCD.	<p>A 2.1 Studies on nutrigenomics and metabolomics in relation to diet-related NCDs risk and control.</p> <p>A 2.2 Identification of new nutritional biomarkers for diet-related NCDs risk and control.</p> <p>A 2.3 Development of nutrigenomics-based personalized nutrition intervention programmes for diet-related risk and control.</p>
	A 3. Association of diet and lifestyle factors in relation to diet-related NCDs risk and control.	Inadequate published data from case control and cohort studies related to dietary and lifestyle risk factors and control of diet-related NCDs among Malaysians. This data is needed to develop targeted implementation and strengthening future intervention programmes for prevention and control of diet-related NCDs.	<p>A 3.1 Nutrient and food group (e.g., ultra-processed foods, sugar sweetened beverages, energy dense food) intakes and risk and control of diet-related NCDs.</p> <p>A 3.2 Dietary patterns (e.g., <i>a priori</i>, <i>a posteriori</i> or hybrid-defined) and risk and control of diet-related NCDs.</p> <p>A 3.3 Eating patterns, dietary practices and risk and control of diet-related NCDs.</p> <p>A 3.4 Intrauterine exposures and long term consequences of risk and control of diet-related NCDs.</p>

Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
9	9	6	7	7	4	42	88	1
8	8	6	7	7	4	40	83	2
8	8	6	7	5	5	39	81	3
9	9	6	7	5	5	41	85	2
9	9	6	7	5	6	42	88	1
8	8	6	7	7	4	40	83	1
8	8	6	7	7	4	40	83	1
8	8	6	7	7	4	40	83	1
8	8	6	7	6	4	39	81	2

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
			<p>A 3.5 Contribution of diet and lifestyle to disease related complication among those with diet-related NCDs.</p>
			<p>A 3.6 Contribution of gut microbiome in development and prognosis of diet-related NCDs.</p>
<p>A 4. Behavioural nutrition issues related to diet-related NCDs risk and control.</p>	<p>Inadequate qualitative studies on behaviour, perception, beliefs, motivation, barriers, facilitators which relate to diet-related NCDs risk and control. These behaviours are unique for each population and data should be derived from Malaysian studies as a foundation in developing strategies for prevention and control of diet-related NCDs.</p>	<p>A.4.1 Understanding of behaviour, beliefs, motivation, perception, barriers and facilitators with relate to diet-related NCDs risk and control.</p>	
<p>A 5. Social and environmental factors in association with diet-related NCDs risk and control.</p>	<p>Inadequate published data on social and environmental factors which relate to diet-related NCDs risk and control. These factors are unique for each population and data should be derived from Malaysian studies as a foundation in developing strategies for prevention and control of diet-related NCDs.</p>	<p>A 5.1 Determination of psychosocial factors influencing dietary behaviours leading to NCDs risk and control.</p> <p>A 5.2 Food insecurity and risk and control of diet-related NCDs among vulnerable groups (e.g., elderly, children, women at reproductive age, aboriginals, B40 and urban poor).</p> <p>A 5.3 Food environment and the risk and control of diet-related NCDs.</p> <p>A.5.4 Built environment and the risk and control of diet-related NCDs.</p> <p>A 5.5 Food related-inequalities i.e., food cost/ purchasing power/ socioeconomic status and the risk and control of diet-related NCDs.</p>	

Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
8	8	6	7	7	4	40	83	1
8	8	6	7	6	4	39	81	2
9	9	6	7	7	6	44	92	1
8	8	5	7	6	6	40	83	1
8	8	5	7	6	6	40	83	1
8	8	5	7	6	6	40	83	1
8	8	5	7	6	5	39	81	2
8	8	5	7	6	6	40	83	1

