Research Priority Area 4

Macro and Micronutrient Excesses and Deficiencies

5 MACRO AND MICRONUTRIENT EXCESSES AND DEFICIENCIES

5.1 Introduction

Malaysia faces the double burden of both undernutrition and overnutrition challenges. While protein-energy malnutrition and micronutrient deficiency persist in low-income and indigenous population, prevalence of overweight children especially from urban areas is emerging and obesity among adults has been growing. Hence, the need to pursue studies on macronutrient and micronutrient excesses and deficiencies has been identified as one of the priority research areas.

Micronutrient deficiencies are a significant cause of malnutrition and associated ill health throughout the world. It is described as the hidden hunger as it often goes unnoticed, even by those affected. Consequences of subclinical forms of micronutrient deficiency can be far reaching, affecting physical growth and causing problems with immunological and cognitive maturation that may be irreversible. Micronutrient deficiencies also lead to birth defects, blindness, as well as decreased school and work performance and poor general health.

In Malaysia, much has been done in identifying and combating problems of "old" but persistent micronutrient deficiencies such as iron deficiency in young children, female subjects of reproductive age and the elderly; iodine deficiency particularly in Sarawak and Sabah and among Orang Asli women and to a lesser extent mild subclinical vitamin A deficiency in rural children. However, there are still gaps in knowledge and cost-effective intervention strategies to be explored.

At the same time, there is a paucity of information on emerging micronutrient deficiency problems identified worldwide such as zinc, selenium, folate and vitamin B12. The other scenario is the rise of micronutrient deficiencies thought to have been overcome such as vitamin D. Rickets due to vitamin D deficiency is hardly reported now but hypovitaminosis D seems to be re-emerging as a worldwide phenomenon not only in Western countries but also in Asia. Recent local studies have shown that despite the abundance of sunshine in the country, Malaysian primary school children, young adults and elderly do not have adequate vitamin D status. Calcium intake is perpetually low (less than 500 mg) across all age-groups. Health consequences of poor vitamin D status include osteoporosis (coupled with low calcium intake) and have been linked with increased risk of other chronic diseases such as diabetes and some cancers.

With this background information on the current situation in Malaysia, the framework for purpose and scope for this research priority area is shown in Figure 5.1. The first focus will be to strengthen epidemiological understanding on the extent of certain macro or micronutrient deficiencies or excesses in the country. In this respect, there is a need to carry out national assessment on the prevalence of deficiency of important micronutrients including zinc and folate, vitamin D and macronutrients such as

dietary fibre and trans fatty acids where data is lacking. The rationale is to develop a sound dataset on the status of Malaysians and the link to health outcomes if deficiencies or excesses exist in our population. The second focus of research priority is in evaluating current strategies and developing novel ways to improve micronutrient status. Several intervention efforts have been put in place by the Ministry of Health to help alleviate these micronutrient deficiencies including iron, folic acid and multivitamin supplementation as well as milk and food supplement programmes. These existing food supplement programmes should be evaluated periodically for their efficacy and efficiency, toward rendering these programmes more cost-effective. For example, studies on feasibility of food fortification can test if this vehicle can be a cost-effective measure to combat micronutrient deficiencies.

While the use of micronutrient supplements serves as an important approach toward the alleviation of malnutrition in specific conditions, the long-term solution of micronutrient deficiency lies in food-based intervention programmes. Innovative methods to tap on locally available foods can be developed for their specific nutrients to alleviate micronutrient deficiencies.

The third focus of research is on enhancing current delivery systems, to help intervention strategies reach deserving target subjects. Intervention efforts need to be intensified especially among the poor in rural and urban areas. Innovative technologies can be used to track target groups and ensure delivery of programmes reach them.

5.2 Conceptual Framework on the Purpose and Scope of the Research Priority Area

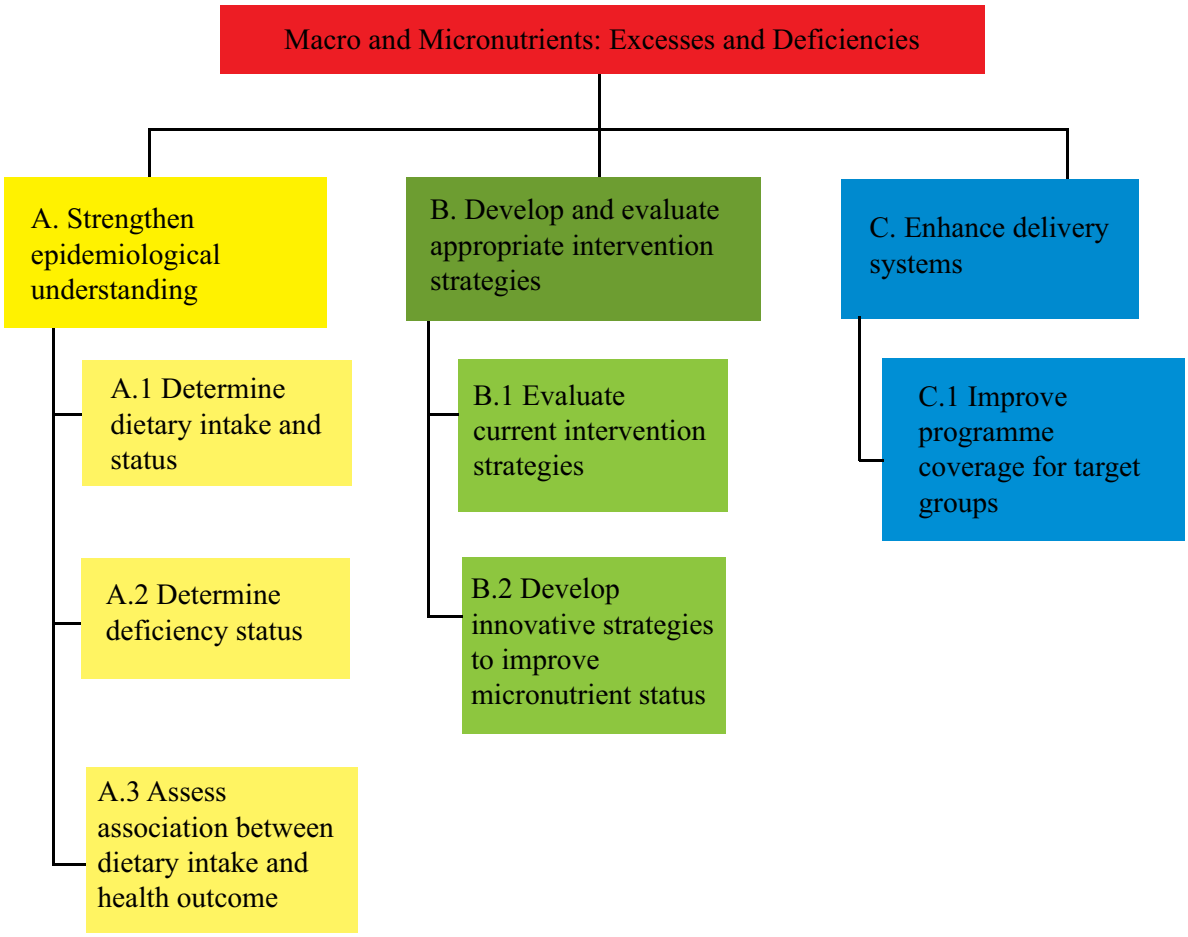

Figure 5.1: Purpose and scope of macro and micronutrients excesses and deficiencies

5.3 Table of Nutrition Research Priority Area

The research priorities are presented in three tables. Table 5.1 presents the research purpose, scope, gaps and needs, rationale for priority ranking and the relative ranks of the scopes and topics. Table 5.2 presents the ranking criteria for suggested topics in each research scope. Table 5.3 presents the relative ranks for each suggested topic.