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
B. To develop and evaluate appropriate nutritional intervention strategies.	B 1. Consolidation of interventional data related to prevention and control of diet-related NCDs.	Require evidence-based data to implement and strengthen future intervention programmes for prevention and control of diet-related NCDs.	<p>B 1.1 Systematic reviews and meta-analysis on the interventional data for prevention and control of diet-related NCDs.</p> <hr/> <p>B 1.2 Scoping reviews on the interventional data for prevention and control of diet-related NCDs.</p>
	B 2. Development of novel and innovative diet and lifestyle intervention specific to age groups for prevention and control of diet-related NCDs.	Inadequate availability of novel and innovative diet and lifestyle intervention specific for age groups for prevention and control of diet-related NCDs including during public health emergencies and threat. Practice of traditional intervention strategies are no longer effective in modern society who impacted from globalisation and nutrition transition in Malaysia.	<p>B 2.1 Development and evaluation of theory grounded intervention studies for prevention and control of diet-related NCDs.</p> <hr/> <p>B 2.2 Development and evaluation of integrated and multi-faceted intervention (e.g., peer support, group therapy, structured nutrition therapy) for prevention and control of diet-related NCDs.</p> <hr/> <p>B 2.3 Development and evaluation of dietary and lifestyle interventions using interactive web-based technology/ mobile app technology for prevention and control of diet-related NCDs.</p> <hr/> <p>B 2.4 Development and evaluation of dietary and lifestyle interventions using adaptive mode of response during public health emergencies and threat for prevention and control of diet-related NCDs.</p>
	B 3. Development of new nutritional products for prevention and control of diet-related NCDs.	Inadequate published scientific evidences on local functional foods, nutraceuticals and dietary supplements for prevention and control of diet-related	B 3.1 Development and evaluation of potential local functional foods, nutraceuticals and dietary supplements for prevention and control of diet-related NCDs.



Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
9	9	6	7	7	5	43	90	1
8	8	6	7	7	5	41	85	2
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	48	100	1
8	8	7	7	6	5	41	85	1

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
		NCDs. Malaysia, a tropical country, is rich with local underutilized plants which contains unexplored bioactive compounds.	B 3.2 RCTs on the efficacy and effectiveness of local functional foods, nutraceuticals and dietary supplements for the prevention and control of diet-related NCDs.
C. To enhance nutritional care delivery system.	C 1. Evaluation of nutritional care delivery system for prevention and management of diet-related NCDs.	Inadequate published data on effectiveness of nutritional care delivery system for prevention and management of diet-related NCDs including during public health emergencies and threat. The data could be used to strengthen nutritional care delivery system in Malaysia.	<p>C 1.1 Assessment of awareness among health care providers on importance of nutritional care delivery system and guidelines for prevention and management of diet-related NCDs.</p> <p>C 1.2 Evaluation of effectiveness of nutritional care delivery system for prevention and management of diet-related NCDs.</p> <p>C 1.3 Evaluation of effectiveness of nutritional care delivery system for prevention and management of diet-related NCDs during public health emergencies and threat.</p> <p>C 1.4 Determination of factors that influences clients adherence to dietary advice (intervention) for prevention and management of diet-related NCDs.</p> <p>C 1.5 Evaluation on the effectiveness of existing tools (MNT, QAP, CPG, SOP) in relation to for prevention and management of diet-related NCDs.</p>

Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
9	9	6	7	4	6	41	85	1
9	9	7	7	7	7	46	96	2
10	10	7	7	7	7	48	100	1
10	10	7	7	7	7	48	100	1
9	9	7	7	7	7	46	96	2
10	10	7	7	7	7	48	100	1

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
	C 2. Monitoring and benchmarking nutrition policies to improve outcomes of diet-related NCDs risk and control.	Inadequate monitoring and benchmarking of nutrition policies with regards to prevention and control of diet-related NCDs. The data could be used to strengthen nutrition policies in Malaysia.	<p>C 2.1 Evaluation on the effectiveness of the nutritional component in community intervention initiatives (e.g., KOSPEN, KOSPEN PLUS) on diet-related NCDs risk and control.</p> <hr/> <p>C 2.2 Understanding the role of food industry and its association with diet-related NCDs risk and control using business impact assessment.</p>

Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
10	10	7	7	7	7	48	100	1
9	8	5	7	6	5	40	83	2