Table 5.1: Purpose and scope of macro and micronutrients excesses and deficiencies

Purpose	Research Scope	Nutrients	Research Gaps and Needs	Suggested Topic and/or Explanatory Notes	Relative Rank (Scope)	Relative Rank (Purpose)
A. Strengthen epidemiological understanding	A.1 Determine dietary intake and status	Fats, fatty acids	Understanding status of trans fatty acid intake in population	A.1.1 Assessment of trans fatty acid intake in children and adults	15	4
		Carbohydrate, dietary fibre	Amount and type of dietary fibre in the population	A.1.2 Assessment of dietary fibre intake (amount and types) across population	10	2
		Zinc	Gap in data on typical dietary intake and prevalence of zinc status	A.1.2 Assessment of dietary fibre intake (amount and types) across population	7	1
		Selenium	Gap in data on typical dietary intake and prevalence of selenium status	A.1.4 Assessment of dietary intake of selenium of adults	17	5
		Vitamin A, selenium, zinc	Lack of data on bioavailability of micronutrients in local foods and meal pattern context	A.1.5 Determination of bioavailability of vitamin A, selenium, zinc in mixed diet	11	3
	A.2 Determine deficiency status	Zinc	Lack of data on zinc in children, reproductive age women, pregnancy and elderly	A.2.1 Prevalence of zinc deficiency in children, reproductive age women, pregnancy and elderly	8	2
		Selenium	Lack of data on selenium deficiency in adults	A.2.2 Prevalence of selenium deficiency in adults	20	3
		Calcium, Vitamin D	Lack of data on vitamin D status in the population	A.2.3 Determination of vitamin D status and associated factors across population	5	1

Purpose	Research Scope	Nutrients	Research Gaps and Needs	Suggested Topic and/or Explanatory Notes	Relative Rank (Scope)	Relative Rank (Purpose)
	A.3 Assess association between dietary intake and health outcome	Fatty acid	Plasma fatty acid profile of population and cardiovascular risk	A.3.1 Assessing dietary intake and fatty acid profile of population in relation to cardiovascular risk	13	6
		Carbohydrate, fats	Ratio of carbohydrate and fats on cardiovascular risk	A.3.2 Impact of different intake levels of carbohydrate and fats on cardiovascular risks (feeding trials)	6	3
			Impact of glycemic index on health or diseases outcomes	A.3.3 Effects of glycemic index on metabolic syndrome	18	8
		Zinc	Lack of data on association between zinc intakes and status and health outcomes	A.3.4 Effects of zinc status and health outcomes: growth retardation, immune status and pregnancy outcome	3	2
		Selenium	Association between selenium intake and chronic disease	A.3.5 Association of selenium status on diabetes and cancer risk	14	7
		Calcium, Vitamin D	Impact of low calcium intake and vitamin D status on health outcomes e.g. bone health across lifespan	A.3.6 Association of calcium and vitamin D status on health outcomes e.g. osteoporosis, colon cancer, cardiovascular	2	1
		Vitamin B12, folate	Lack of data on prevalence of vitamin B12 deficiency in specific population	A.3.7 Assessment of vitamin B12, folate and homocysteine in relation to cardiovascular risks	12	5
		Vitamin B12, folate, ferum	Lack of data on prevalence of vitamin B12, folate and ferum amongst children and elderly.	A.3.8 Interactions between vitamin B12, folate and ferum in anaemia amongst children and elderly	9	4
B. Develop and evaluate appropriate intervention strategies	B.1 Evaluate current intervention strategies	Iron, folate	Need data for effectiveness of wheat flour fortification	B.1.1 Determine iron and folate status pre and post fortification	1	1
		Folic acid, iron	Lack data on compliance of folic acid and iron supplementation in pregnancy	B.1.2 Determine compliance rate and associated factors of folic acid and iron supplementation among pregnant women	4	2

Purpose	Research Scope	Nutrients	Research Gaps and Needs	Suggested Topic and/or Explanatory Notes	Relative Rank (Scope)	Relative Rank (Purpose)
	B.2 Develop innovative strategies to improve micronutrient status	-	Need for convenient food products (cost effective) for target groups	B.2.1 Formulation of convenient food products (cost effective) for target groups	16	1
C. Enhancing delivery systems	C.1 Improve programme coverage for target groups	-	Difficulty to trace target groups for programme delivery	C.1.1 Applying GPRS technology to improve programme coverage	19	1

Table 5.2: Ranking criteria for suggested topics in each research scope

Research Scope	Suggested Topic and/or Explanatory Notes	Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7) - Choose Max. 2 Criteria *				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		
A.1 Determine dietary intake and status	A.1.1 Assessment of trans fatty acid intake in children and adults	6	4		2	2		14	15
	A.1.2 Assessment of dietary fibre intake (amounts and types) across population	6	4		4	2		16	10
	A.1.3 Assessment of dietary intake of zinc amongst children, reproductive age women, pregnancy and elderly	6	4		4	4		18	7
	A.1.4 Assessment of dietary intake of selenium of adults	4	4		4	2		14	17
	A.1.5 Determination of bioavailability of vitamin A, selenium, zinc in mixed diet	4	4		4	3		15	11

Research Scope	Suggested Topic and/or Explanatory Notes	Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7) - Choose Max. 2 Criteria *				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		
A.2 Determine deficiency status	A.2.1 Prevalence of zinc deficiency in children, reproductive age women, pregnancy and elderly	6	4		4	4		18	8
	A.2.2 Prevalence of selenium deficiency in adults	4	4		2	2		12	20
	A.2.3 Determination of Vitamin D status and associated factors across population	6	6		4	4		20	5
A.3 Assess association between dietary intake and health outcome	A.3.1 Assessing dietary intake and fatty acid profile of population in relation to cardiovascular risk	4	4		4	2		14	13
	A.3.2 Impact of different intake levels of carbohydrate and fats on cardiovascular risks (feeding trials)	6	6		4	4		20	6
	A.3.3 Effects of glycemic index on metabolic syndrome	4	2		2	4		12	18

Research Scope	Suggested Topic and/or Explanatory Notes	Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7) - Choose Max. 2 Criteria *				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		
	A.3.4 Effects of zinc status and health outcomes: growth retardation, immune status and pregnancy outcome	7	7		4	4		22	3
	A.3.5 Association of selenium status on diabetes and cancer risk	4	4		4	2		14	14
	A.3.6 Association of calcium and vitamin D status on health outcomes e.g. osteoporosis, colon cancer, cardiovascular	8	8		4	4		24	2
	A.3.7 Assessment of vitamin B12, folate and homocysteine in relation to cardiovascular risks	6	4		2	2		14	12
	A.3.8 Interactions between vitamin B12, folate and ferum in anaemia amongst children and elderly	6	7		2	2		17	9

Research Scope	**Suggested Topic and/or Explanatory Notes**	**Ranking Criteria (Score 1-10)***		**Ranking Criteria (Score 1-7) - Choose Max. 2 Criteria ***				**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		
B.1 Evaluate current intervention strategies	B.1.1 Determine iron and folate status pre and post fortification	8	8		5	5		26	1
	B.1.2 Determine compliance rate and associated factors of folic acid and iron supplementation among pregnant women	7	6		4		4	21	4
B.2 Develop innovative strategies to improve micronutrient status	B.2.1 Formulation of convenient food products (cost effective) for target groups	4	4		2		4	14	16
C.1 Improve programme coverage for target groups	C.1.1 Applying GPRS technology to improve programme coverage	4	4		2	2		12	19