## Research Priority Area 7: Nutrient and Non-nutrient Composition of Foods

### Appendix 7: Ranking criteria for suggested topics in each research scope

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
A. To enhance nutrient data in combating nutrition related diseases.	A 1. Analysis of macro and micronutrients in foods.	Incomplete macro and micronutrients data for raw, processed and prepared foods.  No available data on human breast milk.	A 1.1 Determination of macronutrients (sugars, dietary fibre, fatty acids and amino acid) in view of an increase prevalence of over and undernutrition.  A 1.2 Determination of micronutrients (e.g., iodine, selenium, zinc, magnesium, iron, chromium, vitamins) in view of micronutrient deficiencies among susceptible population (maternal, women at reproduction age, children below 5 years old and elderly).  A 1.3 Determination of macro and micronutrients in different cultivars and varieties (e.g., rice, vegetables, fruits, tubers, roots and legumes).  A 1.4 Effect of food preparation and different cooking methods on nutrient profile.
	A 2. Collation of macro and micronutrients data using standardised procedures.	Scattered and lack of nutrient data.  Insufficient resources (money, man, machine, materials and management).  Increasing number of product reformulation in the market.	A 2.1 Collation and validation of existing data from food industry into MyFCD.  A 2.2 Collation and quality assessment of existing data from published articles into MyFCD.
B. To enrich nutrient data for ethnic, new emerging and underutilised foods.	B 1. Addition of ethnic foods items.	Inadequate nutrient data for ethnic foods.	B 1.1 Determination of nutrient content of ethnic foods from different states.
	B 2. Addition of new emerging food items.	No available nutrient data for hipster foods.  Rapid modification of foods due to lifestyle changes.	B 2.1 Determination of nutrient content of hipster foods (e.g., <i>pisang goreng cheese, corn dog, bubble tea</i> ).

Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
10	10	7	7	5	7	46	96	1
10	10	5	7	5	7	44	92	2
9	8	7	6	5	6	41	85	3
7	7	4	6	4	5	33	69	4
9	9	6	6	3	7	40	83	1
9	9	6	6	4	5	39	81	2
7	7	6	7	5	7	39	81	1
10	10	7	6	5	6	44	92	1

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
		Introduction of new food from other countries.	<p>B 2.2 Determination of nutrient content of street foods (e.g., <i>cakoi</i>, <i>apam balik</i>).</p> <p>B 2.3 Determination of nutrient content of fusion foods (e.g., <i>spagetti masak lemak cili padi</i>).</p> <p>B 2.4 Determination of nutrient content of organic foods (e.g., raw, processed and prepared foods).</p> <p>B 2.5 Determination of nutrient content of GMO foods (e.g., corn and soy based).</p>
	B 3. Addition of underutilised foods.	<p>Insufficient data available.</p> <p>Many underutilised foods believed to have health promoting components without scientific evidence.</p>	B 3.1 Determination of nutrient content of underutilised (fruits, vegetables and edible animals source) relating to nutrition and food security.
C. To develop new data on non-nutrient (phytochemical) and anti-nutrients.	C 1. Analysis of phytochemicals in foods.	<p>Insufficient data available for specific polyphenols.</p> <p>Many reported health benefits.</p> <p>Increasing number of functional food products in the market.</p>	<p>C 1.1 Determination of polyphenols content in plant-based foods.</p> <p>C 1.2 Collation and validation of existing polyphenols data from published paper into MyFCD.</p>
	C 2. Analysis of anti-nutrients in foods.	Lack of data on impact of anti-nutrients on bioavailability of minerals.	C 2.1 Determination of anti-nutrients contents (e.g., phytates, oxalates, caffeine, tannin, theobromine etc.) in plant foods.
D. To improve and develop of food analysis methods.	D 1. Improvement of analytical methods and related methodologies.	Lack of robust, rapid, methodologies using latest technologies.	D 1.1 Adoption, modification and validation of analytical and instrumentation methods for nutrients and non-nutrients.



Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
10	10	7	6	5	6	44	92	1
10	10	7	6	5	6	44	92	1
8	8	5	4	4	5	34	71	2
8	8	5	4	4	5	34	71	2
8	8	5	5	7	7	40	83	1
9	9	6	6	5	6	41	85	1
8	8	5	5	4	5	35	73	2
7	8	6	7	5	7	40	83	1
10	10	7	7	5	7	46	96	1

Purpose	Research Scope	Research /Data Gaps and Needs/ Rationale	Suggested Research Topics
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		D 1.2 Modification of procedures for sampling, preparation and storage of foods.
D 2. Development of reliable and accurate methods in food analysis.	<p>Inadequate quality assurance and control among laboratories (universities, research institutes and government related labs).</p> <p>Challenges in analysing food components at low levels due to complexity of food matrices.</p>	<p>D 2.1 Method validation of nutrients and non-nutrients analysis in various matrices and concentrations.</p> <p>D 2.2 Inter and intra laboratory comparison using reference materials.</p>

Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7)				Total Score	Total Score (%)	Relative Rank
Big Impact On Health Status and/or Delivery of Services	Great Public Health Significance	Capacity Strengthening	Gap In Knowledge/ Evidence that Necessitates Research	Feasibility, Practicality, Cost and Time	Importance for Client Satisfaction			
9	9	6	6	4	6	40	83	2
10	10	7	7	5	7	46	96	1
8	8	6	5	5	7	39	81	2