*1 = the lowest/ worst

Table 5.3: Relative ranks for each suggested topic

Research Scope	Suggested Topic and/or Explanatory Notes	Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7) - Choose Max. 2 Criteria *				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		
B.1 Evaluate current intervention strategies	B.1.1 Determine iron and folate status pre and post fortification	8	8		5	5		26	1
A.3 Assess association between dietary intake and health outcome	A.3.6 Association of calcium and vitamin D status on health outcomes e.g. osteoporosis, colon cancer, cardiovascular	8	8		4	4		24	2
A.3 Assess association between dietary intake and health outcome	A.3.4 Effects of zinc status and health outcomes: growth retardation, immune status and pregnancy outcome	7	7		4	4		22	3
B.1 Evaluate current intervention strategies	B.1.2 Determine compliance rate and associated factors of folic acid and iron supplementation among pregnant women	7	6		4		4	21	4
A.2 Determine deficiency status	A.2.3 Determination of vitamin D status and associated factors across population	6	6		4	4		20	5
A.3 Assess association between dietary intake and health outcome	A.3.2 Impact of different intake levels of carbohydrate and fats on cardiovascular risks (feeding trials)	6	6		4	4		20	6

Research Scope	Suggested Topic and/or Explanatory Notes	Ranking Criteria (Score 1-10)*		Ranking Criteria (Score 1-7) - Choose Max. 2 Criteria *				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		
A.1 Determine dietary intake and status	A.1.3 Assessment of dietary intake of zinc amongst children, reproductive age women, pregnancy and elderly	6	4		4	4		18	7
A.2 Determine deficiency status	A.2.1 Prevalence of zinc deficiency in children, reproductive age women, pregnancy and elderly	6	4		4	4		18	8
A.3 Assess association between dietary intake and health outcome	A.3.8 Interactions between Vitamin B12, folate and ferum in anaemia amongst children and elderly	6	7		2	2		17	9
A. 1 Determine dietary intake and status	A.1.2 Assessment of dietary fibre intake (amount and types) across population	6	4		4	2		16	10
A.1 Determine dietary intake and status	A.1.5 Determination of bioavailability of vitamin A, selenium, zinc in mixed diet	4	4		4	3		15	11
A.3 Assess association between dietary intake and health outcome	A.3.7 Assessment of vitamin B12, folate and homocysteine in relation to cardiovascular risks	6	4		2	2		14	12

MACRO AND MICRONUTRIENT EXCESSES AND DEFICIENCIES

Research Scope	**Suggested Topic and/or Explanatory Notes**	**Ranking Criteria (Score 1-10)***		**Ranking Criteria (Score 1-7) - Choose Max. 2 Criteria ***				**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		
A.3 Assess association between dietary intake and health outcome	A.3.1 Assessing dietary intake and fatty acid profile of population in relation to cardiovascular risk	4	4		4	2		14	13
A.3 Assess association between dietary intake and health outcome	A.3.5 Association of selenium status and diabetes and cancer risk	4	4		4	2		14	14
A.1 Determine dietary intake and status	A.1.1 Assessment of trans fatty acid intake in children and adults	6	4		2	2		14	15
B.2 Develop innovative strategies to improve micronutrient status	B.2.1 Formulation of convenient food products (cost effective) for target groups	4	4		2		4	14	16
A.1 Determine dietary intake and status	A.1.4 Assessment of dietary intake of selenium among adults	4	4		4	2		14	17
A.3 Assess association between dietary intake and health outcome	A.3.3 Effects of glycemic index on metabolic syndrome	4	2		2	4		12	18
C.1 Improve programme coverage for target groups	C.1.1 Applying GPRS technology to improve programme coverage	4	4		2	2		12	19
A.2 Determine deficiency status	A.2.2 Prevalence of selenium deficiency in adults	4	4		2	2		12	20

*1 = the lowest/ worst