## ABBREVIATIONS

AI	:	Artificial intelligence
ASEANFOODS	:	Association of Southeast Asian Networks of Food Data Systems
BFHI	:	Baby Friendly Hospital Initiative
BMI	:	Body mass index
COVID-19	:	Coronavirus Disease 2019
CPG	:	Clinical Practice Guideline
DALYs	:	Disability adjusted life years
DAN	:	National Food Agro Policy, <i>Dasar Agromakanan Negara</i>
DES	:	Dietary energy supply
DOSM	:	Department of Statistics Malaysia
EIU	:	Economist Intelligence Unit
FAO	:	Food and Agriculture Organisation of The United Nations
FBS	:	Food Balance Sheet
FCD	:	Food composition database
FFQ	:	Food Frequency Questionnaire
FIES	:	Food Insecurity Experience Scale
FOP	:	Front of Pack Labelling
GBD	:	Global Burden of Diseases
GDM	:	Gestational diabetes mellitus
GIS	:	Geographic information system
GMO	:	Genetically modified organism
GNR	:	Global nutrition report
GNT	:	Global nutrition target
GUM	:	Growing up milk
HCL	:	Healthier Choice Logo
HDD	:	Household Dietary Diversity
HIES	:	Household Income and Expenditure Survey
IDD	:	Iodine deficiency disorder
IIUM	:	International Islamic University of Malaysia

INFOODS	:	Alnternational Network of Food Data Systems
IOM	:	Institute of Medicine
IPH	:	Institute for Public Health
IYC	:	Infant and young child
IYCF	:	Infant and young child feeding practices
KEMAS	:	Community Development Department, Ministry of Rural Development, Malaysia
KOSPEN	:	<i>Komuniti Sihat Pembina Negara</i>
LDL	:	Low density lipoprotein
LMICs	:	Low middle income countries
LPPKN	:	<i>Lembaga Penduduk dan Pembangunan Keluarga Negara</i>
MANS	:	Malaysian Adult Nutrition Survey
MARDI	:	Malaysian Agricultural Research and Development Institute
MASO	:	Malaysian Association for the Study of Obesity
MDG	:	Malaysian Dietary Guidelines
MFLS	:	Malaysia Family Life Surveys
MNPs	:	Multiple micronutrient powders (MNPs)
MNT	:	Medical Nutrition Therapy
MOH	:	Ministry of Health, Malaysia
MP	:	Malaysia Plan
MyBFF	:	My Body is Fit and Fabulous
MyFCD	:	Malaysia Food Composition Database
MyHeART	:	Malaysian Health and Adolescent Longitudinal Research Team
NCCFN	:	National Coordinating Committee on Food and Nutrition
NCD	:	Non-communicable disease
NGOs	:	Non-governmental organisations
NHMS	:	National Health and Morbidity Survey
NIH	:	National Institute of Health, Malaysia
NPANM	:	National Plan of Action for Nutrition of Malaysia
NRP	:	Nutrition Research Priorities
NSM	:	Nutrition Society of Malaysia
NTD	:	Neural tube defects

OGTT	:	Oral glucose tolerance test
QAP	:	Quality Assurance Programme
QOL	:	Quality of life
RCT	:	Randomized controlled trial
SEANUTS	:	South East Asian Nutrition Survey
SDG	:	Sustainable Development Goals
SGA	:	Small for gestational age
SOP	:	Standard Operation Procedure
SSB	:	Sugar sweetened beverages
SSS	:	<i>Suku Suku Separuh</i>
TWG	:	Technical Working Group
UiTM	:	<i>Universiti Teknologi Mara</i>
UKM	:	<i>Universiti Kebangsaan Malaysia</i>
UM	:	<i>Universiti Malaya</i>
UNSCN	:	United Nations System Standing Committee on Nutrition
UNICEF	:	United Nations Children's Fund
UniSZA	:	<i>Universiti Sultan Zainal Abidin</i>
UPM	:	<i>Universiti Putra Malaysia</i>
USM	:	<i>Universiti Sains Malaysia</i>
WC	:	Waist circumference
WHO	:	World Health Organization
WHR	:	Waist-hip ratio
WHtR	:	Waist-height ratio
WOR	:	World Obesity Federation
WRA	:	Women at reproductive age (15-49 years)
YLD	:	Years live with disability
YLL	:	Years of life lost

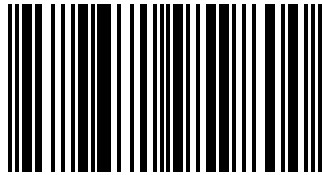




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